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ANNOUNCEMENTS FOR 2018

Exam Registration

Candidates may find online exam registration and related information on the Exam Registration page of the CAS website.

There is only one registration deadline for each exam. **No late registrations will be accepted.** The exam dates and registration deadlines are available in the “2018 Examination Schedule” section. Please allow at least 10 working days for your mailed application to reach its destination. Whether payment is made by personal or company check, it is the candidate’s responsibility to ensure that the application and fee are received by the stated deadline. For Exam 5, all candidates must register online. **Exceptions will not be made.**

New Exam Requirements

- The 2018 *Syllabus of Basic Education* reflects the introduction of two new exam requirements - Modern Actuarial Statistics-I and Modern Actuarial Statistics-II - replacing Exam 5 and Exam 4. The first sitting of Modern Actuarial Statistics-I will be in May 2018 and the first sitting of Modern Actuarial Statistics-II will be in October 2018.

Candidates should review carefully the new exam syllabi, the transition rules adopted by CAS Board of Directors, and the frequently asked questions ([FAQ](#)) web page about these changes to the CAS basic education requirement.

- The 2018 *Syllabus of Basic Education* reflects a change in the syllabus for the basic education requirement, Exam 3F, effective July 1, 2018. The changes include: the name for Exam 3F is changed to Financial Economics; the Learning Objectives are modified; and the options for obtaining credit for this basic education requirement have been updated.

Technology-based Examinations (TBE)

The CAS has announced the transition of its upper level, constructive-response examinations to a computer-based environment, called Technology-Based Examination (TBE). It will replace the traditional paper-and-pencil method of exam administration. The first exam to be administered using this environment will be Exam 5-Basic Techniques for Ratemaking and Estimating Claim Liabilities in May 2018.

The CAS exam registration process for exams offered in the TBE environment is the same as for paper and pencil exams. Candidates will register for the exam by completing an online registration form on the CAS website.

After a candidate completes the regular CAS exam registration process, the CAS Office will notify PSI, the CAS technology partner for online scheduling and remote proctoring, that a candidate has registered for the exam. Each candidate will receive an email from PSI about a week after the exam registration deadline with information about how to set up a PSI account and how to schedule their exam start time.



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To schedule an exam with PSI, each candidate will need to create an account and choose a start time to take the exam. CAS candidates will have 24/7 access to PSI's online system via computer or mobile device. Candidates will be able to select the starting time in the local time zone in which they will take the exam for their exam session among available options on the scheduled exam day, i.e., May 3rd-4th for the May 2018 exam administration. Candidates can change their scheduled exam time up to two weeks before the exam, i.e., April 20th for the May 2018 exam administration.

Details and [step-by-step instructions](#) for creating an account with PSI and scheduling an exam start time are available on the CAS website.

Validation by Educational Experience (VEE)

As part of basic education, the CAS requires Validation by Educational Experience (VEE) topics. The CAS, in conjunction with the Canadian Institute of Actuaries and the Society of Actuaries, implemented VEE requirements beginning in 2005. The topical requirements for VEE have changed beginning in July 2018. The CAS will require candidates to have met the following VEE requirements:

- VEE-Accounting and Finance
- VEE-Economics

Candidates should review carefully the new requirements and the transition rules adopted by CAS Board of Directors.

Examination Results

As announced earlier, beginning with the fall 2017 exam results, the CAS will no longer be posting passing candidate numbers on the CAS website. Instead candidates can access their exam results by logging into their My Exams page within their profile on the CAS website. Candidates will be notified by email when their exam results have been uploaded to their profile

In addition, the spring 2018 exam sitting will be the last sitting in which results are mailed to candidates. Moving forward, candidates will access their exam results only via the website.

Waiver of Examinations for Exam MAS-I

The CAS Executive Council has approved a waiver for Exam MAS-I for candidates that have passed all three Exams CT3, CT4, and CT6 sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), and the Institute of Actuaries of India or all three Exams A101, A202, A204 sponsored by the Actuarial Society of South Africa (ASSA). See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation.

Candidates are expected to have mastered the concepts in the CAS *Syllabus* for Exam MAS-I when sitting for Exam MAS-II.



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Examination Discipline

The CAS Board of Directors approved the updated CAS Examination Discipline Policy in which CAS candidates will be subject to a single sanction offense and ACAS members are reminded that they are bound by the Code of Professional Conduct and may be subject to additional disciplinary action. See the [Examination Discipline Policy](#) page of the CAS website for a complete explanation.

A copy of the full [CAS Policy on Examination Discipline](#) is available on the CAS website.

Note: *This Syllabus is subject to change in the future.*

The Syllabus for each examination is defined in the form of Learning Objectives, Knowledge Statements, and Readings. The Learning Objectives present the learning goals for the underlying subjects being tested and set forth, usually in broad terms, what the candidate should be able to do in actual practice. The Knowledge Statements describe the body of knowledge corresponding to the exam subject and are illustrative of the scope of each Learning Objective. The Readings are recommended resources that support the Learning Objectives and may assist candidates to prepare for the examination. The CAS is not responsible for any errors or omissions found in the content of the resources identified in the Readings.



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INTRODUCTION

Principles of the Casualty Actuarial Society for Basic Education

The primary purpose of the Casualty Actuarial Society (CAS) basic education process is to ascertain whether candidates for the CAS designations have satisfied CAS learning objectives. The CAS Board of Directors adopted the following principles on May 6, 2001.

1. Basic education will remain a cornerstone of the CAS.
2. The CAS will assure that its members have the knowledge of those areas needed to practice effectively in the broad and expanding range of property, casualty, and similar business and financial risks (general insurance).
3. The CAS is committed to a depth of knowledge of techniques associated with the broad range of property, casualty, and similar business and financial risks.
4. The CAS will provide the basic education necessary to meet qualification standards to sign statements of actuarial opinion for general insurance and related specialties in at least the U.S. and Canada.
5. The education process will provide a balance among theoretical concepts, practical applications, and business acumen, to prepare our members to deliver high-quality service to meet current and projected future needs of employers and clients.
6. The CAS will approve the syllabus and examination standards used in determining eligibility for CAS membership.
7. Demonstration of mastery of the skill sets required of members is critical to basic education.
8. The CAS is committed to maintaining self-study as one route for attainment of designations.
9. The CAS will pursue strong working relationships with academia and professionals in related fields.
10. The CAS will attract a pool of strong candidates from a variety of backgrounds to the actuarial profession.
11. The CAS supports the goal of developing a global shared foundation of actuarial education, including joint sponsorship of examinations where consistent with other principles.
12. The CAS, as an educator of general insurance and related specialties, will remain a significant contributor to the worldwide actuarial profession.



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Syllabus Goals and Objectives

One of the primary objectives of the Casualty Actuarial Society (CAS) is the development of qualified professionals in the field of casualty actuarial science. The CAS conducts an educational and examination program for prospective members in order to achieve this objective.

The syllabus goals and objectives are as follows:

1. To develop a general understanding of the social, political, regulatory, legal, economic, and financial environment of the business of property and casualty insurance and similar risk assessment as well as the historical development of that environment.
2. To develop a thorough understanding of the fundamental mathematical concepts applicable to solving insurance and similar risk assessment problems, and to develop a high degree of skill in their applications.
3. To develop a comprehensive understanding of the business of property and casualty insurance, including underwriting, claims, marketing, and finance, as well as how these functions are performed and interrelated.
4. To develop a working knowledge of property and casualty insurance policies and contracts.
5. To develop an expert knowledge of a broad range of techniques to solve problems and to develop the ability to discern the appropriateness of techniques for particular applications based on knowledge of the underlying assumptions, strengths, and weaknesses.
6. To develop an expert knowledge of a broad range of relevant and standard actuarial practices in order to present a framework for the use of problem-solving techniques.
7. To encourage a sense of inquisitiveness and creativity toward problem solving in order to foster an appreciation of the art in actuarial science.

Note: The items in this *Syllabus* were chosen for their educational value. They are intended to expose the candidate to a wide range of information and to a variety of methods, opinions, and practices in the casualty actuarial field. Inclusion of material in the *Syllabus* does not imply that the CAS endorses the views, methodologies, or techniques therein.

Education and Examination System

The CAS vice president-admissions supervises the CAS education and examination system. The vice president-admissions is supported by two standing admissions committees, as described below, and ad-hoc task forces formed to address specific admission-related issues.

CAS Candidate Liaison Committee

The Candidate Liaison Committee strives to focus on issues of importance to candidates who are taking CAS Examinations. The committee serves as a direct point of contact for candidates to voice individual or group concerns regarding the education and examination process. It also provides a means for an exchange of information between candidates and the admissions committees via *Future Fellows*, a quarterly newsletter, and the *Future Fellows* blog. Candidate representatives who are actively involved in the examination process serve as



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advisors to the committee.

CAS Syllabus & Examination Committee

The Syllabus & Examination Committee determines the scope and content of the *CAS Syllabus* and course of readings for CAS Examinations. It also organizes, manages, administers, and grades the CAS Examinations. The committee also establishes the standards to be achieved by successful candidates.

The chairperson supervises the committee and is responsible for the overall development of the *Syllabus of Basic Education* and the administration of the CAS Examinations. The committee is composed of Fellows who represent a broad spectrum of CAS members including insurers, consultants, regulators, and academics. One or more members specialize in the material for each examination part. Several senior committee officers with the title of general officer assist the chairperson. The committee is subdivided into Examination Part Committees, each headed by an examination part chairperson. Two or more vice-chairs assist the examination part chairperson - these vice-chairs take responsibility for the main distinct operations of the examination part team, e.g., syllabus development, examination creation, and exam administration.

Members of the Canadian Institute of Actuaries (CIA) that are also Fellows serve on the Examination Part Committee for Exam 6-Canada for examination creation and administration. The CIA's Exam 6 Canada Syllabus Subcommittee develops the syllabus for that exam.

The following provides details about the CAS-specific syllabi and examinations:

- The responsibility for each CAS examination syllabus is assigned to an Examination Part Committee that reviews the individual exam syllabi regularly. Both short- and long-term goals for improvement are developed. Textbooks and articles may be designated for inclusion. If the committee determines that new study material needs to be developed or that existing material needs to be revised, the committee may commission the creation of Study Notes for inclusion. Every effort is made to develop material that is appropriate, relevant, up-to-date, concise, and well written. Suggestions for improvement are always welcome and should be directed to the Syllabus and Examination Committee at the CAS Office address
- The responsibility for each CAS examination is assigned to an Examination Part Committee that writes, grades, and maintains the standards for that examination. One or more examination consultants who are CAS members and are experts on the material covered by that examination assist each part committee. A proofreader who concentrates on uniformity and grammar also assists the part committees. In addition, academic consultants who are independent experts from the academic community assist some part committees.
- Each examination is drafted by the responsible Examination Part Committee to test candidates' knowledge of the items listed in the syllabus for the specific exam. The individual part committee, examination consultants, one of the Examination Committee general officers, the Examination Committee chairperson, and, in some cases, academic consultants review each examination to assure its quality.
- Every effort is made to ensure that the questions fall within the scope of the individual exam syllabus. Complete coverage of all material is not practical for every examination every year. The goal is to produce examinations that contain representative, high-quality questions that test candidates' knowledge of the material. Trick questions are deliberately avoided, and the wording of each question is considered carefully to eliminate possible ambiguities. Preliminary versions of each examination are thoroughly reviewed in relation



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to all of these factors before the final examination is approved.

Ad-hoc Task Forces

As needed ad-hoc task forces are formed to provide targeted research, analysis, and recommendations to the CAS Executive Council and Board of Directors so they are better able to ensure that the goals of the education and examination system are met, and that the education and examination system meets the needs of the Society, its members, its potential members, and other stakeholders.



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2018 EXAMINATION SCHEDULE

Exams for Online Courses 1 and 2 by Computer-Based Testing

	EXAM DATES	DURATION	START TIME	EXAM REFUND DEADLINE
January-March Test Window	Jan. 15 - March 15, 2018	2 Hours	Various	Three business days prior to scheduled exam—fees apply.
April-June Test Window	April 15 - June 15, 2018	2 Hours	Various	Three business days prior to scheduled exam—fees apply.
July-September Test Window	July 15 - Sept. 15, 2018	2 Hours	Various	Three business days prior to scheduled exam—fees apply.
October-December Test Window	Oct. 15 - Dec. 15, 2018	2 Hours	Various	Three business days prior to scheduled exam—fees apply.

April/May 2018 Exam Administration

Exam	EXAM DATES	DURATION	START TIME	REGISTRATION DEADLINE	REFUND DEADLINE
MAS-I	May 7, 2018	4 Hours	8:30 a.m.	March 8, 2018	April 12, 2018
Exam 5	May 3 and 4, 2018	4 Hours (See notes below)	See notes below	March 8, 2018	April 12, 2018
Exam 6-Canada and 6 U.S.	April 30, 2018	4 Hours	8:30 a.m.	March 8, 2018	April 12, 2018
Exam 7	May 2, 2018	4 Hours	8:30 a.m.	March 8, 2018	April 12, 2018
Exam 9	May 3, 2018	4 Hours	8:30 a.m.	March 8, 2018	April 12, 2018



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SYLLABUS OF BASIC EDUCATION

2018

Examination Schedule

October 2018 Exam Administration

Exam	EXAM DATES	DURATION	START TIME	REGISTRATION DEADLINE	REFUND DEADLINE
MAS-I	October 25, 2018	4 Hours	8:30 a.m.	August 30, 2018	October 11, 2018
MAS-II	October 26, 2018	4 Hours	8:30 a.m.	August 30, 2018	October 11, 2018
Exam 5	October 22, 2018	4 Hours (See notes below)	See notes below	August 30, 2018	October 11, 2018
Exams 6-Canada and 6-U.S.	October 23, 2018	4 Hours	8:30 a.m.	August 30, 2018	October 11, 2018
Exam 8	October 24, 2018	4 Hours	8:30 a.m.	August 30, 2018	October 11, 2018

ST9 Exam Administration for CERA Designation

Exam	EXAM DATES	DURATION	START TIME	REGISTRATION DEADLINE	REFUND DEADLINE
April Administration	April 19, 2018	3 Hours	Check Entry Permit	January 25, 2018	January 24, 2018
September Administration	September 20, 2018	3 Hours	Check Entry Permit	TBD	TBD



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Important Schedule Notes

- Starting times listed for examinations refer to local time except for Exam 5, which is using a technology-based examination environment. For Exam 5, candidates will schedule their individual start time with PSI, the remote proctoring vendor.
- Exam 5 is developed to be a four-hour exam; however, candidates will have five hours to take the exam in the TBE environment. The clock starts after the check-in process, when the remote proctor releases the exam.
- Candidates should arrive at the examination center at least 30 minutes prior to the scheduled exam time for the check-in process. For Exam 5, candidates should start the check-in process up to thirty minutes before the scheduled start of their examination.
- For Exams MAS I, MAS II, and 6-9, there will be a 15-minute reading period prior to the commencement of the timed exams. Exam 5 will not have a reading period.
- Waivers for Exam 1, Exam 2, Exam 3F, and Exam 4 are accepted from the Actuarial Society of South Africa, the Actuaries Institute (Australia), the Canadian Institute of Actuaries (except for Exam 1), the Institute and Faculty of Actuaries, and the Society of Actuaries. In addition, the CAS will grant exam waivers based on exams administered by the China Association of Actuaries as a cohort for CAS Exams 1, 2, and 3F, CAS Exam 4 (prior to July 1, 2018), and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance subsequent to July 1, 2018) and Economics. Updated information for waivers for Exam 1, Exam 2, Exam 3F, and Exam 4 will be incorporated as necessary and will be noted in the *Syllabus* section for the specific exam. See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation.
- To meet the CAS requirements for CERA, candidates should submit their registration to the CAS for Institute and Faculty of Actuaries (U.K.) Exam ST9.



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ASSOCIATESHIP REQUIREMENTS

Validation by Educational Experience

Prior to July 1, 2018	VEE-Corporate Finance VEE-Economics
Starting July 1, 2018	VEE-Accounting and Finance VEE-Economics

Online Courses

Online Course 1	Risk Management and Insurance Operations (same as The Institutes Course CA1)
Online Course 2	Insurance Accounting, Coverage Analysis, Insurance Law, and Insurance Regulation (same as The Institutes Course CA2)

Examinations

Exam 1	Probability
Exam 2	Financial Mathematics
Exam 3F	Models for Financial Economics (prior to July 1, 2018) Financial Economics (after July 1, 2018)
Exam 4	Construction and Evaluation of Actuarial Models (prior to July 1, 2018)
Exam MAS-I	Modern Actuarial Statistics-I*
Exam MAS-II	Modern Actuarial Statistics-II* (after July 1, 2018)
Exam 5	Basic Techniques for Ratemaking and Estimating Claim Liabilities
Exam 6	Regulation and Financial Reporting (Nation-Specific)

**New exams required beginning in Spring 2018 for MAS-I and Fall 2018 for MAS-II.*

To receive credit for the new Exam MAS-I (Modern Actuarial Statistics-I), the candidate must have credit for Exam 5-Statistics and Probabilistic Models through an examination administered prior to January 1, 2018.

To receive credit for the new Exam MAS-II (Modern Actuarial Statistics-II), the candidate must have credit for Exam 4-Construction and Evaluation of Actuarial Models through an examination administered prior to July 1, 2018. See [Waiver of Examinations Rules](#) for the various ways a candidate can be granted a waiver by the CAS for its Exam 4 examination requirement.

For further information, candidates should review the [transition rules](#) adopted by CAS Board of Directors.

Course on Professionalism



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FELLOWSHIP REQUIREMENTS

Fellowship requires all Associateship requirements plus the following:

Exam 7	Estimation of Policy Liabilities, Insurance Company Valuation, and ERM
Exam 8	Advanced Ratemaking
Exam 9	Financial Risk and Rate of Return

CERA DESIGNATION REQUIREMENTS

The CERA designation requires all Associateship requirements plus the following:

Exam 7	Estimation of Policy Liabilities, Insurance Company Valuation, and ERM
Exam 9	Financial Risk and Rate of Return

Enterprise Risk Management and Modeling Seminar

Exam ST9 of the Institute and Faculty of Actuaries (U.K.) on Enterprise Risk Management



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EXAMINATION RULES

Starting in 2018, Exam 5 is being administered using a computer-based environment called Technology-Based Examination (TBE). Because there are distinctive processes and procedures for TBE, additional information is available on the [Technology-based Examination](#) web page. The rules and procedures provided on the TBE web page related to Exam 5 are part of the CAS Examination Rules.

A. Registration

Administration of Examinations

The CAS basic education structure has Validation by Educational Experience (VEE) requirements, two online courses, several examinations (see [Basic Education Summary](#)), and the Course on Professionalism. Credit for Exams 1, 2, 3F, and 4 is granted based on exam options as defined in the individual exam syllabi. The two online courses are available through The Institutes. The CAS exclusively administers Exams MAS-I, MAS-II, and 5-9 and the Course on Professionalism. The Canadian Institute of Actuaries (CIA) cosponsors all the examinations except Exam 6-United States and Exam 6-Actuarial Institute of Chinese Taipei.

Filing of Applications and Deadlines

Exams 1, 2, 3F, and 4

For Exams 1, 2, 3F, and 4, the candidate should follow the application process and deadlines of the sponsoring organizations.

Exams MAS-I, MAS-II, and 6-9

All candidates filing for an examination(s) must submit a signed application for each examination period. Both online registration and application forms are linked at each of the individual Examination pages under the “Exams and Admissions” section of the CAS website. Payment must accompany each application to be valid. **Applications must be received by the registration deadlines stated in the Examination Schedule of this Syllabus.** Please allow at least 10 working days for your mailed application to reach its destination. Whether payment is made by personal or company check, **it is the candidate’s responsibility to ensure that the application and fee are received by the stated deadline. Exceptions will not be made.**



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SYLLABUS OF BASIC EDUCATION
2018
Examination Rules

Send applications as follows: Candidates may submit examination registrations for Exams MAS-I, MAS-II, and 6-9 by mail or online. Applications must be received by the published deadlines. Candidates submitting a hard copy of their registration should mail them as follows:

<p><i>Mail application with check or money order in U.S. funds or Canadian equivalent (payable to "Casualty Actuarial Society") to:</i></p> <p>Casualty Actuarial Society P.O. Box 425 Merrifield, VA 22116-0425</p>	<p><i>Send application with credit card payment (Visa, MasterCard, or American Express) and all overnight deliveries to:</i></p> <p>Casualty Actuarial Society 4350 N. Fairfax Drive, Suite 250 Arlington, Virginia 22203 Telephone: 703.276.3100</p>
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Candidates submitting their registrations online for Exams MAS-I, MAS-II, and 6-9 must pay by credit card. All credit card payments will be processed in U.S. funds.

Candidates will be sent an acknowledgment of receipt of their application within three weeks of the date that the application form was received at the CAS Office beginning in early February for April/May Examinations and early August for October/November Examinations. This acknowledgment is the candidate's receipt of exam fees paid. Please retain this acknowledgment for tax purposes if needed. **Candidates that have not received an acknowledgment prior to the registration deadline should contact the CAS Office or their accounting department to ensure that their applications reached the CAS Office.** The candidate can also verify their registration by logging into their CAS account and checking their profile.

Exam 5

The CAS exam registration process for exams offered in the TBE environment is the same as for paper and pencil exams. Candidates will register for the exam by completing an online registration form on the CAS website. Registration will open in December 2017.

Candidates will find information on creating an account with PSI and scheduling their exam start time on the [Technology-based Examination](#) web page. These additional details and step-by-step instructions will be available in early 2018.

Online Courses 1 and 2

CAS Online Courses 1/CA1 and 2/CA2 are available through The Institutes. When candidates register for the individual online course, the fee includes one attempt at the exam. Before registering for the exam, candidates must obtain their Master ID number from the CAS—it will be required to register for the exam. After progressing through the online course, candidates arrange for their exam by contacting:

The Institutes, Customer Service
720 Providence Road, Suite 100
Malvern, PA 19355-3433
Telephone: (800) 644-2101 or (610) 644-2100 ext. 6000
E-mail: CustomerService@TheInstitutes.org
CAS Online Courses page at The Institutes website: www.aicpcu.org/cas.htm



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Name

Candidates must use their legal name on all examination registration materials and when corresponding with the CAS. Any change in name must be accompanied by acceptable documentation.

Fees

Examination fees must be paid each time a candidate registers for an exam. Payment options are described in a previous section, Filing of Applications and Deadlines. A \$20 surcharge will be assessed for all returned checks. The charts below show the examination fee schedules for 2018 at the time of publication. All fees are listed in U.S. dollars and are subject to change. Other fees that may apply include fees for change of center, refund, and/or a special exam center.

Exams 1, 2, 3F, and 4

Contact the sponsoring organization.

Exams MAS-I, MAS-II, and 5-9 and Online Courses 1 and 2

2018 Examination Fees			Other Fees	
	Candidates	Full-Time Students		
Exam MAS-I & MAS-II	\$450	\$360	Refund (Exams MAS-I, MAS-II, 5-9, and ST9)	\$100
Exams 5, 6, 7, 8, and 9	\$675	\$540	Change of Exam Center	\$60
Online Courses 1 & 2 Retest [†]	\$315	\$315	Online Courses 1/CA1 and 2/CA2: Contact The Institutes for fees that apply.	
Exam ST9	\$675	\$650		

[†]The first exam attempt is included in the \$575 Online Course fee.

Exams 1 and 2 Fee Reimbursement Program in the U.S.

The Joint CAS/SOA Committee on Career Encouragement and Actuarial Diversity sponsors a program to reimburse qualified minority candidates for Exam 1 (SOA Exam P) and Exam 2 (SOA Exam FM) fees. Eligible candidates are members of specified groups that are underrepresented in the actuarial profession in the United States, including African-Americans, Hispanics, and Native North Americans who are sitting for actuarial exams. The reimbursement application is available in the Diversity Programs section of the actuarial career website at <http://www.BeAnActuary.org>.

Fee Discount Program in Qualified Countries

The CAS sponsors a program to provide financial relief to candidates of qualified countries. Eligible candidates must be current full-time residents of a qualified country. Candidates must write their exams in a qualified country. Information, including a list of qualified countries and the application, is available on the [Fees Discount](#)



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The exams for Online Courses 1/CA1 and 2/CA2 are offered by computer-based testing (CBT). Because there are distinctive processes and procedures for CBT, additional information is available on The Institutes website. The rules and procedures provided on The Institutes website related to Online Courses 1/CA1 and 2/CA2 are part of the CAS examination rules.

Examination Centers

CAS examination centers are listed on the Exam Registration page of the CAS website. Centers are determined by the number of candidates near a center and the availability of proctors. Special examination centers may be arranged at the discretion of the CAS on a case-by-case basis if the request is received by the registration deadline. Candidates will be sent the exact location of their examination center at least two weeks before the examination.

For Exam 5, examination centers are not utilized (see the [Technology-based Examination](#) web page for more information).

Examinations by computer-based testing - Online Courses 1 and 2 - are administered at established test centers. The Prometric website (<http://www.prometric.com/SOA/default.htm>) contains a list of the CBT centers.

The CAS will not host exams in any country that has trade sanctions held against it per the [U.S. Department of the Treasury](#).

Change of Center

For Exams MAS, MAS-II, and 6-9, any registered candidate who requests a change in examination center must pay a change-of-center fee. No requests will be accepted after the registration deadline. If a request for a change of center occurs, every effort will be made to have the candidate's records and supplies on hand at the appropriate center in time for the examination. If this effort fails, however, the CAS is not responsible. If either a candidate's registration and fees, or request for change of center are received so late that it is not feasible to arrange for the candidate to write the examination, the fees will be refunded in full. The CAS is not responsible for difficulties caused by postal service delays or inadequate postage.

Details for changing a CBT center for the exams for Online Courses 1/CA1 and 2/CA2 are available on The Institutes website (<http://www.aicpcu.org/cas.htm>).

Languages other than English

Exams MAS-I, MAS-II, and 5-9 and Online Courses 1 and 2

Exam questions and instructions will be printed, and exams administered, exclusively in English. Candidates must submit written responses in English; non-English responses will not be graded with the following exception: Should a candidate for an exam jointly sponsored by the Canadian Institute of Actuaries wish to respond to any or all of the constructed-response test items (essay questions) in French, advanced notice must be provided to the CAS Office when applying to write the exam. Provided such advanced notice was received and a suitable translator is available from the Canadian Institute of Actuaries, responses submitted in French will be translated into English by qualified translators and graded exclusively in translation. All translations will be literal translations from French to English. If advanced notice has not been provided, non-English responses will not be graded. If a suitable translator cannot be engaged before the date of the exam, the candidate will be notified. The CAS cannot guarantee the accuracy of any translation. Appeals based upon errors in translation of a candidate's responses will not be considered. Grade reports for exams requiring translation may be delayed.

Special Arrangements for Candidates with a Disability

A candidate with a formally diagnosed disability who needs special testing arrangements must submit a written request for



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each examination that the candidate intends to write. Documentation of the disability, e.g., physician's statement, diagnostic test results, as well as the need for special arrangements, is required of each candidate. Previous accommodations given to the candidate in an educational program or work setting may be considered.

Requests for special arrangements and supporting documentation must be submitted at the applicant's expense at least two weeks prior to the registration deadline for Exams MAS-I, MAS-II, and 6-9; at least two weeks prior to the registration deadline for Exam 5; and prior to the first day of the testing window for the exams for Online Courses 1/CA1 and 2/CA2. For Exams MAS-I, MAS-II, and 5-9, contact the CAS Examinations Coordinator. For the two online courses, contact The Institutes.

For Exams 1, 2, 3F, and 4, contact the sponsoring organization.

Refunds

Exams 1, 2, 3F, and 4

Contact the sponsoring organization.

Online Courses 1 and 2

The fee for Online Courses 1/CA1 and 2/CA2 includes one attempt at the exam by CBT. No refund for a course is provided once the candidate has accessed the online course. If the candidate decides not to access the online course after payment has been made, the candidate may submit a request for a refund. The request must be submitted to Customer Service at The Institutes.

Any candidate who registered for a course exam and subsequently decides not to take the exam may receive a refund for the exam portion of the course fee (\$190) only by doing both of the following:

- Cancel the appointment prior to the third day preceding the exam at the test center, and
- Submit a refund request to Customer Service at The Institutes (CustomerService@TheInstitutes.org) that must arrive prior to the third day preceding the exam.

Exams MAS-I, MAS-II, and 5-9

Any candidate who submits an application for Exams MAS-I, MAS-II, or 5-9 and subsequently does not write the examination should submit a written request for an examination fee refund. This request must reach the CAS Office by the refund deadline stated in the Examination Schedule of this *Syllabus*. Refund requests may be sent via e-mail to refund@casact.org or by fax to (703) 276-3108. Late requests will not be considered. A \$100 administrative fee per examination will be assessed on all refunds. Change-of-center fees, special center fees, and other additional fees will not be refunded in any case. Refunds will be issued one month after the refund deadline. Refunds are issued in the manner that fees were paid (i.e., by credit to a bank card or by check to an individual or company). Fees cannot be transferred from one exam session to another.



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B. The Examination

Introduction

The examinations for admission to the Casualty Actuarial Society are designed to establish the qualifications of candidates. The CAS Syllabus & Examination Committee creates exams that follow guidelines developed for and shown in the *Syllabus*. Complete coverage of all readings listed in the *Syllabus* is not practical for every exam every year. The goal is to produce exams that contain representative, high-quality questions that test a candidate's knowledge of topics that are presented in the learning objectives. Thus, the candidate should expect that each exam will cover a large proportion of the learning objectives and associated knowledge statements and syllabus readings, and that all of these will be tested at least once over the course of a few years.

The Syllabus for each examination is defined in the form of Learning Objectives, Knowledge Statements, and Readings. The Learning Objectives present the learning goals for the underlying subjects being tested and set forth, usually in broad terms, what the candidate should be able to do in actual practice. The Knowledge Statements describe the body of knowledge corresponding to the exam subject and are illustrative of the scope of each Learning Objective. The Readings are recommended resources that support the Learning Objectives and may assist candidates to prepare for the examination. The CAS is not responsible for any errors or omissions found in the content of the resources identified in the Readings.

The exam questions will be based on the published learning objectives and supporting knowledge statements. It is intended that the readings, in conjunction with the material as outlined in the next section, will provide sufficient resources to allow the candidate to perform the learning objectives. The exams will test not only a candidate's knowledge of the subject matter, but also a candidate's ability to apply that knowledge.

The Institutes create exams for the online courses that follow the learning objectives contained in the individual courses.

Note: *This Syllabus is subject to change in the future.*

Order of Examinations and VEE Topics

In the development of the syllabus readings and exam questions, it is generally assumed that candidates for Associateship-level Exams MAS-I, MAS-II, 5, and 6 are familiar with material covered on the preliminary exams; Fellowship-level Exams 7, 8, and 9 generally assume familiarity with material on the Associateship-level exams. There are, however, circumstances when another order might be more appropriate. For example, a candidate may wish to study an exam that is closely related to his or her current work.

VEE topics are not prerequisites to taking actuarial exams and may be fulfilled independently of the exam process, i.e., prior to or concurrent with taking actuarial exams. In some cases, however, understanding the material within a VEE topic may help make an exam easier to understand. For example, VEE-Economics and VEE-Corporate Finance (VEE- Accounting and Finance after July 1, 2018) will help strengthen candidates' understanding of managerial decision-making and completing these topics prior to taking Exam 9 will make this exam easier to understand.

Candidates are encouraged to take Online Course 1 and Online Course 2 immediately after they begin their first property-casualty employment. For Exams 5 through 9, the general concepts and knowledge covered on those two Online Courses is often used to establish real-world context for exam questions. Thus, it will be helpful for candidates to take the two Online Courses prior to taking CAS Exams 5 through 9, although detailed knowledge is not assumed except as noted below.

To help candidates decide which exam to take, the following chart indicates which exams assume knowledge of material found



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Examination Rules

on prior exams. While the CAS does not test Learning Objectives and Knowledge Statements directly from other exams, most candidates will find it easiest to study for an exam after studying for all of the exams listed in the “prior knowledge” column.

Exam or VEE Requirement	Assumes Prior Knowledge from the Following Exam(s)
VEE-Corporate Finance	None
VEE-Accounting and Finance	None
VEE-Economics	None
Online Course 1/CA1	None
Online Course 2/CA2	None
Exam 1	None
Exam 2	None
Exam 3F	Exams 1 and 2
Exam 4	Exam 1
Exam MAS-I	Exam 1
Exam MAS-II	Exam 1, MAS-I
Exam 5	Exams 1 and 2
Exam 6C or 6U	Exams 1 and 5 and Online Course 2
Exam 7	Exams 1, 2, MAS-II/4, and 5 and VEE-Corporate Finance/Accounting and Finance
Exam 8	Exams 1, 2, 3F, MAS-I, MAS-II/4, and 5
Exam 9	Exams 1, 2, 3F, MAS-II/4, and 5 and VEE-Economics and VEE-Corporate Finance/Accounting and Finance

Hours of Study

Passing actuarial exams requires many hours of study—more for some people and less for others—but often more than many candidates realize. Putting in enough hours can actually save a candidate time. Suppose, for example, that mastering the syllabus for one exam will take a candidate 400 study hours, and that a candidate only puts in 300 hours and fails the exam the first time. He or she then puts in an additional 300 hours and passes the exam the second time. That candidate will have spent 600 hours, when by studying 400 hours the first time around, he or she would have saved 200 hours, not to mention passing sooner. It is recommended that candidates decide for themselves how many hours they really need to study, and then do that much studying—the first time around.



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Requirements for Admission to Examination Center

To be admitted into an examination center, each candidate must present a positive identification with a signature and a photograph (e.g., driver's license, passport, etc.). If a photo ID is not available, the candidate must present two forms of identification with a signature, with at least one form containing a physical description (height, weight, hair color, eye color, etc.). Each candidate will be required to sign in at the examination center. A candidate who does not present positive identification or who refuses will not be permitted to write the examination.

For examinations offered by computer-based testing, each candidate must present a valid government-issued photo identification that includes the candidate's signature (details are available on The Institutes website for exams for the two online courses).

Candidates should arrive at the examination center at least 30 minutes before the scheduled exam time. Candidates may not leave until two hours after the start of the examination. For Exams MAS-I, MAS-II, and 6-9, candidates may not leave during the last 15 minutes of the examination.

For Exam 5, candidates will no longer present themselves at an examination center to take the examination (see the [Technology-based Examination](#) web page for more information).

Conduct of Examinations

The examinations are recorded exclusively in writing (except for exams that are administered by computer-based testing or technology-based examination). Except as is noted in the following paragraphs, no books, papers, typewriters, slide rules, laptops, or electronic or mechanical aids for computation of any kind may be brought into the examination room by candidates, nor may any candidate communicate with, or obtain any assistance from, any other candidate during the examination. Candidates must respond to constructed-response test items (essay questions) in English unless advance notice is given (see Languages other than English under Examination Rules—Registration). Examination answer sheets are not returned to candidates.

For Exams MAS-I, MAS-II, and 6-9, a candidate wishing to obtain his or her own examination booklet and scrap paper subsequent to the examination must bring a self-addressed stamped envelope to the examination center. (No inter-office mailing is acceptable.) The recommended minimum postage is \$2.87 for domestic mail in the U.S.

For Exams MAS-I, MAS-II, and 5-9, approximately one week after all exams have been completed, the exam will be posted on the [Exams](#) section of the CAS website.

For Exam 5, see the [Technology-based Examination](#) web page for details on the conduct of the examination.



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Calculators for Exams MAS-I, MAS-II, and 6-9

Electronic calculators will be allowed in the examination room for Exams MAS-I, MAS-II, and 6-9. Only the calculators listed below may be brought into the examination room. Books, papers, computers, or other electronic devices may not be brought into the examination room. Candidates may use the battery- or solar-powered models of the following Texas Instruments calculators:

BA-35	TI-30Xa
BA II Plus	TI-30X II (IIS solar or IIB battery)
BA II Plus Professional	TI-30XS MultiView (or XB battery)

Candidates may use more than one of the approved calculators during the examination. **For those using the BA II Plus, BA II Plus Professional, TI-30X II (IIS solar or IIB battery) or TI-30XS MultiView (or XB battery) models, candidates will be required to show examination proctors that the memory has been cleared prior to the start of the examination. For the BA II Plus and BA II Plus Professional, clearing will reset the calculator to the factory default settings.**

Calculator instructions cannot be brought into the examination room. During the examination, the calculator must be removed from its carrying case so the proctor can confirm it is an approved model. **Any unauthorized calculator brought to the examination center will be confiscated for the duration of the examination. Candidates using a calculator other than the approved models will be subject to examination disqualification and other disciplinary action.**

Candidates may purchase calculators from stores or directly from Texas Instruments: telephone: (800) 842-2737 [1-800-TI-CARES]; website: <http://www.ti.com>.

It is the candidate's responsibility to see that the calculator used during the examination is in good working order. Spare calculators are no longer being provided to exam centers. Candidates will be expected to provide their own working calculator(s).

Earplugs for Exams MAS-I, MAS-II, and 6-9

Simple foam earplugs are allowed and must be checked-in with the supervisor upon entrance to the exam. The ability to hear all verbal instructions, including exam start and stop times is the responsibility of the candidates, regardless of the use of earplugs.

Reading Period for Exams MAS-I, MAS-II, and 6-9

Prior to the start of the examinations administered by the CAS, there will be a reading period in which the candidate can silently read the questions and check the exam booklet for missing or defective pages. Writing will NOT be permitted during this time and candidates will not be permitted to hold pens or pencils or be allowed to use calculators. The reading period will be 15 minutes for Exams MAS-I, MAS-II, 6C, 6U, 7, 8, and 9.

Exam 5 will no longer have a reading period (see the [Technology-based Examination](#) web page for more information).



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Examination Discipline

Candidates must not give or receive assistance of any kind during the examination. Any cheating, attempt to cheat, assisting others to cheat, participating therein, or engaging in improper conduct such as noted in the CAS Examination Discipline Policy is a serious violation and will result in the CAS disqualifying the candidate's exam and additional consequences determined by the Vice President Admissions. This may include a temporary or permanent ban from sitting for CAS Examinations. Members of the CAS are also subject to the CAS investigative and discipline process, such as through the Actuarial Board for Counseling and Discipline (ABCD) or the Canadian Institute of Actuaries (CIA), for any violations of the CAS Code of Professional Conduct. Candidates have agreed in their applications for examination to be bound by the rules and regulations governing the examinations.

Examples of improper conduct include but are not limited to:

1. Gaining access to examination questions before the examination or aiding someone else to do so.
2. Using an unauthorized calculator (as defined in the *Syllabus*) or other mechanical aid that is not permitted.
3. Looking in the examination envelope before the instruction to begin is given.
4. Marking or otherwise writing on the examination booklet or answer sheet before the instruction to begin is given.
5. Making any changes, additions, deletions, or otherwise marking, erasing, or writing on the examination book or answer sheet after the time for the examination has expired.
6. Having access to or consulting notes or books during the examination.
7. Looking at or copying from another candidate's paper.
8. Enabling another candidate to copy from one's paper.
9. Talking or otherwise communicating with another candidate during the examination.
10. Disturbing other candidates during the examination.
11. Consulting other persons outside the examination room during the examination.
12. Copying questions, answers, or answer choices to take from the examination room.
13. Taking an examination booklet from the examination room.
14. Taking an examination for another candidate.
15. Arranging to have another person take an examination for the candidate.
16. Threatening or physically or verbally abusing a supervisor or proctor responsible for curbing or reporting improper conduct.
17. Disclosing the contents of an examination to any other person prior to the examination's release. For CAS-administered exams, this would generally apply to the day when the examination is administered.
18. Presenting false information on an examination application.



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19. Failing to remain in the examination room for a minimum of two hours during the examination (for examinations with this requirement).
 20. Failing to follow other examination instructions.
 21. Accessing or using a communication device (PDA, cell phone, tablet, etc.) during the exam or while at the exam site.

The CAS Syllabus & Examination Committee, or its designee, will investigate any irregularity or suspected violation of the rules involving the examination process, and a determination will be made regarding the matter. Where there is a determination to invoke a penalty, the candidate is advised by letter. In the case of a candidate who is a member of the CAS, the candidate's conduct will be reported to the Actuarial Board for Counseling and Discipline (ABCD) or to the Canadian Institute of Actuaries (CIA) if the final penalty invoked is more than disqualification of the examination.

Candidates for the CAS Examinations are expected to follow the rules and procedures included in this *Syllabus* including those specific to technology-based examinations, the Instructions to Candidates printed on their examination booklets, announcements made by the supervisors at the examination locations, and instructions made by the remote proctors for the technology-based examinations. All candidates, on their applications for examinations, are required to read and sign the following statement: "I have read the rules and regulations concerning the examination(s) for which I am applying and agree to be bound by them. I also agree that the results of any examination(s) which I take, and any action taken as a result of my conduct may, at the sole discretion of the Casualty Actuarial Society, be disclosed to any other bona fide actuarial organization that has a legitimate interest in such results and/or actions."

The CAS may, at its sole discretion, disclose to any other bona fide actuarial organization having a legitimate interest, information on the identity of candidates determined to have committed a serious examination violation (those for which the penalty is greater than the simple disqualification/nullification of the examination), and the specific penalties imposed on those candidates.

If an actuarial organization with which the CAS has a working relationship (such as the Society of Actuaries) invokes a penalty against a candidate for improper conduct during an examination for which the CAS is not a joint sponsor, the CAS will invoke the same penalty for all CAS-sponsored examinations. If the CAS takes any disciplinary action, it will notify the other actuarial organizations of that action.

These standards may seem stricter than those which candidates are accustomed to in other examination environments. The CAS maintains these strict standards because the examinations are such a significant part of a candidate's career. Therefore, the equitable administration of the examinations and enforcement of the highest standards of conduct cannot be emphasized too strongly.

The [CAS Rules of Procedure for Disciplinary Action Involving Candidates](#) is available on the CAS website.

Discipline for Computer-Based Testing and Technology-Based Examinations

The Policy on Examination Discipline is the same for those taking exams by computer-based testing, by technology-based examination testing, or in the traditional paper-and-pencil format.

The rules for the CBT administration for Online Courses 1/CA1 and 2/CA2 are available on The Institutes website (<http://www.aicpcu.org/>). If there is a discrepancy between specific rules for the traditional paper-and-pencil exam administration and computer-based testing administered by The Institutes, the computer-based testing rules will govern.

Multiple-Choice Questions



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Exams MAS-I and MAS-II consist entirely of multiple-choice questions; other CAS examinations may have a section of multiple-choice questions. Each multiple-choice problem includes five answer choices identified by the letters A, B, C, D, and E, only one of which is correct. A separate answer sheet provides a row of five ovals for each problem, identified with the letters A, B, C, D, and E, corresponding to the five answer choices. After deciding which answer is correct, candidates should blacken the oval that has the same letter as the appropriate answer. Since the answer sheets are scored by optical scanning equipment, a Number 2 pencil must be used to blacken the ovals. It is important that only one oval be blackened for each question.

Exams for the two online courses will consist entirely of multiple-choice questions. Each multiple-choice problem includes four answer choices identified by the letters A, B, C, and D, only one of which is correct. For exams administered by computer-based testing, candidates should click on the appropriate answer. For all other exams, a separate answer sheet provides a row of four ovals for each problem, identified with the letters A, B, C, and D, corresponding to the four answer choices. After deciding which answer is correct, candidates should blacken the oval that has the same letter as the appropriate answer. Since the answer sheets are scored by optical scanning equipment, a Number 2 pencil must be used to blacken the ovals. It is important that only one oval be blackened for each question.

Guessing Adjustment

For the exams for Online Courses 1/CA1 and 2/CA2, no guessing adjustment are made to candidates' scores. Therefore, candidates will maximize their scores on these examinations by answering every question. On Exams MAS-I, MAS-II, and 5-9, multiple-choice questions are scored in such a way that there is no advantage or disadvantage to be anticipated from guessing answers in a purely random fashion as compared with omitting the answers entirely. No additional points will be given for multiple-choice questions left blank, but one-quarter of the point value for each question will be deducted for each incorrect answer.

Constructed-Response Test Items

The admissions process is intended to identify candidates that have demonstrated sufficient mastery of the learning objectives to be admitted as members of the CAS. Examinations that provide a means for better-prepared candidates to demonstrate that mastery are critical to meeting that objective.

Educators often refer to a tool called Bloom's Taxonomy to classify questions into six cognitive levels. Bloom levels range from Level 1, broadly characterized as knowledge, to Level 6, characterized as evaluation. Lower levels of the taxonomy stress recall of facts and an understanding of main ideas; higher levels within the taxonomy stress synthesis, comparison, and subtlety of understanding.

Bloom levels are as follows:

Level 1: Knowledge—tests the ability of the candidate to recall or remember knowledge or facts

Level 2: Comprehension—requires the candidate to demonstrate comprehension of central concepts through explanation of those concepts

Level 3: Application—measures the candidate's ability to apply ideas and concepts to new situations

Level 4: Analysis—requires the candidate to analyze information by separating material into component parts, including identification of facts and development of inferences with respect to a situation

Level 5: Synthesis—tests the ability of a candidate to synthesize, or combine, concepts or ideas and develop and defend the position resulting from that combination



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Level 6: Evaluation—requires the candidate to support conclusions by evaluating the validity of ideas and concepts

Generally, questions at higher Bloom levels will have higher associated point values. As a result, examinations with more questions at higher Bloom levels will contain fewer questions, which may result in less syllabus coverage on a particular exam.

Lost Examinations

The CAS—or its designee—is not responsible for lost or destroyed examinations. In the case where an examination is lost or destroyed, the examination fee will be refunded. The CAS and its designees will assume no other obligation and candidates must take the examinations with this knowledge. For Online Courses 1/CA1 and 2/CA2 that are administered by The Institutes, the policy of The Institutes will apply.



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C. Grades and Accreditation

CAS Examination Processing

Computer-based tests – Online Courses 1 and 2 – are administered and scored according to computer-based testing methodologies. Although the multiple-choice exams that are administered exclusively by paper-and-pencil – MAS-I and MAS-II – have a process that is similar to the description below, this section and the next, Grading of Examinations: A Timeline, provide details about CAS-specific Exams 5-9.

Examination papers where applicable are sent to the CAS Office upon completion of the examination. The CAS Office prepares the examinations for the grading process. The next business day following the administration of all examinations, the examinations and a preliminary list of multiple-choice answers will be posted on the Exams page of the CAS website. This is intended to assist candidates and the CAS Syllabus & Examination Committee in determining whether they believe a question is ambiguous or defective.

For Exam 5, exam processing for weeks #1 and #2 as described below are modified appropriately to take advantage of the TBE environment (see the [Technology-based Examination](#) web page for more information).

Grading of Examinations: A Timeline

Week 1

After the examinations are administered, proctors return the exam packages to the CAS Office. Staff members log in each exam. Signatures are verified and the candidate numbers are checked against the proctor's report. As each envelope is opened, the candidate's number must be checked against the number on the short answer card (both the written number and the coded number) and on all the essay sheets. The short answer cards are prepared for scanning and the essay sheets for all the candidates must be sorted so that individual questions can be copied for the graders.

Week 2

Constructed response (essay) question responses are sent to a vendor to be reproduced. Short answer cards are scanned twice and output is compared to ensure accuracy. Random checks are made of each series of cards to ensure that the scanner is working properly. When the essay sheet copies are received, copies of candidate responses are sent to the individual graders. Any comments on potentially ambiguous or defective questions are forwarded to the graders, exam part chair, and the general officer of the exam series for review.

Weeks 3 and 4

Committee members review candidate comments about possibly ambiguous or defective questions and decide how they will be handled in the grading process. Discussions on the best course of action are often a very time-consuming part of the grading process.

Copies of responses to each constructed-response test item on the exam are sent to two graders. Some graders are given more than one question to grade. There can be 500 to more than 1,000 answer sheets for each grader to evaluate for a single question. A suggested answer key exists for each question, but alternative solutions may be correct, and the graders must be open to different approaches to a problem. About two-dozen responses are graded and then the results are compared. The grading partners will establish a consistent grading rubric and then evaluate the solution key. Consistency and accuracy are the most important factors in grading the responses. After looking at hundreds of papers, it is possible that a grader could slightly shift focus (either harder or easier). To minimize the chance of this happening the graders will begin grading at different points on the candidate list, then when the two grades are compared any significant differences will be checked. Each grader prepares a computer file with each candidate's number and the score for each question.



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Week 5

The part chair holds the grading session with the graders. The first step is running the data through a standard grading program, verifying the data, and noting any significant discrepancies. For each candidate and each question the scores of each grading partner must be within a prescribed tolerance. If the scores do not fall within this tolerance, the partners must discuss the candidate's answer sheet and come to a decision on what the point value should be. When all the questions have been reconciled to the required tolerance, the scores are totaled and a tentative pass score is selected based on the pass mark panel's recommendation, various statistics, and guidelines.

This triggers the second round of reconciliation. Candidates who have scores within a certain number of points from the tentative pass score will have all of their answers reconciled completely. This gives an exact score for any candidate near the passing score. The scores for any candidates who are close to passing will be checked manually as well. The committee members will then look at the statistics one more time and make a final recommendation for the passing score.

Weeks 6 and 7

After the grading session, the part chair will create and submit a report to the general officer of the exam series, the CAS Syllabus & Examination Committee chairperson, and the vice president–admissions. In the report, the part chair recommends a passing score, gives a detailed analysis of the exam, and notes any unusual questions or situations that required special handling. The chairperson and general officer hold a teleconference with the vice president–admissions and a representative from the Canadian Institute of Actuaries (except for Exam 6-US) to discuss all of the exams from the series and to finalize the passing scores.

Week 8

After the vice president–admissions and a representative from the Canadian Institute of Actuaries (except for Exam 6-US) have approved the passing score the data is verified and released to the CAS Office to update each candidate's record. Candidates will be notified by email when their exam results have been uploaded to their profile. Candidates can access their exam results by logging into their My Exams page within their profile on the CAS website.

Determination of the Pass Mark

The goal of the examination system of the CAS is to pass all candidates who have demonstrated adequate knowledge of the syllabus and to fail those candidates who have not. The objective of the examinations is to evaluate candidate performance using criteria for demonstrating adequate knowledge that remain constant throughout the lifetime of the exam series. Pre-set pass marks, e.g., a candidate will pass if he or she answers x percent of the questions correctly, are counter to this philosophy. The examinations are meant to measure the candidate's level of achievement of the required learning objectives and their required level of capability of accomplishing specified learning outcomes.

Multiple-Choice Test Items

As part of the input to the pass mark determination process for the multiple-choice exams that are not offered by computer-based testing, a modified Angoff passing score study is performed where a panel of experts in the subject material is convened to review the examination. This is a common testing and measurement technique. Each expert is asked to review each question in the examination and assess the difficulty of that question. More specifically, they are asked to estimate the likelihood that a candidate with minimum adequate knowledge competency would answer the question correctly. The sum of these probabilities, averaged across the panel of experts, gives a preliminary estimate of the pass mark.

The estimated pass mark resulting from the modified Angoff passing score study is compared to and balanced with the actual performance statistics on the exam in finalizing the pass mark. The effects of any particularly difficult questions are also factored into the determination of the final pass mark.



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Computer-based tests are administered and scored according to computer-based testing methodologies.

Constructed-Response Test Items

For CAS examinations consisting of constructed-response test items (written-answer or essay questions), the assessment process is somewhat different and is described below.

Before the exam is administered, a pass mark panel consisting of subject matter experts and selected exam committee volunteers reviews each question and makes a determination of how the panelists think a minimally qualified candidate will perform on each question. This evaluation is based on the panelists' consideration of:

- a predetermined definition of the minimally qualified candidate (MQC) – for example, for Exam 5, the definition of an MQC might include deep knowledge of basic development techniques but a lower level of knowledge of uncommon
- how they would expect such a candidate to answer each question under exam conditions; and
- the amount of points (the MQC score) that corresponds to such responses based on the initial grading rubric constructed by the exam creation team of the Examination Part Committee.

Some general examples of determinations of the pass mark panel include:

- For this question asking for three descriptions, the minimally qualified candidate will generally know the exam material and under exam conditions will be able to provide two of the three descriptions required, scoring 1 out of 1.5 points.
- For this question, the minimally qualified candidate will not know the material well enough to answer the question but will be able to state the initial formula and perform the first step of the formula, scoring 0.5 out of 2 points.
- For this question, the minimally qualified candidate will know the material and be able to perform all calculations, but there are a lot of calculations and under exam conditions we would expect the minimally qualified candidate to lose 0.25 point due to "calculation errors," i.e., pressing the wrong button on the calculator. (Note for this same question, if asked under TBE, the pass mark panel might expect the minimally qualified candidate to receive full credit as the use of Excel and the ability to see calculations on the screen would reduce the probability of a "calculation error".)

Following the administration of each exam, a candidate's response to each constructed-response test item is graded simultaneously by two graders who must reconcile their grading rubrics and grades. During this process, the grading rubrics may be modified from the original grading rubric created by the exam creation team and used by the pass mark panel, e.g., if additional valid solutions are found during grading, or if candidates had a valid alternative interpretation of the question that was not considered by the exam creation team.

As part of this grading process, the graders also determine their estimate of the MQC score for their question, using the same guidelines as used by the pass mark panel, supplemented with any additional knowledge they have, such as changes they may have made to the initial rubric and the manner in which they graded, e.g., if they graded more leniently or strictly than envisioned by the pass mark panel.

The Examination Part Committee chooses a preliminary MQC score for each question based on a review of the MQC scores suggested by both the pass mark panel and the graders. The Examination Part Committee uses this information to select a preliminary pass mark for the exam. In most cases, this is simply the sum of the preliminary MQC scores selected by question. Where there are unusual circumstances that would not be reflected in the individual MQC scores, e.g., if an exam is considered to be unusually long and as a result the minimally qualified candidate is not expected to complete it, an adjustment may be made by the Examination Part Committee to the sum of the preliminary MQC scores by question to produce the preliminary



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pass mark for the exam.

Candidate papers with scores close to the preliminary pass mark are re-graded multiple times to ensure appropriate, consistent scoring.

While this re-grading occurs, the Examination Part Committee along with an Examination Committee General Officer discusses the MQC score for each question with the graders of that question. A reconciliation between the MQC score determined by the pass mark panel and that suggested by the graders is performed in order to understand any differences that exist and make a final selection. The final selection may be that selected by the pass mark panel, that suggested by the graders, or a separate number entirely, reflecting all of the information gathered.

Some general examples of results of such discussion include:

- The graders adjusted the rubric in the course of their work such that they required more (or less) from the candidate than originally envisioned by the pass mark panel based on their review of the initial rubric. In such cases, the final selected MQC score would be lower (higher) than the MQC score selected by the pass mark panel.
- Through discussion it is determined that the question is more ambiguous (or more straightforward) than the pass mark panel originally thought due to the presence of (absence of) complications in the manner in which the question was asked. In such cases, the final selected MQC score would be lower (higher) than the MQC score selected by the pass mark panel.

Actual candidate performance is not used to determine the MQC score; it may be used to help direct the discussions that take place, e.g., if candidates performed particularly poorly on a question relative to the MQC, those discussing might question whether there was something ambiguous about the question that might help explain the results, but the MQC scores are not selected based on candidate performance.

The Examination Part Committee then determines the tentative pass mark. This is done in the same manner as the preliminary pass mark, with the tentative pass mark equal to the sum of the individual selected MQC scores, with adjustments to that total made only due to unusual circumstances (such as when an exam is considered to be unusually long; the Examination Part Committee looks at a number of metrics to determine whether such an adjustment is appropriate).

With the use of content-based pass marks, fluctuation in the pass rate from session to session is expected. Although the percentage of candidates passing will vary from year to year, those candidates demonstrating the required level of competence with the material on an individual examination will pass.

Final Pass Mark

A recommended pass mark is reached by consultation among the examination part chairperson, the general officer overseeing that examination, and the CAS Syllabus & Examination Committee chairperson. Any significant deviations from the à priori pass mark set by the pass mark panel are explored at this time. The recommended pass mark and explanations for deviations from the à priori pass mark are submitted to the vice president—admissions who approves the final pass mark.

After the pass mark is finalized, each candidate is assigned a score. Scores of 0 to 5 are assigned to candidates who do not pass. On this scale, each interval is 10 percent of the pass mark. For example, a grade of 5 equates to a candidate's score of at least 90 percent, but less than 100 percent, of the pass mark. A grade of 0 means that the candidate's score is less than 50 percent of the pass mark. Candidates at or above the passing mark will receive a score of 6 to 10.

The CAS releases the pass scores for Exams MAS-I, MAS-II, and 5-9 after the appeals deadline for the specific exam session. They are available from the [Past Exams and Pass Marks](#) page of the CAS website. The purpose of releasing the pass scores is to help candidates prepare for future exam sittings. The 75th and 95th percentile scores are also released for each exam. These



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two key statistics indicate the performance level achieved by the better-prepared candidates on the exam. Raw scores are not provided to candidates.

The final exam statistics are forwarded to the CAS Executive Council and CAS Board of Directors.

Examination Results

Exams MAS-I, MAS-II, and 5-9

Examination results are available approximately eight to nine weeks after the examination date. After exam results are received from the CAS Syllabus & Examination Committee at the CAS Office, candidates will be notified by email that their exam results have been uploaded to their profile. Candidates can access their exam results by logging into their My Exams page within their profile on the CAS website. Candidates will be apprised of their scores – 0 to 5 for those who did not pass the exam and 6 to 10 for those who passed the exam.

In addition, the spring 2018 exam sitting will be the last sitting in which exam results are mailed to candidates; generally on the day the results become available. Moving forward, candidates will access their exam results only via the website.

Candidates for Exams MAS-I, MAS-II, and 5-9 who did not pass will automatically be sent an analysis of their examination. The analysis of an examination is computer-generated. Actual points received for multiple-choice questions will be displayed. For constructed-response test items, ranges will be given for the actual score. This information is intended to provide the educational guidance that most candidates desire. Copies of the exam analyses will not be provided after the appeals deadline.

To preserve candidate confidentiality, in the event of a lost or misplaced candidate ID number, the candidate ID number will be mailed to the candidate upon request. Under no circumstance will a candidate number be given out over the telephone or by e-mail. Candidates can also verify their candidate number by logging into their profile on the CAS website.

Online Courses 1 and 2

The exams for Online Courses 1 and 2 are offered by computer-based testing. An unofficial pass/fail result will be displayed on the computer screen at the conclusion of the exam. When the official grades have been processed, candidates will receive an e-mail from The Institutes stating that their grades are available. Candidates may then log into their account on The Institutes website (<http://www.TheInstitutes.org>) to access their grades. The grade report for each candidate will show the candidate's overall score on the exam in ten point increments (e.g., 60 to 69%, 70 to 79%, and so on). It will similarly show the candidate's performance by assignment using those same ten point increments. Numeric scores are not released. Once final grades have been released, The Institutes will send a copy of the grades directly to the CAS Office to be added to the candidates' admissions records. **The Institutes sends this information to the CAS several weeks following the closing of the testing window. The CAS will post the list of passing names approximately two weeks later.**

Ambiguous or Defective Questions

For Exams 1, 2, 3F, and 4, the candidate should follow the procedural rules of the sponsoring organizations.

Online Courses 1 and 2

If a candidate believes a question is ambiguous or defective, he or she should bring this to the attention of The Institutes **in writing** within two weeks after the examination was administered. The candidate must submit this correspondence to The Institutes for the two online courses. The correspondence should include detailed reasons why the question is believed to be ambiguous or defective. The Institutes will investigate all questions brought to its attention.



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SYLLABUS OF BASIC EDUCATION
2018
Examination Rules

A copy of the correspondence to The Institutes should be sent to the CAS Syllabus & Examination Committee at defective-item@casact.org.

Exams MAS-I, MAS-II, and 5-9

The committee compiles and monitors various statistics for the questions it puts on the exams. These statistics often help to uncover potential defects, wording issues, or ambiguities. However, if a candidate believes that a multiple-choice or constructed-response test item is ambiguous or defective, he or she should bring this to the attention of the CAS Syllabus & Examination Committee in writing within two weeks after the examination date. In order to aid the candidate, preliminary answer keys for multiple-choice questions will be available the week following the examinations. The candidate may submit comments to the CAS Office by mail, fax, or e-mail at defective-item@casact.org. The correspondence should include detailed reasons why the question is believed to be ambiguous or defective. The CAS Syllabus & Examination Committee will investigate all questions brought to its attention in writing. To be considered in the grading process, correspondence must reach the CAS Office **within two weeks of the date that the exam was administered**. The decision of the CAS Syllabus & Examination Committee chairperson is final. Items judged to be defective will be identified within the Examiner's Report for Exams 5-9 and within the final posted grading key for Exam MAS-I and MAS-II.

Any multiple-choice question found to be defective is carefully examined to determine the most reasonable way to correct the situation. In some cases, the question is discarded, leaving scores and rankings, as they would have been if the defective question had not been asked. In other cases, more than one answer for a multiple-choice question is given credit for being correct.

No investigation of ambiguous or defective questions will be considered after these deadlines.



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Appeals for Exams MAS-I, MAS-II, and 5-9

Multiple-Choice Questions

After grades are released, the only appeal permitted on multiple-choice questions will be to request an administrative check of the candidate's short answer card to verify that the card reader scanned the card correctly and that the output file reflected this data. This request must be made within three weeks after the candidates are notified that their exam results have been uploaded to their profile by emailing appeals@casact.org.

Constructed-Response Test Items

For the constructed-response test items, appeals must reach the CAS Office not later than 2 weeks after the publication of the Examiner's Report for the specific exam. The Examiner's Report will be published to the CAS website as soon as possible after releasing exam results and candidates registered for the respective exam will be alerted by e-mail when this occurs. The candidate may submit his or her appeals to the CAS Office by mail, fax, or e-mail at appeals@casact.org.

If the candidate believes that there is an alternative correct solution, the candidate must provide specific reasoning in support of this claim. With specific information, the CAS Syllabus & Examination Committee can research the answer properly and reply to the candidate. An example of an invalid appeal would be the following: "I am appealing my score of 5 on Exam 9, please recheck my examination." Another example of an invalid appeal would be: "On question number 2, I believe I should get full credit because I answered the following . . ."

The examination part chairperson reviews each appeal and makes a recommendation to the CAS Syllabus & Examination Committee chairperson. The CAS Syllabus & Examination Committee chairperson will respond based on the recommendation of the examination part chairperson. **The decision of the CAS Syllabus & Examination Committee chairperson is final.**

No appeals will be considered after these deadlines.

Confidentiality of Examination Records

The fact that a candidate has passed a particular examination is considered public knowledge. Any further information as to examinations taken by candidates and scores received by candidates is available only to the candidates themselves, to CAS Syllabus & Examination Committee officials if required for committee purposes, and to the CAS Office, unless the candidate requests in writing that such information be provided to someone else. However, if any action is taken against a candidate as a result of his or her conduct (as described in the section on Examination Discipline), the Casualty Actuarial Society, at its sole discretion, may disclose such information to any other bona fide actuarial organization that has a legitimate interest in such results and/or actions. The candidate authorizes and consents to the Society using and disclosing (including, but not limited to, disclosing to the third-party contractors and service-providers of the Society) personally identifiable information about the candidate as necessary and appropriate for the purposes of registering the candidate for the exam, conducting the exam, determining the results of the exam, and communicating with the candidate regarding the results of the exam.



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Transition Programs

The CAS generally reviews and makes revisions to the study material on an annual basis. Occasionally, a major topic will be added to or deleted from the syllabus. A major topic is defined as a series of learning objectives comprising a segment of an examination. When a major topic is added, the CAS Syllabus & Examination Committee will determine if a transition program is appropriate. A transition program is generally appropriate when candidates are in a position to lose credit for a segment of an examination.

A transition program usually will provide candidates with at least two opportunities to complete the requirements for that examination. The completion of the requirements will result in the achievement of credit for that entire examination. The failure to fulfill the requirements for that complete examination could result in the expiration of credit for that deleted topic at the end of the transition period. The CAS Board of Directors must approve any transition program.

Current Education Structure

- The CAS Board of Directors approved the following transition rules for the **2018 education structure**.

To receive credit for the new Exam Modern Actuarial Statistics-I (MAS-I), the candidate must have credit for Exam S—Statistics and Probabilistic Models by January 1, 2018. To receive credit for the new Exam Modern Actuarial Statistics-II (MAS-II), the candidate must have credit for Exam 4—Construction and Evaluation of Actuarial Models by July 1, 2018. If the candidate has not completed Exam S and Exam 4 by these dates, the candidate will need to pass both Exams MAS-I and MAS-II.

Candidate Credit		Candidate Credit under Examination Structure Implemented in January 2018		Action Required to Earn Credit for new Exams MAS-I and MAS-II
Exam S by 1/1/2018*	Exam 4 by 7/1/2018**	Exam MAS-I	Exam MAS-II	
x	x	x	x	Credit granted. No candidate action required.
x		x		Complete Exam 4 examination requirement by 7/1/2018 or pass Exam MAS-II.
	x		x	Pass Exam S before 1/1/2018 or pass Exam MAS-I.
				Candidate must pass both Exam MAS-I and Exam MAS-II.

* Credit for Exam S must be achieved through an examination administered prior to January 1, 2018.

** Credit for Exam 4 must be achieved through an examination administered prior to July 1, 2018 or through course work completed by 12/31/2018 under the CIA's University Accreditation Program. See [Waiver of Examinations Rules](#) for the various ways a candidate can be granted a waiver by the CAS for its Exam 4 examination requirement.



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The CAS has approved the following transitional waiver policies for examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS Syllabus and the syllabi of each of the aforementioned actuarial organizations. The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities.

- If a candidate has passed all three Exams CT4, CT5, and CT6 or A202, A203, and A204 by 8/31/2016, they will receive credit for CAS Exam S and subsequently CAS Exam MAS-I. See #1 under Older Transition Rules Applicable to the Current Education Structure below for additional details.
- If a candidate has passed both Exams CT4 and CT6 or A202 and A204 by 7/1/2018, they will receive credit for CAS Exam 4 and subsequently CAS Exam MAS-II.

2. The CAS Board of Directors approved the following transition rules for the **2018 education structure**.

Credit Prior to July 1, 2018	Credit in Education Structure Implemented in July 2018
VEE-Corporate Finance	VEE-Accounting and Finance
VEE-Economics	VEE-Economics

3. The CAS Board of Directors approved the following transition rule for the **2018 education structure**.

Credit Prior to July 1, 2018	Credit in Education Structure Implemented in July 2018
Exam 3F - Models for Financial Economics	Exam 3F - Financial Economics

Older Transition Rules Applicable to the Current Education Structure

1. The CAS Board of Directors approved the following transition rules for the education structure that was implemented in the Fall of 2015.

To receive credit for the new Exam S on Statistics and Probabilistic Models during the transition, the candidate must have credit for Exams ST and LC[†] and the VEE-Applied Statistical Methods educational requirement.

At the time of transition, if a candidate has credit for either Exam ST or Exam LC, but not both, the candidate will be allowed to take just the exam for which he or she is missing credit in order to obtain partial credit for the new exam. This option will be available for a transition period of two sittings, i.e., Fall 2015 and Spring 2016.

Credit for the VEE-Applied Statistical Methods educational requirement will also be accepted for those candidates who complete it by August 31, 2016. If the candidate has not completed Exam ST, Exam LC, and the VEE-Applied Statistical Methods educational requirement by this date, the candidate will need to pass the full version of Exam S to receive credit.

Candidates with credit for neither Exam ST nor Exam LC on August 31, 2015 will not be permitted to sit for Exam ST or Exam LC during the transition period and will need to pass the full version of Exam S to receive credit.

The following table summarizes the above:

Candidate Credit on August 31, 2015	Action Required by August 31, 2016 to Earn Credit for



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Exam ST	Exam LC	VEE-Applied Statistical Methods	new Exam S
x	x	x	Credit granted. No candidate action required.
x	x		Complete VEE-Applied Statistical Methods.
x		x	Pass Exam LC.
x			Pass Exam LC and complete VEE-Applied Statistical Methods.
	x	x	Pass Exam ST.
	x		Pass Exam ST and complete VEE-Applied Statistical Methods.
		x	Candidate must take full version of Exam S.
			Candidate must take full version of Exam S.

†The CAS has also granted waivers for Exam LC to candidates who have:

- Passed SOA Exam MLC;
- Passed the Institute and Faculty of Actuaries (U.K.), Actuaries Institute (Australia), or Institute of Actuaries of India Subject CT5; or
- Passed the Actuarial Society of South Africa Course A203; or
- Received a waiver granted by the Canadian Institute of Actuaries University Accreditation Program.

For those candidates who have credit for Exam ST by August 31, 2015, the CAS will continue to grant the above Exam LC waivers through August 31, 2016.



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The CAS has approved the following transitional waiver policy for examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS Syllabus and the syllabi of each of the aforementioned actuarial organizations. The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities.

Candidate Credit on August 31, 2015		Action Required by August 31, 2016 to Earn Credit for new Exam S
CT5 or A203	CT4 and CT6 or A202 and A204	
x	x	Credit granted. No candidate action required.
x		Pass CT4 and CT6 or A202 and A204.
	x	Pass CT5 or A203.
		Candidate must take full version of Exam S.

2. The CAS Board of Directors approved the following transition rules for the education structure that was implemented in January 2014:

Credit in 2013*	Credit in Education Structure Implemented in 2014
Exam 3L	Exams LC and ST
SOA Exam MLC	Exams LC and ST

***Note:** Credit for Exam 3L or SOA Exam MLC must have been achieved through an examination administered prior to January 2014.

In addition, the CAS Board of Directors approved the following waiver that will continue beyond January 2014:

Credit	Credit in Education Structure Implemented in 2014
SOA Exam MLC	Exam LC



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4. The CAS Board of Directors approved the following transition rules for the education structure that was implemented in January 2011:

Credit in 2010	Credit in Education Structure Implemented in 2011
Exam 5	Half of Exam 5 (section on Basic Techniques for Ratemaking)* and Online Course 1
Exam 6	Half of Exam 5 (section on Estimating Claim Liabilities)* and Exam 7 on Estimation of Policy Liabilities, Insurance Company Valuation, and Enterprise Risk Management
Exam 7	Nation-specific Exam 6 on Regulation and Financial Reporting and Online Course 2
Exam 8	Exam 9 on Financial Risk and Rate of Return
Exam 9	Exam 8 on Advanced Ratemaking

***Note:** To receive credit for the new Exam 5 on Basic Techniques for Ratemaking and Estimating Claim Liabilities, the candidate must have credit for both old Exams 5 and 6. At the time of transition, if a candidate has credit for only one of the required exams (either old Exam 5 or Exam 6), the candidate will be allowed to take just the part of the exam for which he or she is missing credit (i.e., either the Basic Techniques for Ratemaking section or the Estimating Claim Liabilities section of the new exam) in order to obtain credit for the new exam. This option will be available for a transition period of two sittings after the official conversion to the new education structure (i.e., May 2011 and May 2012). If the candidate does not have credit for both halves of Exam 5 at the end of the transition period, the candidate would have to pass the full version of Exam 5 to receive credit.

5. The CAS Board of Directors approved the following transition rule for the revision to Exam 3 that was implemented in January 2008:

Credit in 2007	Credit in Education Structure Implemented in 2008
Exam 3	Exams 3F and 3L

6. The CAS Board of Directors approved the following transition rules for the revised education structure that was implemented in January 2005:

Credit in 2004	Credit in Education Structure Implemented in 2005
Exam 1	Exam 1
Exam 2	Exam 2, VEE-Economics, VEE-Corporate Finance
Exam 3	Exam 3 [Exams 3F and 3L]
Exam 4	Exam 4, VEE-Applied Statistical Methods



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7. The following rules apply for candidates with unused credit from exams administered prior to 2000:

Pre-2000 Credit	Credit in Education Structure Implemented in 2014
Exam 2 (Probability & Statistics) and Exam 4B (Credibility Theory and Loss Distributions)	Exam ST
Pre-2000 Credit	Credit in Education Structure Implemented in 2011
Exam 3B	Online Course 1
Pre-2000 Credit	Credit in Education Structure Implemented in 2005
Exam 3A	VEE-Applied Statistical Methods
Exam 4A	Exam 2
Exam 4B	Exam 4
Exam 5A	VEE-Economics
Exam 5B	VEE-Corporate Finance

CAS Course on Professionalism

The CAS Course on Professionalism is designed to present candidates with real situations that contain ethical and professional issues for the actuary. Volunteer members of the CAS facilitate small group discussions of actual case studies. Although grades are not given for the course, candidates must actively participate in order to receive credit. Successful completion of this course is required before a candidate can become a member of the Casualty Actuarial Society.

Candidates are urged to register for this course as soon as they are eligible. To be eligible for the CAS Course on Professionalism, the candidate should refer to the CAS website:

- For the US/Canada Course on Professionalism - <http://www.casact.org/admissions/index.cfm?fa=cop>
- For the Asia Course on Professionalism - <http://www.casact.org/admissions/index.cfm?fa=cop-asia>

Dates for the course will be posted in the CAS Course on Professionalism page of the CAS website (<http://www.casact.org/education/index.cfm?fa=prof>). Each course has a limited number of participants; early registration is recommended. Facility information and course times are provided when registration for specific courses is announced.



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CAS Membership Requirements

Associateship

Candidates for Associateship in the Casualty Actuarial Society must fulfill the examination requirements by successful completion of, or credit for, Exams 1, 2, 3F, 4 (prior to July 1, 2018), MAS-I, MAS-II (after July 1, 2018), 5, and 6; have credit for Online Courses 1/CA1 and 2/CA2; have credit by Validation by Educational Experience (VEE) for the required topics of corporate finance (accounting and finance after July 1, 2018) and economics; and successful completion of, or credit for, the CAS Course on Professionalism. Exam 6 is nation specific and passage of any one of the CAS-approved nation-specific exams fulfills the Associateship requirements.

After completing all the prescribed requirements, all prospective Associate members must submit a [formal application](#) to the Casualty Actuarial Society. The application form and list of application requirements are available on the CAS website in the Join/Renew section. Obtaining the two letters of reference is the prospective member's responsibility. If no member of the CAS is familiar with the prospective Associate and his or her work history, references from members of the American Academy of Actuaries, the Canadian Institute of Actuaries, the Society of Actuaries, other actuarial organizations that are part of the International Actuarial Association, or senior executives where the candidate is employed may be substituted. For further information on alternative acceptable references, please contact the CAS Office. An application for membership will not be processed without these references. Candidates must have completed all educational requirements prior to submitting an application for CAS membership.

After all requirements are met and a completed application has been submitted to the CAS, each candidate is voted on by the CAS Executive Council. Upon approval of the CAS Executive Council, the candidate will be admitted as an Associate of the Casualty Actuarial Society (ACAS). Candidates approved by the Executive Council will be notified by letter from the CAS president. Members may indicate their designation as an Associate of the Casualty Actuarial Society by using the initials "A.C.A.S." after their names only after they have received official notification of acceptance as an Associate from the CAS.

Fellowship

In addition to fulfilling all the requirements of Associateship, successful completion of, or credit for, all Fellowship examinations is required to fulfill the requirements for Fellowship and to be designated as a Fellow of the Casualty Actuarial Society (FCAS). Candidates who are admitted to the CAS as Fellows rather than Associates may indicate their designation as a Fellow of the Casualty Actuarial Society by using the initials "F.C.A.S." after their names only after they have received official notification of acceptance as a Fellow from the CAS. Associates who complete their Fellowship requirements may use the "F.C.A.S." designation immediately following official notification of successful completion of all the Fellowship requirements as prescribed by the Board of Directors.

CERA Designation Requirements

Candidates for the CERA (Certified Enterprise Risk Analyst) designation must fulfill the educational requirements by successful completion of all CAS Associateship requirements, CAS Exams 7 and 9, the Enterprise Risk Management and Modeling Seminar (specifically designed for the CERA designation), and Exam ST9 of the Institute and Faculty of Actuaries (U.K.).

After completing all the prescribed requirements, all prospective CERA designees must submit a formal application to the Casualty Actuarial Society. The application form will be available in the CERA section of the CAS website (<http://www.casact.org/cera/>). Candidates must have completed all educational requirements prior to submitting an application for the CERA designation.



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After all requirements are met and a completed application has been submitted to the CAS, each candidate is voted on by the CAS Executive Council and then submitted to the international Treaty Board for the CERA Global Credential for approval. Upon approval, the candidate will be granted the CERA designation. CERA designees may indicate their designation by using the initials “CERA” after their names only after they have received official notification from the CAS.

Waiver of Examinations

Actuarial Examinations

The CAS’s **Basic Education Waiver Policy** addresses the extent to which the CAS will grant waivers of its basic education requirements including Exams 1, 2, and 3F, and Exam 4 prior to 7/1/2018; Online Courses 1 and 2; Course on Professionalism; and Validation by Educational Experience requirements, or their equivalents as defined by the Executive Council.

The Board of Directors agrees that an exam waiver should be considered for verified educational accomplishments, e.g., exams or university courses, required by another actuarial organization that substantially meet the learning objectives of a particular CAS exam with reasonably equivalent rigor and level of mastery of the material. The Board agrees that the alternative should not be required to cover every learning objective that is covered in the CAS *Syllabus* for the particular exam in order to consider a waiver and that other learning objectives covered by the alternative may be considered as substitutes.

In addition to actuarial exam requirements, the CAS may grant waivers for other basic education requirements provided that the educational experience is deemed equivalent in subject matter coverage and depth. For example, the CAS may accept a professionalism course offered by another actuarial organization provided that it is deemed equivalent to the CAS Course on Professionalism or the Executive Council provides a supplement to address any significant CAS requirement that may be lacking. Other examples where CAS requirements may be waived include Online Courses or Validation by Educational Experience requirements. In general, the CAS will not grant waivers for its upper-level exams, i.e., Exams 5-9.

The CAS will not grant waiver of all or any portion of its examination requirements for work experience or contribution to actuarial literature.

Under this Policy, the granting of waivers by the Executive Council will be based on the recommendation of the vice president-admissions.



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Canadian Institute of Actuaries

The CAS recognizes the exam waivers granted by the Canadian Institute of Actuaries University Accreditation Program for CAS Exams 2 and 3F, and CAS Exam 4 (see below). The CAS will only grant waivers for CIA UAP exam credits that were awarded based on work at universities in Canada. The list of candidates granted waivers by the CIA is provided to the CAS following the end of a semester. The CAS automatically updates its records. No further action is required of candidates.

Note:

- Under previous education structures, the CAS recognized the exam waivers for CAS Exams 3L and LC.
- If a candidate has been granted a waiver for CAS Exam 4 under the University Accreditation Program through course work completed by 12/31/2018, then they will receive credit for CAS Exam 4 and subsequently CAS Exam MAS-II.

China Association of Actuaries

The CAS recognizes the preliminary examinations sponsored by the China Association of Actuaries (CAA). Credit will be granted for examinations passed or waived as a cohort for CAA exams A1, A2, A3, A4, and A7. When a candidate submits credit for all five exams, they will be given credit for CAS Exams 1, 2, and 3F, CAS Exam 4 prior to 7/1/2018, and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance after 7/1/2018) and Economics. **Credit will not be given on an individual exam basis. Credit will only be given for an entire cohort of examinations.**

The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities, nor for credit granted to candidates not qualifying directly in obtaining membership through the normal qualification/examination process.

Credit will not be given to Fellows of the CAA who have attained their designation through mutual recognition rather than through the organization's standard credentialing process. Fellows by mutual recognition should pursue examination waivers based on their original credentials.

The CAS has approved the following waiver policy:

Submitted CAA Exam Cohort	Waiver Granted for CAS Exam/Educational Experience Cohort Equivalent
A1, A2, A3, A4, & A7	1, 2, and 3F, 4 (prior to 7/1/2018), VEE-Corporate Finance (prior to 7/1/2018), VEE-Accounting and Finance (after 7/1/2018), & VEE-Economics

Note: If a candidate has passed CAA Exams A1, A2, A3, A4, & A7 by 7/1/2018, then they will receive credit for CAS Exam 4 and subsequently CAS Exam MAS-II.



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Institute and Faculty of Actuaries (U.K.), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and Institute of Actuaries of India Examinations

The CAS recognizes some of the examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS *Syllabus* and the syllabi of each of the aforementioned actuarial organizations.

The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities, nor for credit granted to candidates not qualifying directly in obtaining membership through the normal qualification/examination process.

Credit will not be given to Fellows of these actuarial organizations who have attained their designation through mutual recognition rather than through the organization’s standard credentialing process. Fellows by mutual recognition should pursue examination waivers based on their original credentials.

The CAS has approved the following waiver policy:

Subject of the Institute and Faculty of Actuaries (U.K.), Actuaries Institute (Australia), and Institute of Actuaries of India	Subject of the Actuarial Society of South Africa	Waiver Granted for CAS Exam/Educational Experience
CT2	A103	VEE-Corporate Finance (prior to 7/1/2018) or VEE-Accounting and Finance (after 7/1/2018)
CT7	A102	VEE-Economics
CT3	A101	Exam 1
CT1	A201	Exam 2
CT8	A205	Exam 3F
CT3, CT4, and CT6 (passed after 9/1/2016)	A101, A202, and A204 (passed after 9/1/2016)	Exam MAS-I

Note: The CAS has approved the following **transitional waiver policies** for examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS *Syllabus* and the syllabi of each of the aforementioned actuarial organizations. The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities.

- If a candidate has passed all three Exams CT4, CT5, and CT6 or A202, A203, and A204 by 8/31/2016, they will receive credit for CAS Exam S and subsequently CAS Exam MAS-I.
- If a candidate has passed both Exams CT4 and CT6 or A202 and A204 by 7/1/2018, they will receive credit for CAS Exam 4



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and subsequently CAS Exam MAS-II.

Society of Actuaries

The CAS recognized the SOA exams listed in the chart below. Candidates who check the “Property and Casualty” field on their preliminary exam application will have the results of their exams automatically updated in the CAS candidate database. Candidates who did not check the “Property and Casualty” field can have their exam results verified and updated in the CAS candidate database by completing the [online form](#).

The CAS recognizes the following exams and the transition rules adopted by the SOA for the changes to their examinations in 2017:

SOA Exam	Waiver Granted for CAS Exam
P (Probability)	1
FM (Financial Mathematics)	2
MFE (Models for Financial Economics)	3F (prior to 7/1/2018)
IFM (Investments and Financial Markets)	3F (after 7/1/2018)
C (Construction of Actuarial Models)	4 (prior to 7/1/2018)

CAS Exam Requirements of SOA Members

An actuary who achieved Fellowship or Associateship of the SOA by completing the qualification requirements of the SOA, not solely in recognition of membership of another actuarial association, has CAS examination credit for:

- Exam 1
- Exam 2
- Exam 3F
- Exam 4 (prior to 7/1/2018)
- VEE-Corporate Finance or VEE-Accounting and Finance (after 7/1/2018)
- VEE-Economics

Therefore, the remaining exams/courses required of an ASA or FSA to achieve ACAS are:

- Online Course 1
- Online Course 2
- Exam MAS-I[†]
- Exam MAS-II^{††}
- Exam 5
- Exam 6
- CAS Course on Professionalism

[†] If a SOA Member completed SOA Exam MLC and VEE-Applied Statistics prior to 2014, credit for CAS Exam 5 would be granted under Transition Rules and subsequently Exam MAS-I.

^{††} If a SOA Member completed SOA Exam C prior to 7/1/2018, they will receive credit for CAS Exam 4 and subsequently Exam MAS-II.

Important Notes:



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- The syllabus material covered on CAS Exam 7 is still required in addition to ACAS to sign a Statement of Actuarial Opinion, NAIC Property and Casualty Annual Statement, in the United States.
 - At this time, there is no waiver of any other CAS exams based on the SOA's General Insurance (GI) examination process.

Members of Other Actuarial Organizations

For individuals of actuarial organizations that are a member of the International Association of Actuaries (IAA), the CAS will grant waivers for its preliminary examinations/educational requirements as defined by the Executive Council (CAS Exams 1, 2, and 3F, CAS Exam 4 prior to 7/1/2018; and Validation by Educational Experience requirements) provided that the organization's individual member achieved the highest possible designation in that organization and has been practicing as a professional actuary for at least two years subsequent to obtaining the qualification.

Candidates of Other Actuarial Organizations

Actuarial organizations that are full members of the IAA and have an exam-based admissions requirement may request that the CAS grant waivers to its individual candidates for the CAS preliminary examinations/educational requirements – as a cohort of CAS Exams 1, 2, and 3F, CAS Exam 4 prior to 7/1/2018, and Validation by Educational Experience requirements – based on credit for their examinations that meet certain IAA requirements. An actuarial organization should contact the CAS Examinations Coordinator for the requirements to obtain this approval. All organization submissions are subject to the approval of the vice president-admissions and Executive Council.

Online Courses and VEE

Online Courses: The CAS will grant a waiver of CAS Online Course 1, Risk Management and Insurance Operations, to those who have the Chartered Property Casualty Underwriter (CPCU) designation.

Validation by Educational Experience: Unlike other CAS admissions requirements, the Validation by Educational Experience (VEE) requirements are generally fulfilled outside an actuarial organization. Candidates requesting waiver of any VEE requirements based on actuarial exams should follow the procedure for requesting a waiver. Most candidates, however, will fulfill the VEE requirements through approved educational experiences and must submit the Application for Validation by Educational Experience Credit. Details are provided in the VEE section of this *Syllabus*.

Waiver Request Process

For a waiver of a CAS admissions requirement that has an approved waiver policy stated above, candidates should present their request to the CAS Examinations Coordinator with appropriate evidence that demonstrates the passing of (or score on) the educational equivalent for which a waiver is requested.

Requests for waivers for CAS admissions requirements for which there currently is no approved waiver policy are considered on a case-by-case basis. Candidates must present their requests to the CAS Examinations Coordinator and include with their applications documented evidence that demonstrates the asserted equivalence, as well as the appropriate educational policy material of their local actuarial organization or appropriate educational organization. If such material is not included, the CAS Examinations Coordinator will request it from the candidates. The vice president-admissions will review all such requests and, when appropriate, recommend action to the Executive Council.

Please address all waiver requests to: CAS Examinations Coordinator, Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203, U.S.A.



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D. CAS Code of Professional Ethics for Candidates

The purpose of the Casualty Actuarial Society (CAS) Code of Professional Ethics for Candidates (Candidate Code) is to require actuarial candidates to adhere to the high standards of conduct, practice, and qualifications of the actuarial profession, thereby supporting the actuarial profession in fulfilling its responsibility to the public. An actuarial candidate shall comply with the Candidate Code. An actuarial candidate who commits a material violation of the provisions of the Candidate Code shall be subject to the counseling and discipline procedures of the CAS.

“Actuarial candidates” are those persons who have registered for a CAS specific exam but have yet to fulfill all of the requirements for admission into the CAS. In situations where actuarial candidates perform actuarial work, their “principal” is defined as their client or employer. “Actuarial services” are professional services provided to a principal by an individual acting in the capacity of an actuary. Such services include the rendering of advice, recommendations, findings, or opinions based upon actuarial considerations.

Rule 1: An actuarial candidate shall act honestly, with integrity and competence, to uphold the reputation of the actuarial profession.

Rule 2: An actuarial candidate shall not engage in any professional conduct involving dishonesty, fraud, deceit, or misrepresentation or commit any act that reflects adversely on the actuarial profession.

Rule 3: An actuarial candidate shall perform actuarial services with courtesy and professional respect and shall cooperate with others in the principal’s interest.

Rule 4: An actuarial candidate shall adhere to the CAS Policy on Examination Discipline.

Rule 5: Actuarial candidates are not authorized to use membership designations of the CAS until they are admitted to membership by the CAS Executive Council.

Rule 6: An actuarial candidate shall not disclose to another party any confidential information unless authorized to do so by the principal or required to do so by law, statute, or regulation. Confidential information includes information of a proprietary nature and information that is legally restricted from circulation.

Rule 7: An actuarial candidate shall respond promptly, truthfully, and fully to any request for information by, and cooperate fully with, appropriate counseling and disciplinary body of the CAS in connection with any disciplinary, counseling or other proceeding of such body relating to the Candidate Code. The actuarial candidate’s responsibility to respond shall be subject to applicable restrictions listed in Rule 6 and those imposed by law, statute, or regulation.

(The CAS Board of Directors approved the code above on November 12, 2006, effective with the Spring 2008 exam sitting.)

A copy of the Casualty Actuarial Society Rules of Procedure for Disciplinary Actions Involving Candidates is available in the Exams & Admissions section of the CAS website under “Candidate’s Code of Ethics.”



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EXAMINATION RULES

The CAS has announced the transition of its upper level, constructive-response examinations to a computer-based environment, called Technology-Based Examination (TBE). It will replace the traditional paper-and-pencil method of exam administration. The first exam to be administered using this environment will be Exam 5-Basic Techniques for Ratemaking and Estimating Claim Liabilities in May 2018.

Because there are distinctive processes and procedures for TBE, the rules and procedures provided below are in addition to those for other CAS-administered exams. These “Examination Rules for TBE” are part of the CAS Examination Rules of the 2018 *Syllabus for Basic Education*.

A. Registration

Filing of Applications and Deadlines

The CAS exam registration process for exams offered in the TBE environment is the same as for paper-and-pencil exams. Candidates will register for the exam by completing an online registration form on the CAS website.

Scheduling for the Exam with Remote Proctor

After a candidate completes the regular CAS exam registration process, the CAS Office will notify PSI, the CAS technology partner for online scheduling and remote proctoring, that a candidate has registered for the exam. Each candidate will receive an email from PSI about a week after the exam registration deadline with information about how to set up a PSI account and how to schedule their exam start time.

To schedule an exam with PSI, each candidate will need to create an account and choose a start time to take the exam. CAS candidates will have 24/7 access to PSI’s online system via computer or mobile device. Candidates will be able to select the starting time in the local time zone in which they will take the exam for their exam session among available options on the scheduled exam day, i.e., May 3rd-4th for the May 2018 exam administration. Candidates can change their scheduled exam time up to two weeks before the exam, i.e., April 20th for the May 2018 exam administration.

Details and [step-by-step instructions](#) for creating an account with PSI and scheduling an exam start time are available on the CAS website.

Examination Administration Locations

For TBE, examination centers are not utilized. Candidates will take the exam within Excel 2016 via a virtual desktop that is accessed on the candidate’s computer. Candidates will sit for the exam at the location of their choosing that meets certain criteria, and at a time of their choosing, within certain windows available on specific dates. See Appropriate Workspace section below for additional guidance.

Candidates will need to have a reliable Internet connection, be familiar with Excel, and have a computer that



meets certain requirements to sit for a technology-based examination. The candidate's computer does not need to have Excel 2016 installed, as it will be available on the virtual desktop.

A professional remote proctor will administer the exam for each candidate, with the ability to monitor candidates through the candidate's webcam and microphone throughout the exam sitting.

The CAS will not administer exams to candidates located in any country that has trade sanctions held against it per the [U.S. Department of the Treasury](#).

Special Arrangements for Candidates with a Disability

A candidate with a formally diagnosed disability who needs special testing arrangements must submit a written request for each examination that the candidate intends to write. Documentation of the disability, e.g., physician's statement, diagnostic test results, as well as the need for special arrangements, is required of each candidate. Previous accommodations given to the candidate in an educational program or work setting may be considered.

For exams administered using the TBE environment, requests for special arrangements and supporting documentation must be submitted at the applicant's expense at least two weeks prior to the registration deadline for the exam to Bob Craver at bcraver@casact.org. For the May 2018 exam administration of Exam 5, a candidate's request must be submitted by February 22, 2018.

B. The Examination

Conduct of Examinations

Candidates may not bring books, papers, electronic wearables such as smart watches, or electronic or mechanical aids for computation of any kind into the examination area. Candidates may not communicate with, or obtain any assistance from, any other candidate or person during the examination.

Candidates must respond to constructed-response test items (essay questions) in English unless advance notice is given and approved (see [Languages other than English](#) under Examination Rules—Registration). Examination answers as entered in the Excel file are not returned to candidates.

Requirements for Access to the Examination (Appropriate Workspace)

To take the examination, a candidate needs to ensure that they have a quiet area where they will be alone and uninterrupted for the time necessary to check in for and take the exam, a computer and accessories that meet the requirements (see below), a steady Internet connection, and a clear work surface, aside from the allowed items (see below). An office, conference room, or other public area must be walled, with a closed door, away from disruptions with coverings over any transparent walls or doors. A room in a candidate's home should be away from disruptions.

Candidates will be able to schedule their specific exam time approximately two months in advance of the exam date, and can use the time between then and the exam date to secure a suitable location. Options for a suitable location that candidates could consider are suggested in the [Exam Day Guidelines](#) PDF.

Candidates will also need a government-issued identification. The CAS will accept a non-expired passport or a non-



expired government-issued identification that includes a photo and signature as a valid identification. As with all CAS-administered exams, the name on the government-issued identification must match the name under which the candidate has registered for the exam.

Candidates may log in to the exam up to thirty minutes before the scheduled start of their examination. Some candidates may experience a short wait to check in to the exam as other candidates are being checked in.

Candidates who attempt to check in more than 15 minutes after their scheduled start time will not be allowed to take the exam and will not be able to reschedule the exam. While TBE offers much more flexibility in allowing a candidate to decide when to take an exam, there are also limitations. Due to the remote proctor scheduling requirements, we regret that we cannot offer late candidates the opportunity to take the exam for a shorter length of time like is allowed in the paper-and-pencil testing environment.

Additional guidance is provided in the [Exam Day Guidelines](#) PDF.

Computer Compatibility

Candidates need to provide their own computer and accessories to take an exam in the TBE environment.¹ The CAS will not provide computers or accessories to candidates. Candidates should carefully review the requirements described below.

Candidate computers must meet the following criteria:

- Operating Systems Supported: Windows (7 or later) 32bit (x86) and 64bit (x64), Mac OS X version 10.9 and above
- Browser: Candidates will download a secure browser to use to access the remote proctored environment.
- Webcam: Minimum VGA with 640 x 480 resolution; enabled built-in or external webcam. The webcam must have the capability to show the work surface, under the work surface, and a 360-degree view of the room.
- Microphone: Enabled built-in or external microphone
- Internet Bandwidth: Minimum 256kb/s download and 256kb/s upload
- Hardware Requirements: 2GB RAM, minimum 1368 x 768 resolution, 1GB free space for installation

Candidates may not use a virtual machine or virtual desktop to access the exam.

Candidates may use the following accessories with their computer/laptop:

- Standard or ergonomic QWERTY keyboard
- Attached 10-key pad in addition to keyboard

¹ If a candidate is planning to use a company laptop that may have added security protocols installed, [additional information](#) on the CAS website may be helpful to the candidate's IT department to ensure their computer will have access to the proctored exam on exam day.



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- Webcam, attached to laptop or separate
 - Wired or Bluetooth mouse
 - Only one monitor will be allowed. If using a docking station, the laptop must be closed and all other equipment used (one monitor, keyboard, mouse, and webcam) must be separate from the laptop.

Candidates who would like to use other accessories can apply for an exception by contacting Bob Craver at bcraiver@casact.org. Exception requests must be submitted no later than five weeks before the exam. For the May 2018 exam administration of Exam 5, a candidate's request for exceptions must be submitted by March 30, 2018.

A CAS-specific compatibility check is available to registered candidates who schedule their exam with PSI.

Candidate Behavior During the Exam

Exam behavior should be similar to that of in-person proctored exams. The candidate should not act in any manner that would cast suspicion that they may be receiving assistance or using unauthorized material. The candidate is expected to be working on the exam until they have completed the exam. Professionally-trained remote proctors will be monitoring candidate behavior, including watching eye movements, lip movements, and questionable noises. The entire exam session is recorded, including both the webcam feed and the virtual desktop activity; both recordings are available to the CAS.

It is the candidate's responsibility to ensure that they have a quiet area for the duration of the exam where they will be alone and uninterrupted. However, if someone does enter the workspace, the remote proctor will warn the candidate, and the person should leave the workspace immediately. If there is a chance that the candidate may be disturbed, the candidate should post "do not disturb" signage.

Examination Discipline

Candidates must not give or receive assistance of any kind during the examination. Any cheating, attempt to cheat, assisting others to cheat, participating therein, or engaging in improper conduct such as noted in the [CAS Examination Discipline Policy](#) is a serious violation and will result in the CAS disqualifying the candidate's exam and additional consequences determined by the Vice President Admissions. This may include a temporary or permanent ban from sitting for CAS Examinations. Members of the CAS are also subject to the CAS investigative and discipline process, such as through the Actuarial Board for Counseling and Discipline (ABCD) or the Canadian Institute of Actuaries (CIA), for any violations of the CAS Code of Professional Conduct. Candidates have agreed in their applications for examination to be bound by the rules and regulations governing the examinations.

Allowed Items on Work Surface

The only items allowed on the candidate's work surface are their computer and allowed accessories, a government-issued ID, quiet food and beverages, an acceptable dry-erase board, one or two dry-erase pens, and a dry-erase board eraser. Other items, such as any papers, including scratch paper, ink pens or pencils, and calculators are not allowed. In addition, electronic devices capable of sending or receiving wireless or cellular signals such as phones, pagers, PDAs, smart watches, smart pens, tablets, or MP3 players are not allowed.

A calculator is not allowed. All calculations should be performed in the Excel file such that the graders can follow the candidate's work.



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Candidates may use a desktop dry-erase board during the exam if desired. The dry-erase board must be no larger than 11" by 14" (or no larger than 27.9 cm x 35.5 cm) and must not be electronic. Candidates will be required to show that the dry-erase board is blank before the exam begins, after a break, and again after the exam ends. Dry-erase boards can be found online and at most retail chains. Here is an example from Amazon: <https://www.amazon.com/Magnetic-Dry-Erase-Board-Marker-11/dp/B00F6X1AX2>.

Candidates who expect to need to additional items on their work surface should contact Bob Craver at bcraver@casact.org to request an exception. Exception requests must be submitted no later than five weeks before the exam. For the May 2018 exam administration of Exam 5, a candidate's request for exceptions must be submitted by March 30, 2018. Exception requests based on medical necessity must include written documentation from a physician.

Food and Beverage

Quiet food and beverage are allowed. Please note that candidates must have the food and drink they are going to consume on the desk when the exam starts for review by the remote proctor. The candidate cannot bring additional items in from a break. Be sure to remove any food wrappers before the exam begins.

Clothing/Accessories

Electronic wearables, such as smart watches, are not allowed.

Listening to Music, Using Ear Buds, or Using Earplugs

Listening to music and wearing ear buds during the exam is not allowed.

The candidate should ensure that they have a quiet area reserved for the duration of the exam where they will be alone and uninterrupted. Therefore, earplugs should not be needed. The remote proctor will be receiving an audio feed of the sounds in the candidate's environment, and it is important that candidates are aware of sounds being heard by the proctor so that they can respond to questions about those sounds if asked.

Exam Duration

Exam 5 is developed to be a four-hour exam; however, candidates will have five hours to take the exam in the TBE environment. The clock starts after the check-in process, when the remote proctor releases the exam, and does not stop, e.g. for breaks.

The candidate may submit the exam as soon as they have finished. Once the exam is submitted, it cannot be accessed again.

Reading Period

A reading period will not be offered for exams in the TBE environment; however, candidates will have five hours to complete the exam.

Communicating with Remote Proctor

The professional remote proctor will contact each candidate via a chat window to check the candidate in to the



examination. As part of the check-in process, each candidate will be required to scan their workspace/room with their webcam to ensure that they are alone and that their work surface is clear. The proctor is required to view the candidate's entire testing area, so the candidate should ensure that the webcam has the capability to show the work surface, under the work surface, and a 360-degree view of the room. Candidates who utilize a laptop to take the exam will use the laptop's webcam and will pick up and turn the laptop as instructed. If a candidate has unapproved items on their work surface or in the workspace/room during the check-in process, they will be given time to correct this, but the remote proctor will move on to check in other candidates, and they may need to wait to be checked in again. When the check-in process is complete, the remote proctor will release the exam to the candidate.

Following the initial check-in process, the remote proctor will only contact a candidate if there is an issue that needs to be addressed. If a candidate needs to contact the remote proctor, they may do so at any time using the chat feature.

Candidates may be asked to re-scan the environment at any time during the exam.

Taking the Exam

Some other useful things to know:

- Each question will be presented in a single tab. Answers should be provided in the same tab, with work clearly shown for the graders to follow the candidate's calculations.
- Candidates can navigate throughout the exam in the order they wish.
- A point grid outlining points available by question will be provided to assist candidates with their exam-taking strategy. Additional tools that facilitate candidates' navigation through the exam are also offered in the TBE environment.
- The exam automatically saves every 60 seconds. The candidate may also save the exam at any time.
- As with paper-and-pencil exams, candidates should show all of their work. Interim steps of calculations should be shown in order to receive partial credit as appropriate. Questions can be answered in Excel using free-form text, formulas, or any combination thereof. Graders will receive copies of the candidate's Excel files and will have access to the formulas within the cells as well as the results that appear on the screen. For additional guidance on showing work, candidates may review the Sample Solutions file for the TBE Sample Exam (available from the [TBE Sample Exam, Practice Exam Session and Tools to Prepare for a TBE Exam](#) web page) and [Excel Exam Frequently Asked Questions \(FAQ\)](#).
- For the Spring 2018 administration of Exam 5, candidates will not be required to draw a parallelogram within Excel. Candidates need to understand the parallelogram concept and be able to work with parallelograms, but for the first TBE exam the questions will not require drawing to answer the question.
- For details regarding the structure of the Excel file, see the [TBE Sample Exam, Practice Exam Session and Tools to Prepare for a TBE Exam](#) web page and [Excel Exam Frequently Asked Questions \(FAQ\)](#).
- The French Language Accessory Pack will be available in the virtual exam environment. A Canadian keyboard layout will also be available in the virtual exam environment. For details about how to utilize these options, see the [Excel Exam Frequently Asked Questions \(FAQ\)](#) and the Exam Instructions sheet



within the exam. A candidate may preview the [Exam Instructions](#) in advance of the exam.

Break Periods During the Examination

Candidates will be permitted to take one break for up to ten minutes by following the procedures below:

1. The candidate needs to inform their remote proctor before they take their break; the proctor will acknowledge the break and remove access to the exam. The candidate needs to show the proctor that the dry-eraser board is blank before leaving.
2. The candidate may not bring any items with them back into their exam area from their break, including additional food and beverages.
3. When the candidate returns from the break they will need to communicate with their proctor. The proctor will require them to scan their workspace/room and dry-erase board again with their webcam. Some candidates may experience a short wait to re-check in to the exam after their break as other candidates are being checked in.
4. The proctor will re-release the exam.
5. The time spent on a break, including the time to check back in from the break and re-scan the workspace/room and dry-erase board, is included in the total five hours available to complete the exam.

The CAS will receive reports on candidate breaks and will investigate questionable behavior.

Candidates who expect to need to take more than one ten-minute break during the exam should contact Bob Craver at bcraiver@casact.org to request an exception. Exception requests must be submitted no later than five weeks before the exam. For the May 2018 exam administration of Exam 5, a candidate's request for exceptions must be submitted by March 30, 2018. Exception requests based on medical necessity must include written documentation from a physician.

Loss of Power or Loss of Connectivity

If the candidate's Internet connection or power goes out, the candidate should work quickly to rectify the situation. When the candidate is able to get back online they will need to re-scan their environment before the exam will be released. The five-hour exam timer continues to run during outages. The CAS will investigate instances where candidates are disconnected from the exam session.

Technical Problems

If the candidate experiences technical problems during the exam, the candidate should inform the remote proctor using the chat feature. The proctor will contact TrueAbility, the CAS technology partner providing the online testing environment, for technical support to resolve the issue.

Emergency Situation

If feasible, the candidate should communicate the emergency situation to the remote proctor. Should the candidate need to stop taking the exam, it will be submitted with the responses that they completed before



stopping.

C. Grading

For Technology-Based Examination (TBE), the grading process is similar to the process used for the paper-and-pencil constructed-response exams. The major difference is that graders will receive electronic copies of the Excel file with candidate responses instead of photocopied answer sheets. Graders will be able to see both the formula used in a cell as well as the result of that formula.

As with all other CAS examinations, exam results will be available approximately eight weeks after the examination date. The CAS will not provide the candidates with their answers to the exam questions.

The CAS will make the exam available in an Excel format following the administration of the exam. As with other CAS-administered exams, an Examiner's Report will be produced for the Spring 2018 administration of Exam 5 and appeals will be accepted.

D. Sample Exam, Sample Solutions, and Practice Exam Session

It is important that candidates understand that the format and style of questions that will be tested on Exam 5 in Spring 2018 will not differ from previous offerings of Exam 5. Additionally, the 2018 Exam 5 Syllabus is very similar to the 2017 Exam 5 Syllabus, with the same learning objectives and readings. Therefore, the information available in prior Examiner's Reports is still relevant, and the CAS strongly encourages candidates to include this information in their study plans.

To prepare candidates for what the exam will look like in the TBE environment, the CAS has released a TBE Sample Exam and TBE Sample Solutions, as well as an [Excel Exam Frequently Asked Questions \(FAQ\)](#). A TBE Practice Exam Session is also available.

See the [TBE Sample Exam, Practice Exam Session and Tools to Prepare for a TBE Exam](#) web page for links to the TBE Sample Exam and TBE Sample Solutions.

TBE Sample Exam

The TBE Sample Exam allows candidates to familiarize themselves with how questions will be presented in an Excel environment. The TBE Sample Exam is a downloadable Excel file that can be accessed with Excel 2007 or later. The TBE Sample Exam is the Spring 2016 Exam 5, presented in Excel in the same format that candidates can expect for the Spring 2018 Exam 5. There is no fee to download the TBE Sample Exam.

The CAS will not provide additional sample exams.

TBE Sample Solutions

A separate file showing sample solutions may also be downloaded. The TBE Sample Solutions will contain solutions from the Spring 2016 Exam 5 Examiner's Report to provide examples of how candidates may show their work in the Excel environment. There is no fee to download the TBE Sample Solutions file.



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TBE Practice Exam Session

The [TBE Practice Exam Session](#) will allow candidates to familiarize themselves with the virtual environment.

The TBE Practice Exam Session will offer the Spring 2016 Exam 5 in the TBE virtual desktop, without a remote proctor. Note that the Excel file in the TBE Practice Exam Session includes the same content as the Excel file that is downloadable as the TBE Sample Exam. The primary reason for candidates to access the TBE Practice Exam Session would be to familiarize themselves with Excel 2016 and the TBE virtual environment, if they desire to do so before sitting for the exam. It is not required that candidates access the TBE Practice Exam Session.

Upon accessing the TBE Practice Exam Session, candidates will have access to it for five hours. Candidates will **not** have access to their responses made within the TBE Practice Exam Session after the exam session is completed.

Candidates who wish to access the TBE Practice Exam Session more than once can do so by registering and paying the fee more than once.

A registration fee of \$40 will be required.

The CAS will not provide additional practice exams.



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STUDY RESOURCES

Study and Exam Techniques

The candidates may want to review various articles on a web page titled [Helpful Future Fellows Articles](#) in the Study Tips, Tools and Past Pass Marks section of the individual Examination pages under the “Exams and Admissions” section of the CAS website. These articles provide insight into the examination process.

Syllabus Updates

Occasionally, the course of reading for an examination may be changed after publication of the *Syllabus*. Such a change will be announced on the Syllabus Material section of the individual Examination page under the “Exams and Admissions” section of the CAS website.

Study Notes

Official Study Notes are published to help candidates prepare for the examinations. In some instances, Study Notes are the principal materials for study; in others, they are designed to coordinate the subject matter for the candidate or to complement other readings. Study Notes may be downloaded at no charge from the specific exam syllabus web page.

Study Kits for CAS-administered Exams

The Study Kit contains required readings not owned by the CAS but for which the CAS has been granted permission to include in the Study Kit. Study Kits will be available in mid-December for the following April/May examinations and by mid-June for the following October/November examinations. Study Kits may be purchased from the CAS Online Store; there are **NO RETURNS** and **NO REFUNDS**.

Online Publications for CAS-administered Exams

All readings that are denoted as “Online Publications” will be available on a web page titled Complete Online Text References for each examination at no charge.

Online Courses 1/CA1 and 2/CA2

All required educational content for Online Courses 1/CA1 and 2/CA2 is provided in the online courses themselves.



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Sample Examination Questions and Past Examinations

Preliminary Exams

Sample examination questions for Exams 1, 2, 3F, and 4 may be available from the sponsoring organizations.

CAS-administered Exams

In general, the CAS does not provide sample examination questions for the examinations that it administers. Instead, it provides copies of previously administered exams. In referring to previously administered exams, candidates should keep in mind that the questions were based on the learning objectives in effect for that particular examination and may not reflect the current learning objectives. Candidates may also expect future examinations to vary somewhat as to the proportions of question styles and subjects. New forms of questions may appear from time to time, and the total number of questions may vary from one exam sitting to the next.

CAS-administered exams will be posted in the “[Exams](#)” section of the CAS website the day after the given examination has been administered. They will include a preliminary list of multiple-choice answers. For exams administered using the Technology-based Examination (TBE) environment, the examination will be available in an Excel format. The Examiner’s Report will be posted at the end of July for April/May Examinations and at the end of January for October/November Examinations.

- ***Exam MAS-I and MAS-II***

For Exams MAS-I and MAS-II, the candidate can look to previously CAS-administered Exams 3L, LC, ST, and S for actual questions/answers for Learning Objectives that overlap with Exams MAS-I and MAS-II. [Sample questions/answers](#) for new topics for Exams MAS-I and MAS-II are available on the website and are available in the “Study Tips, Tools, and Past Pass Marks” section of the CAS website.

Copies of recent past exams including answer key for Exams 3L, LC, ST, and S are available at no charge in the “[Past Exams and Pass Marks](#)” section of the CAS website. While the last exam administration was October 2013 for Exam 3L, May 2016 for Exams LC and ST, and October 2017 for Exam S, copies of past Exams 3L, LC, ST, and S are still provided to assist candidates in preparing for Exam MAS-I and MAS-II.

- ***Exams 5-9***

Copies of recent past exams for Exams 5-9 are available at no charge in the “[Past Exams and Pass Marks](#)” section of the CAS website. The Examiner’s Report includes narratives for each question describing where points were achieved and where the candidates commonly missed points. The Examiners’ Report is an invaluable tool when preparing for an upcoming exam or consequently assessing missed opportunities on a prior exam. All candidates should read the reports from prior versions of the exam for which they are sitting. However, when incorporating the Examiners’ Report into your studying routine, it is important to keep in mind what the report is and, most importantly, what it is not. Candidates should review the *Future Fellows* article “[Getting the Most out of the Examiners’ Report.](#)”



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Sample Exam and Practice Exam for TBE

To prepare candidates for what the exam will look like in the TBE environment, the CAS will release a TBE Sample Exam, a TBE Practice Exam, and TBE Sample Solutions. These materials will all be based on the spring 2016 Exam 5.

E-Mail Study Groups

The CAS has e-mail [study groups](#) available on the Online Community for those preparing for CAS examinations. To join a CAS e-mail study group, click on the corresponding community and then “Join” on the right sidebar. Please direct any related questions to Sophie Uy, CAS IT and Online Services Coordinator, at suy@casact.org.

CAS Library

The CAS Library has a limited number of the books available for loan marked with a bold **B** in this *Syllabus*. Candidates registered for CAS Examinations and all members of the CAS have access to the library. The CAS Library is located at the CAS Office in Arlington, Virginia. For those who reside in East Asia, the Casualty Actuarial Society (Hong Kong Office) has CAS Library books available for lending and candidates residing in that area should contact the office in Hong Kong.

Books and manuals may be withdrawn from the library for a period of one month without charge. In general, not more than two references may be in the hands of one borrower at a time.

Requests for library books may be sent via e-mail or in writing to the addresses below. The request must include the borrower’s complete name, address, and telephone number as well as the complete title(s) and author(s) of the requested book(s).

For Candidates Outside East Asia:

Casualty Actuarial Society
Attention: Library Service
4350 N. Fairfax Drive, Suite 250
Arlington, Virginia 22203
E-mail: library@casact.org

For Candidates in East Asia:

Joint Actuaries Office - Hong Kong
Casualty Actuarial Society (Hong Kong Office)
Attention: Patricia Kum
2202 Tower Two, Lippo Centre
89 Queensway
Hong Kong
E-mail: hongkonglibrary@casact.org

Candidates are responsible for the cost of returning library books. Books must be returned to the office from which they were borrowed. The CAS ships the requested book(s) in the U.S. via United Parcel Service (UPS) and internationally via Air Mail. Due to delays in the mail system, the CAS requires all shipments of books returned to the CAS Office to be shipped via UPS, FedEx, or an equivalent carrier with tracking capabilities. Please do not use the postal service. Overdue books will be charged at a cost of 25¢ per day.

Books that are not available through the CAS Library may be obtained by contacting the organizations listed in the “Publishers and Distributors” section at the end of each examination syllabus section.



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EXAMINATION RULES

Starting in 2018, Exam 5 is being administered using a computer-based environment called Technology-Based Examination (TBE). Because there are distinctive processes and procedures for TBE, additional information is available on the [Technology-based Examination](#) web page. The rules and procedures provided on the TBE web page related to Exam 5 are part of the CAS Examination Rules.

A. Registration

Administration of Examinations

The CAS basic education structure has Validation by Educational Experience (VEE) requirements, two online courses, several examinations (see [Basic Education Summary](#)), and the Course on Professionalism. Credit for Exams 1, 2, 3F, and 4 is granted based on exam options as defined in the individual exam syllabi. The two online courses are available through The Institutes. The CAS exclusively administers Exams MAS-I, MAS-II, and 5-9 and the Course on Professionalism. The Canadian Institute of Actuaries (CIA) cosponsors all the examinations except Exam 6-United States and Exam 6-Actuarial Institute of Chinese Taipei.

Filing of Applications and Deadlines

Exams 1, 2, 3F, and 4

For Exams 1, 2, 3F, and 4, the candidate should follow the application process and deadlines of the sponsoring organizations.

Exams MAS-I, MAS-II, and 6-9

All candidates filing for an examination(s) must submit a signed application for each examination period. Both online registration and application forms are linked at each of the individual Examination pages under the “Exams and Admissions” section of the CAS website. Payment must accompany each application to be valid. **Applications must be received by the registration deadlines stated in the Examination Schedule of this Syllabus.** Please allow at least 10 working days for your mailed application to reach its destination. Whether payment is made by personal or company check, **it is the candidate’s responsibility to ensure that the application and fee are received by the stated deadline. Exceptions will not be made.**



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Send applications as follows: Candidates may submit examination registrations for Exams MAS-I, MAS-II, and 6-9 by mail or online. Applications must be received by the published deadlines. Candidates submitting a hard copy of their registration should mail them as follows:

<p><i>Mail application with check or money order in U.S. funds or Canadian equivalent (payable to "Casualty Actuarial Society") to:</i></p> <p>Casualty Actuarial Society P.O. Box 425 Merrifield, VA 22116-0425</p>	<p><i>Send application with credit card payment (Visa, MasterCard, or American Express) and all overnight deliveries to:</i></p> <p>Casualty Actuarial Society 4350 N. Fairfax Drive, Suite 250 Arlington, Virginia 22203 Telephone: 703.276.3100</p>
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Candidates submitting their registrations online for Exams MAS-I, MAS-II, and 6-9 must pay by credit card. All credit card payments will be processed in U.S. funds.

Candidates will be sent an acknowledgment of receipt of their application within three weeks of the date that the application form was received at the CAS Office beginning in early February for April/May Examinations and early August for October/November Examinations. This acknowledgment is the candidate's receipt of exam fees paid. Please retain this acknowledgment for tax purposes if needed. **Candidates that have not received an acknowledgment prior to the registration deadline should contact the CAS Office or their accounting department to ensure that their applications reached the CAS Office.** The candidate can also verify their registration by logging into their CAS account and checking their profile.

Exam 5

The CAS exam registration process for exams offered in the TBE environment is the same as for paper and pencil exams. Candidates will register for the exam by completing an online registration form on the CAS website. Registration will open in December 2017.

Candidates will find information on creating an account with PSI and scheduling their exam start time on the [Technology-based Examination](#) web page. These additional details and step-by-step instructions will be available in early 2018.

Online Courses 1 and 2

CAS Online Courses 1/CA1 and 2/CA2 are available through The Institutes. When candidates register for the individual online course, the fee includes one attempt at the exam. Before registering for the exam, candidates must obtain their Master ID number from the CAS—it will be required to register for the exam. After progressing through the online course, candidates arrange for their exam by contacting:

The Institutes, Customer Service
720 Providence Road, Suite 100
Malvern, PA 19355-3433
Telephone: (800) 644-2101 or (610) 644-2100 ext. 6000
E-mail: CustomerService@TheInstitutes.org
CAS Online Courses page at The Institutes website: www.aicpcu.org/cas.htm



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Name

Candidates must use their legal name on all examination registration materials and when corresponding with the CAS. Any change in name must be accompanied by acceptable documentation.

Fees

Examination fees must be paid each time a candidate registers for an exam. Payment options are described in a previous section, Filing of Applications and Deadlines. A \$20 surcharge will be assessed for all returned checks. The charts below show the examination fee schedules for 2018 at the time of publication. All fees are listed in U.S. dollars and are subject to change. Other fees that may apply include fees for change of center, refund, and/or a special exam center.

Exams 1, 2, 3F, and 4

Contact the sponsoring organization.

Exams MAS-I, MAS-II, and 5-9 and Online Courses 1 and 2

2018 Examination Fees			Other Fees	
	Candidates	Full-Time Students		
Exam MAS-I & MAS-II	\$450	\$360	Refund (Exams MAS-I, MAS-II, 5-9, and ST9)	\$100
Exams 5, 6, 7, 8, and 9	\$675	\$540	Change of Exam Center	\$60
Online Courses 1 & 2 Retest [†]	\$315	\$315	Online Courses 1/CA1 and 2/CA2: Contact The Institutes for fees that apply.	
Exam ST9	\$675	\$650		

[†]The first exam attempt is included in the \$575 Online Course fee.

Exams 1 and 2 Fee Reimbursement Program in the U.S.

The Joint CAS/SOA Committee on Career Encouragement and Actuarial Diversity sponsors a program to reimburse qualified minority candidates for Exam 1 (SOA Exam P) and Exam 2 (SOA Exam FM) fees. Eligible candidates are members of specified groups that are underrepresented in the actuarial profession in the United States, including African-Americans, Hispanics, and Native North Americans who are sitting for actuarial exams. The reimbursement application is available in the Diversity Programs section of the actuarial career website at <http://www.BeAnActuary.org>.

Fee Discount Program in Qualified Countries

The CAS sponsors a program to provide financial relief to candidates of qualified countries. Eligible candidates must be current full-time residents of a qualified country. Candidates must write their exams in a qualified country. Information, including a list of qualified countries and the application, is available on the [Fees Discount](#)



[Program](#) page of the CAS website.

Computer-Based Testing - Online Courses 1 and 2

The exams for Online Courses 1/CA1 and 2/CA2 are offered by computer-based testing (CBT). Because there are distinctive processes and procedures for CBT, additional information is available on The Institutes website. The rules and procedures provided on The Institutes website related to Online Courses 1/CA1 and 2/CA2 are part of the CAS examination rules.

Examination Centers

CAS examination centers are listed on the Exam Registration page of the CAS website. Centers are determined by the number of candidates near a center and the availability of proctors. Special examination centers may be arranged at the discretion of the CAS on a case-by-case basis if the request is received by the registration deadline. Candidates will be sent the exact location of their examination center at least two weeks before the examination.

For Exam 5, examination centers are not utilized (see the [Technology-based Examination](#) web page for more information).

Examinations by computer-based testing - Online Courses 1 and 2 - are administered at established test centers. The Prometric website (<http://www.prometric.com/SOA/default.htm>) contains a list of the CBT centers.

The CAS will not host exams in any country that has trade sanctions held against it per the [U.S. Department of the Treasury](#).

Change of Center

For Exams MAS, MAS-II, and 6-9, any registered candidate who requests a change in examination center must pay a change-of-center fee. No requests will be accepted after the registration deadline. If a request for a change of center occurs, every effort will be made to have the candidate's records and supplies on hand at the appropriate center in time for the examination. If this effort fails, however, the CAS is not responsible. If either a candidate's registration and fees, or request for change of center are received so late that it is not feasible to arrange for the candidate to write the examination, the fees will be refunded in full. The CAS is not responsible for difficulties caused by postal service delays or inadequate postage.

Details for changing a CBT center for the exams for Online Courses 1/CA1 and 2/CA2 are available on The Institutes website (<http://www.aicpcu.org/cas.htm>).

Languages other than English

Exams MAS-I, MAS-II, and 5-9 and Online Courses 1 and 2

Exam questions and instructions will be printed, and exams administered, exclusively in English. Candidates must submit written responses in English; non-English responses will not be graded with the following exception: Should a candidate for an exam jointly sponsored by the Canadian Institute of Actuaries wish to respond to any or all of the constructed-response test items (essay questions) in French, advanced notice must be provided to the CAS Office when applying to write the exam. Provided such advanced notice was received and a suitable translator is



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available from the Canadian Institute of Actuaries, responses submitted in French will be translated into English by qualified translators and graded exclusively in translation. All translations will be literal translations from French to English. If advanced notice has not been provided, non-English responses will not be graded. If a suitable translator cannot be engaged before the date of the exam, the candidate will be notified. The CAS cannot guarantee the accuracy of any translation. Appeals based upon errors in translation of a candidate's responses will not be considered. Grade reports for exams requiring translation may be delayed.

Special Arrangements for Candidates with a Disability

A candidate with a formally diagnosed disability who needs special testing arrangements must submit a written request for each examination that the candidate intends to write. Documentation of the disability, e.g., physician's statement, diagnostic test results, as well as the need for special arrangements, is required of each candidate. Previous accommodations given to the candidate in an educational program or work setting may be considered.

Requests for special arrangements and supporting documentation must be submitted at the applicant's expense at least two weeks prior to the registration deadline for Exams MAS-I, MAS-II, and 6-9; at least two weeks prior to the registration deadline for Exam 5; and prior to the first day of the testing window for the exams for Online Courses 1/CA1 and 2/CA2. For Exams MAS-I, MAS-II, and 5-9, contact the CAS Examinations Coordinator. For the two online courses, contact The Institutes.

For Exams 1, 2, 3F, and 4, contact the sponsoring organization.

Refunds

Exams 1, 2, 3F, and 4

Contact the sponsoring organization.

Online Courses 1 and 2

The fee for Online Courses 1/CA1 and 2/CA2 includes one attempt at the exam by CBT. No refund for a course is provided once the candidate has accessed the online course. If the candidate decides not to access the online course after payment has been made, the candidate may submit a request for a refund. The request must be submitted to Customer Service at The Institutes.

Any candidate who registered for a course exam and subsequently decides not to take the exam may receive a refund for the exam portion of the course fee (\$190) only by doing both of the following:

- Cancel the appointment prior to the third day preceding the exam at the test center, and
- Submit a refund request to Customer Service at The Institutes (CustomerService@TheInstitutes.org) that must arrive prior to the third day preceding the exam.

Exams MAS-I, MAS-II, and 5-9

Any candidate who submits an application for Exams MAS-I, MAS-II, or 5-9 and subsequently does not write the examination should submit a written request for an examination fee refund. This request must reach the CAS Office by the refund deadline stated in the Examination Schedule of this *Syllabus*. Refund requests may be sent via e-mail to refund@casact.org or by fax to (703) 276-3108. Late requests will not be considered. A \$100



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SYLLABUS OF BASIC EDUCATION

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Examination Rules

administrative fee per examination will be assessed on all refunds. Change-of-center fees, special center fees, and other additional fees will not be refunded in any case. Refunds will be issued one month after the refund deadline. Refunds are issued in the manner that fees were paid (i.e., by credit to a bank card or by check to an individual or company). Fees cannot be transferred from one exam session to another.



B. The Examination

Introduction

The examinations for admission to the Casualty Actuarial Society are designed to establish the qualifications of candidates. The CAS Syllabus & Examination Committee creates exams that follow guidelines developed for and shown in the *Syllabus*. Complete coverage of all readings listed in the *Syllabus* is not practical for every exam every year. The goal is to produce exams that contain representative, high-quality questions that test a candidate's knowledge of topics that are presented in the learning objectives. Thus, the candidate should expect that each exam will cover a large proportion of the learning objectives and associated knowledge statements and syllabus readings, and that all of these will be tested at least once over the course of a few years.

The Syllabus for each examination is defined in the form of Learning Objectives, Knowledge Statements, and Readings. The Learning Objectives present the learning goals for the underlying subjects being tested and set forth, usually in broad terms, what the candidate should be able to do in actual practice. The Knowledge Statements describe the body of knowledge corresponding to the exam subject and are illustrative of the scope of each Learning Objective. The Readings are recommended resources that support the Learning Objectives and may assist candidates to prepare for the examination. The CAS is not responsible for any errors or omissions found in the content of the resources identified in the Readings.

The exam questions will be based on the published learning objectives and supporting knowledge statements. It is intended that the readings, in conjunction with the material as outlined in the next section, will provide sufficient resources to allow the candidate to perform the learning objectives. The exams will test not only a candidate's knowledge of the subject matter, but also a candidate's ability to apply that knowledge.

The Institutes create exams for the online courses that follow the learning objectives contained in the individual courses.

Note: *This Syllabus is subject to change in the future.*

Order of Examinations and VEE Topics

In the development of the syllabus readings and exam questions, it is generally assumed that candidates for Associateship-level Exams MAS-I, MAS-II, 5, and 6 are familiar with material covered on the preliminary exams; Fellowship-level Exams 7, 8, and 9 generally assume familiarity with material on the Associateship-level exams. There are, however, circumstances when another order might be more appropriate. For example, a candidate may wish to study an exam that is closely related to his or her current work.

VEE topics are not prerequisites to taking actuarial exams and may be fulfilled independently of the exam process, i.e., prior to or concurrent with taking actuarial exams. In some cases, however, understanding the material within a VEE topic may help make an exam easier to understand. For example, VEE-Economics and VEE-Corporate Finance (VEE- Accounting and Finance after July 1, 2018) will help strengthen candidates' understanding of managerial decision-making and completing these topics prior to taking Exam 9 will make this exam easier to understand.

Candidates are encouraged to take Online Course 1 and Online Course 2 immediately after they begin their first property-casualty employment. For Exams 5 through 9, the general concepts and knowledge covered on those two



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Online Courses is often used to establish real-world context for exam questions. Thus, it will be helpful for candidates to take the two Online Courses prior to taking CAS Exams 5 through 9, although detailed knowledge is not assumed except as noted below.

To help candidates decide which exam to take, the following chart indicates which exams assume knowledge of material found on prior exams. While the CAS does not test Learning Objectives and Knowledge Statements directly from other exams, most candidates will find it easiest to study for an exam after studying for all of the exams listed in the “prior knowledge” column.

Exam or VEE Requirement	Assumes Prior Knowledge from the Following Exam(s)
VEE-Corporate Finance	None
VEE-Accounting and Finance	None
VEE-Economics	None
Online Course 1/CA1	None
Online Course 2/CA2	None
Exam 1	None
Exam 2	None
Exam 3F	Exams 1 and 2
Exam 4	Exam 1
Exam MAS-I	Exam 1
Exam MAS-II	Exam 1, MAS-I
Exam 5	Exams 1 and 2
Exam 6C or 6U	Exams 1 and 5 and Online Course 2
Exam 7	Exams 1, 2, MAS-II/4, and 5 and VEE-Corporate Finance/Accounting and Finance
Exam 8	Exams 1, 2, 3F, MAS-I, MAS-II/4, and 5
Exam 9	Exams 1, 2, 3F, MAS-II/4, and 5 and VEE-Economics and VEE-Corporate Finance/Accounting and Finance

Hours of Study

Passing actuarial exams requires many hours of study—more for some people and less for others—but often more than many candidates realize. Putting in enough hours can actually save a candidate time. Suppose, for example, that mastering the syllabus for one exam will take a candidate 400 study hours, and that a candidate only puts in 300 hours and fails the exam the first time. He or she then puts in an additional 300 hours and passes the exam the second time. That candidate will have spent 600 hours, when by studying 400 hours the first time around, he or she would have saved 200 hours, not to mention passing sooner. It is recommended that candidates decide for themselves how many hours they really need to study, and then do that much studying—the first time around.



Requirements for Admission to Examination Center

To be admitted into an examination center, each candidate must present a positive identification with a signature and a photograph (e.g., driver's license, passport, etc.). If a photo ID is not available, the candidate must present two forms of identification with a signature, with at least one form containing a physical description (height, weight, hair color, eye color, etc.). Each candidate will be required to sign in at the examination center. A candidate who does not present positive identification or who refuses will not be permitted to write the examination.

For examinations offered by computer-based testing, each candidate must present a valid government-issued photo identification that includes the candidate's signature (details are available on The Institutes website for exams for the two online courses).

Candidates should arrive at the examination center at least 30 minutes before the scheduled exam time. Candidates may not leave until two hours after the start of the examination. For Exams MAS-I, MAS-II, and 6-9, candidates may not leave during the last 15 minutes of the examination.

For Exam 5, candidates will no longer present themselves at an examination center to take the examination (see the [Technology-based Examination](#) web page for more information).

Conduct of Examinations

The examinations are recorded exclusively in writing (except for exams that are administered by computer-based testing or technology-based examination). Except as is noted in the following paragraphs, no books, papers, typewriters, slide rules, laptops, or electronic or mechanical aids for computation of any kind may be brought into the examination room by candidates, nor may any candidate communicate with, or obtain any assistance from, any other candidate during the examination. Candidates must respond to constructed-response test items (essay questions) in English unless advance notice is given (see Languages other than English under Examination Rules—Registration). Examination answer sheets are not returned to candidates.

For Exams MAS-I, MAS-II, and 6-9, a candidate wishing to obtain his or her own examination booklet and scrap paper subsequent to the examination must bring a self-addressed stamped envelope to the examination center. (No inter-office mailing is acceptable.) The recommended minimum postage is \$2.87 for domestic mail in the U.S.

For Exams MAS-I, MAS-II, and 5-9, approximately one week after all exams have been completed, the exam will be posted on the [Exams](#) section of the CAS website.

For Exam 5, see the [Technology-based Examination](#) web page for details on the conduct of the examination.



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Calculators for Exams MAS-I, MAS-II, and 6-9

Electronic calculators will be allowed in the examination room for Exams MAS-I, MAS-II, and 6-9. Only the calculators listed below may be brought into the examination room. Books, papers, computers, or other electronic devices may not be brought into the examination room. Candidates may use the battery- or solar-powered models of the following Texas Instruments calculators:

BA-35	TI-30Xa
BA II Plus	TI-30X II (IIS solar or IIB battery)
BA II Plus Professional	TI-30XS MultiView (or XB battery)

Candidates may use more than one of the approved calculators during the examination. **For those using the BA II Plus, BA II Plus Professional, TI-30X II (IIS solar or IIB battery) or TI-30XS MultiView (or XB battery) models, candidates will be required to show examination proctors that the memory has been cleared prior to the start of the examination. For the BA II Plus and BA II Plus Professional, clearing will reset the calculator to the factory default settings.**

Calculator instructions cannot be brought into the examination room. During the examination, the calculator must be removed from its carrying case so the proctor can confirm it is an approved model. **Any unauthorized calculator brought to the examination center will be confiscated for the duration of the examination. Candidates using a calculator other than the approved models will be subject to examination disqualification and other disciplinary action.**

Candidates may purchase calculators from stores or directly from Texas Instruments: telephone: (800) 842-2737 [1-800-TI-CARES]; website: <http://www.ti.com>.

It is the candidate's responsibility to see that the calculator used during the examination is in good working order. Spare calculators are no longer being provided to exam centers. Candidates will be expected to provide their own working calculator(s).

Earplugs for Exams MAS-I, MAS-II, and 6-9

Simple foam earplugs are allowed and must be checked-in with the supervisor upon entrance to the exam. The ability to hear all verbal instructions, including exam start and stop times is the responsibility of the candidates, regardless of the use of earplugs.

Reading Period for Exams MAS-I, MAS-II, and 6-9

Prior to the start of the examinations administered by the CAS, there will be a reading period in which the candidate can silently read the questions and check the exam booklet for missing or defective pages. Writing will NOT be permitted during this time and candidates will not be permitted to hold pens or pencils or be allowed to use calculators. The reading period will be 15 minutes for Exams MAS-I, MAS-II, 6C, 6U, 7, 8, and 9.

Exam 5 will no longer have a reading period (see the [Technology-based Examination](#) web page for more information).

Examination Discipline

Candidates must not give or receive assistance of any kind during the examination. Any cheating, attempt to cheat, assisting others to cheat, participating therein, or engaging in improper conduct such as noted in the CAS Examination Discipline Policy is a serious violation and will result in the CAS disqualifying the candidate's exam and additional consequences determined by the Vice President Admissions. This may include a temporary or permanent ban from sitting for CAS Examinations. Members of the CAS are also subject to the CAS investigative and discipline process, such as through the Actuarial Board for Counseling and Discipline (ABCD) or the Canadian Institute of Actuaries (CIA), for any violations of the CAS Code of Professional Conduct. Candidates have agreed in their applications for examination to be bound by the rules and regulations governing the examinations.

Examples of improper conduct include but are not limited to:

1. Gaining access to examination questions before the examination or aiding someone else to do so.
2. Using an unauthorized calculator (as defined in the *Syllabus*) or other mechanical aid that is not permitted.
3. Looking in the examination envelope before the instruction to begin is given.
4. Marking or otherwise writing on the examination booklet or answer sheet before the instruction to begin is given.
5. Making any changes, additions, deletions, or otherwise marking, erasing, or writing on the examination book or answer sheet after the time for the examination has expired.
6. Having access to or consulting notes or books during the examination.
7. Looking at or copying from another candidate's paper.
8. Enabling another candidate to copy from one's paper.
9. Talking or otherwise communicating with another candidate during the examination.
10. Disturbing other candidates during the examination.
11. Consulting other persons outside the examination room during the examination.
12. Copying questions, answers, or answer choices to take from the examination room.
13. Taking an examination booklet from the examination room.
14. Taking an examination for another candidate.
15. Arranging to have another person take an examination for the candidate.
16. Threatening or physically or verbally abusing a supervisor or proctor responsible for curbing or reporting improper conduct.
17. Disclosing the contents of an examination to any other person prior to the examination's release. For CAS-administered exams, this would generally apply to the day when the examination is administered.



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18. Presenting false information on an examination application.
 19. Failing to remain in the examination room for a minimum of two hours during the examination (for examinations with this requirement).
 20. Failing to follow other examination instructions.
 21. Accessing or using a communication device (PDA, cell phone, tablet, etc.) during the exam or while at the exam site.

The CAS Syllabus & Examination Committee, or its designee, will investigate any irregularity or suspected violation of the rules involving the examination process, and a determination will be made regarding the matter. Where there is a determination to invoke a penalty, the candidate is advised by letter. In the case of a candidate who is a member of the CAS, the candidate's conduct will be reported to the Actuarial Board for Counseling and Discipline (ABCD) or to the Canadian Institute of Actuaries (CIA) if the final penalty invoked is more than disqualification of the examination.

Candidates for the CAS Examinations are expected to follow the rules and procedures included in this *Syllabus* including those specific to technology-based examinations, the Instructions to Candidates printed on their examination booklets, announcements made by the supervisors at the examination locations, and instructions made by the remote proctors for the technology-based examinations. All candidates, on their applications for examinations, are required to read and sign the following statement: "I have read the rules and regulations concerning the examination(s) for which I am applying and agree to be bound by them. I also agree that the results of any examination(s) which I take, and any action taken as a result of my conduct may, at the sole discretion of the Casualty Actuarial Society, be disclosed to any other bona fide actuarial organization that has a legitimate interest in such results and/or actions."

The CAS may, at its sole discretion, disclose to any other bona fide actuarial organization having a legitimate interest, information on the identity of candidates determined to have committed a serious examination violation (those for which the penalty is greater than the simple disqualification/nullification of the examination), and the specific penalties imposed on those candidates.

If an actuarial organization with which the CAS has a working relationship (such as the Society of Actuaries) invokes a penalty against a candidate for improper conduct during an examination for which the CAS is not a joint sponsor, the CAS will invoke the same penalty for all CAS-sponsored examinations. If the CAS takes any disciplinary action, it will notify the other actuarial organizations of that action.

These standards may seem stricter than those which candidates are accustomed to in other examination environments. The CAS maintains these strict standards because the examinations are such a significant part of a candidate's career. Therefore, the equitable administration of the examinations and enforcement of the highest standards of conduct cannot be emphasized too strongly.

The [CAS Rules of Procedure for Disciplinary Action Involving Candidates](#) is available on the CAS website.

Discipline for Computer-Based Testing and Technology-Based Examinations

The Policy on Examination Discipline is the same for those taking exams by computer-based testing, by technology-based examination testing, or in the traditional paper-and-pencil format.



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The rules for the CBT administration for Online Courses 1/CA1 and 2/CA2 are available on The Institutes website (<http://www.aicpcu.org/>). If there is a discrepancy between specific rules for the traditional paper-and-pencil exam administration and computer-based testing administered by The Institutes, the computer-based testing rules will govern.

Multiple-Choice Questions

Exams MAS-I and MAS-II consist entirely of multiple-choice questions; other CAS examinations may have a section of multiple-choice questions. Each multiple-choice problem includes five answer choices identified by the letters A, B, C, D, and E, only one of which is correct. A separate answer sheet provides a row of five ovals for each problem, identified with the letters A, B, C, D, and E, corresponding to the five answer choices. After deciding which answer is correct, candidates should blacken the oval that has the same letter as the appropriate answer. Since the answer sheets are scored by optical scanning equipment, a Number 2 pencil must be used to blacken the ovals. It is important that only one oval be blackened for each question.

Exams for the two online courses will consist entirely of multiple-choice questions. Each multiple-choice problem includes four answer choices identified by the letters A, B, C, and D, only one of which is correct. For exams administered by computer-based testing, candidates should click on the appropriate answer. For all other exams, a separate answer sheet provides a row of four ovals for each problem, identified with the letters A, B, C, and D, corresponding to the four answer choices. After deciding which answer is correct, candidates should blacken the oval that has the same letter as the appropriate answer. Since the answer sheets are scored by optical scanning equipment, a Number 2 pencil must be used to blacken the ovals. It is important that only one oval be blackened for each question.

Guessing Adjustment

For the exams for Online Courses 1/CA1 and 2/CA2, no guessing adjustment are made to candidates' scores. Therefore, candidates will maximize their scores on these examinations by answering every question. On Exams MAS-I, MAS-II, and 5-9, multiple-choice questions are scored in such a way that there is no advantage or disadvantage to be anticipated from guessing answers in a purely random fashion as compared with omitting the answers entirely. No additional points will be given for multiple-choice questions left blank, but one-quarter of the point value for each question will be deducted for each incorrect answer.

Constructed-Response Test Items

The admissions process is intended to identify candidates that have demonstrated sufficient mastery of the learning objectives to be admitted as members of the CAS. Examinations that provide a means for better-prepared candidates to demonstrate that mastery are critical to meeting that objective.

Educators often refer to a tool called Bloom's Taxonomy to classify questions into six cognitive levels. Bloom levels range from Level 1, broadly characterized as knowledge, to Level 6, characterized as evaluation. Lower levels of the taxonomy stress recall of facts and an understanding of main ideas; higher levels within the taxonomy stress synthesis, comparison, and subtlety of understanding.

Bloom levels are as follows:

Level 1: Knowledge—tests the ability of the candidate to recall or remember knowledge or facts



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Level 2: Comprehension—requires the candidate to demonstrate comprehension of central concepts through explanation of those concepts

Level 3: Application—measures the candidate’s ability to apply ideas and concepts to new situations

Level 4: Analysis—requires the candidate to analyze information by separating material into component parts, including identification of facts and development of inferences with respect to a situation

Level 5: Synthesis—tests the ability of a candidate to synthesize, or combine, concepts or ideas and develop and defend the position resulting from that combination

Level 6: Evaluation—requires the candidate to support conclusions by evaluating the validity of ideas and concepts

Generally, questions at higher Bloom levels will have higher associated point values. As a result, examinations with more questions at higher Bloom levels will contain fewer questions, which may result in less syllabus coverage on a particular exam.

Lost Examinations

The CAS—or its designee—is not responsible for lost or destroyed examinations. In the case where an examination is lost or destroyed, the examination fee will be refunded. The CAS and its designees will assume no other obligation and candidates must take the examinations with this knowledge. For Online Courses 1/CA1 and 2/CA2 that are administered by The Institutes, the policy of The Institutes will apply.



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C. Grades and Accreditation

CAS Examination Processing

Computer-based tests - Online Courses 1 and 2 - are administered and scored according to computer-based testing methodologies. Although the multiple-choice exams that are administered exclusively by paper-and-pencil - MAS-I and MAS-II - have a process that is similar to the description below, this section and the next, Grading of Examinations: A Timeline, provide details about CAS-specific Exams 5-9.

Examination papers where applicable are sent to the CAS Office upon completion of the examination. The CAS Office prepares the examinations for the grading process. The next business day following the administration of all examinations, the examinations and a preliminary list of multiple-choice answers will be posted on the Exams page of the CAS website. This is intended to assist candidates and the CAS Syllabus & Examination Committee in determining whether they believe a question is ambiguous or defective.

For Exam 5, exam processing for weeks #1 and #2 as described below are modified appropriately to take advantage of the TBE environment (see the [Technology-based Examination](#) web page for more information).

Grading of Examinations: A Timeline

Week 1

After the examinations are administered, proctors return the exam packages to the CAS Office. Staff members log in each exam. Signatures are verified and the candidate numbers are checked against the proctor's report. As each envelope is opened, the candidate's number must be checked against the number on the short answer card (both the written number and the coded number) and on all the essay sheets. The short answer cards are prepared for scanning and the essay sheets for all the candidates must be sorted so that individual questions can be copied for the graders.

Week 2

Constructed response (essay) question responses are sent to a vendor to be reproduced. Short answer cards are scanned twice and output is compared to ensure accuracy. Random checks are made of each series of cards to ensure that the scanner is working properly. When the essay sheet copies are received, copies of candidate responses are sent to the individual graders. Any comments on potentially ambiguous or defective questions are forwarded to the graders, exam part chair, and the general officer of the exam series for review.

Weeks 3 and 4

Committee members review candidate comments about possibly ambiguous or defective questions and decide how they will be handled in the grading process. Discussions on the best course of action are often a very time-consuming part of the grading process.

Copies of responses to each constructed-response test item on the exam are sent to two graders. Some graders are given more than one question to grade. There can be 500 to more than 1,000 answer sheets for each grader to evaluate for a single question. A suggested answer key exists for each question, but alternative solutions may be correct, and the graders must be open to different approaches to a problem. About two-dozen responses are graded and then the results are compared. The grading partners will establish a consistent grading rubric and then evaluate the solution key. Consistency and accuracy are the most important factors in grading the responses. After looking at hundreds of papers, it is possible that a grader could slightly shift focus (either harder or easier). To minimize the chance of this happening the graders will begin grading at different points on the candidate list, then



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when the two grades are compared any significant differences will be checked. Each grader prepares a computer file with each candidate's number and the score for each question.

Week 5

The part chair holds the grading session with the graders. The first step is running the data through a standard grading program, verifying the data, and noting any significant discrepancies. For each candidate and each question the scores of each grading partner must be within a prescribed tolerance. If the scores do not fall within this tolerance, the partners must discuss the candidate's answer sheet and come to a decision on what the point value should be. When all the questions have been reconciled to the required tolerance, the scores are totaled and a tentative pass score is selected based on the pass mark panel's recommendation, various statistics, and guidelines.

This triggers the second round of reconciliation. Candidates who have scores within a certain number of points from the tentative pass score will have all of their answers reconciled completely. This gives an exact score for any candidate near the passing score. The scores for any candidates who are close to passing will be checked manually as well. The committee members will then look at the statistics one more time and make a final recommendation for the passing score.

Weeks 6 and 7

After the grading session, the part chair will create and submit a report to the general officer of the exam series, the CAS Syllabus & Examination Committee chairperson, and the vice president-admissions. In the report, the part chair recommends a passing score, gives a detailed analysis of the exam, and notes any unusual questions or situations that required special handling. The chairperson and general officer hold a teleconference with the vice president-admissions and a representative from the Canadian Institute of Actuaries (except for Exam 6-US) to discuss all of the exams from the series and to finalize the passing scores.

Week 8

After the vice president-admissions and a representative from the Canadian Institute of Actuaries (except for Exam 6-US) have approved the passing score the data is verified and released to the CAS Office to update each candidate's record. Candidates will be notified by email when their exam results have been uploaded to their profile. Candidates can access their exam results by logging into their My Exams page within their profile on the CAS website.

Determination of the Pass Mark

The goal of the examination system of the CAS is to pass all candidates who have demonstrated adequate knowledge of the syllabus and to fail those candidates who have not. The objective of the examinations is to evaluate candidate performance using criteria for demonstrating adequate knowledge that remain constant throughout the lifetime of the exam series. Pre-set pass marks, e.g., a candidate will pass if he or she answers x percent of the questions correctly, are counter to this philosophy. The examinations are meant to measure the candidate's level of achievement of the required learning objectives and their required level of capability of accomplishing specified learning outcomes.

Multiple-Choice Test Items

As part of the input to the pass mark determination process for the multiple-choice exams that are not offered by computer-based testing, a modified Angoff passing score study is performed where a panel of experts in the subject material is convened to review the examination. This is a common testing and measurement technique.



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Each expert is asked to review each question in the examination, and assess the difficulty of that question. More specifically, they are asked to estimate the likelihood that a candidate with minimum adequate knowledge competency would answer the question correctly. The sum of these probabilities, averaged across the panel of experts, gives a preliminary estimate of the pass mark.

The estimated pass mark resulting from the modified Angoff passing score study is compared to and balanced with the actual performance statistics on the exam in finalizing the pass mark. The effects of any particularly difficult questions are also factored into the determination of the final pass mark.

Computer-based tests are administered and scored according to computer-based testing methodologies.

Constructed-Response Test Items

For CAS examinations consisting in whole or in part of constructed-response test items (written-answer or essay questions), the assessment process is somewhat different. Before the exam is administered, a pass mark panel reviews the exam and assesses it based on how the panelists think a minimally qualified candidate will perform based on a predetermined definition of the minimally qualified candidate. This process follows the same basic technique used for multiple-choice exams as described above. Based on this assessment, an expected pass mark is set.

Following the administration of each exam, responses to each constructed-response test item are graded simultaneously by two graders who must reconcile their grading rubrics and grades. When all responses have been scored, the Examination Part Committee chooses a preliminary pass mark based on the results of the pass mark panel augmented by actual performance of the current candidates versus historical performance of previous candidate cohorts. Candidate papers with scores close to the preliminary pass mark are re-graded to ensure correct and consistent scoring.

The Examination Part Committee then determines the tentative pass mark by again balancing actual performance statistics against minimum adequate knowledge while taking into account other factors such as time pressure situations that may have occurred on some questions. Because the level of difficulty for each examination may vary from year to year, each Examination Part Committee collects extensive data to ascertain the level of difficulty of its examination. The Examination Part Committee compares the performance of the present year's candidates to the performance of candidates from prior years. Appropriate recognition is given to any peculiarities that may appear in connection with the answers to any question on an examination despite all the care taken in setting the examination questions.

With the use of content-based pass marks, fluctuation in the pass rate from session to session is expected. Although the percentage of candidates passing will vary from year to year, those candidates demonstrating the required level of competence with the material will pass.

Final Pass Mark

A recommended pass mark is reached by consultation among the examination part chairperson, the general officer overseeing that examination, and the CAS Syllabus & Examination Committee chairperson. Any significant deviations from the à priori pass mark set by the pass mark panel are explored at this time. The recommended pass mark and explanations for deviations from the à priori pass mark are submitted to the vice president-admissions who approves the final pass mark. The final exam statistics are forwarded to the CAS Executive Council and CAS Board of Directors.



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After the pass mark is finalized, each candidate is assigned a score. Scores of 0 to 5 are assigned to candidates who do not pass. On this scale, each interval is 10 percent of the pass mark. For example, a grade of 5 equates to a candidate's score of at least 90 percent, but less than 100 percent, of the pass mark. A grade of 0 means that the candidate's score is less than 50 percent of the pass mark. Candidates at or above the passing mark will receive a score of 6 to 10. Historic passing numeric scores will not be provided.

The CAS releases the pass scores for Exams MAS-I, MAS-II, and 5-9 after the appeals deadline for the specific exam session. They are available from the [Past Exams and Pass Marks](#) page of the CAS website. The purpose of releasing the pass scores is to help candidates prepare for future exam sittings. The 75th and 95th percentile scores are also released for each exam. These two key statistics indicate the performance level achieved by the better-prepared candidates on the exam. Raw scores are not provided to candidates.

Examination Results

Exams MAS-I, MAS-II, and 5-9

Examination results are available approximately eight to nine weeks after the examination date. After exam results are received from the CAS Syllabus & Examination Committee at the CAS Office, candidates will be notified by email that their exam results have been uploaded to their profile. Candidates can access their exam results by logging into their My Exams page within their profile on the CAS website. Candidates will be apprised of their scores - 0 to 5 for those who did not pass the exam and 6 to 10 for those who passed the exam.

In addition, the spring 2018 exam sitting will be the last sitting in which exam results are mailed to candidates; generally on the day the results become available. Moving forward, candidates will access their exam results only via the website.

Candidates for Exams MAS-I, MAS-II, and 5-9 who did not pass will automatically be sent an analysis of their examination. The analysis of an examination is computer-generated. Actual points received for multiple-choice questions will be displayed. For constructed-response test items, ranges will be given for the actual score. This information is intended to provide the educational guidance that most candidates desire. Copies of the exam analyses will not be provided after the appeals deadline.

To preserve candidate confidentiality, in the event of a lost or misplaced candidate ID number, the candidate ID number will be mailed to the candidate upon request. Under no circumstance will a candidate number be given out over the telephone or by e-mail. Candidates can also verify their candidate number by logging into their profile on the CAS website.

Online Courses 1 and 2

The exams for Online Courses 1 and 2 are offered by computer-based testing. An unofficial pass/fail result will be displayed on the computer screen at the conclusion of the exam. When the official grades have been processed, candidates will receive an e-mail from The Institutes stating that their grades are available. Candidates may then log into their account on The Institutes website (<http://www.TheInstitutes.org>) to access their grades. The grade report for each candidate will show the candidate's overall score on the exam in ten point increments (e.g., 60 to 69%, 70 to 79%, and so on). It will similarly show the candidate's performance by assignment using those same ten point increments. Numeric scores are not released. Once final grades have been released, The Institutes will send a copy of the grades directly to the CAS Office to be added to the candidates' admissions records. **The Institutes sends this information to the CAS several weeks following the closing of the testing window. The CAS will post**



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the list of passing names approximately two weeks later.

Ambiguous or Defective Questions

For Exams 1, 2, 3F, and 4, the candidate should follow the procedural rules of the sponsoring organizations.

Online Courses 1 and 2

If a candidate believes a question is ambiguous or defective, he or she should bring this to the attention of The Institutes in **writing** within two weeks after the examination was administered. The candidate must submit this correspondence to The Institutes for the two online courses. The correspondence should include detailed reasons why the question is believed to be ambiguous or defective. The Institutes will investigate all questions brought to its attention.

A copy of the correspondence to The Institutes should be sent to the CAS Syllabus & Examination Committee at defective-item@casact.org.

Exams MAS-I, MAS-II, and 5-9

The committee compiles and monitors various statistics for the questions it puts on the exams. These statistics often help to uncover potential defects, wording issues, or ambiguities. However, if a candidate believes that a multiple-choice or constructed-response test item is ambiguous or defective, he or she should bring this to the attention of the CAS Syllabus & Examination Committee in writing within two weeks after the examination date. In order to aid the candidate, preliminary answer keys for multiple-choice questions will be available the week following the examinations. The candidate may submit comments to the CAS Office by mail, fax, or e-mail at defective-item@casact.org. The correspondence should include detailed reasons why the question is believed to be ambiguous or defective. The CAS Syllabus & Examination Committee will investigate all questions brought to its attention in writing. To be considered in the grading process, correspondence must reach the CAS Office **within two weeks of the date that the exam was administered**. The decision of the CAS Syllabus & Examination Committee chairperson is final. Items judged to be defective will be identified within the Examiner's Report for Exams 5-9 and within the final posted grading key for Exams MAS-I and MAS-II.

Any question found to be defective is carefully examined to determine the most reasonable way to correct the situation. In some cases, the question is discarded, with scores and the determination of the pass mark, as they would have been if the defective question had not been asked. In some cases, more than one answer may be given credit for being correct. In some cases, an exam may be graded both including and excluding the defective question, with two different pass marks considered, with the universe of candidates that would have passed under either of the two versions all considered as passing the exam.

No investigation of ambiguous or defective questions will be considered after the deadlines.



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Appeals for Exams MAS-I, MAS-II, and 5-9

Multiple-Choice Questions

After grades are released, the only appeal permitted on multiple-choice questions will be to request an administrative check of the candidate's short answer card to verify that the card reader scanned the card correctly and that the output file reflected this data. This request must be made within three weeks after the candidates are notified that their exam results have been uploaded to their profile by e-mailing appeals@casact.org.

Constructed-Response Test Items

For the constructed-response test items, appeals must reach the CAS Office not later than 2 weeks after the publication of the Examiner's Report for the specific exam. The Examiner's Report will be published to the CAS website as soon as possible after releasing exam results and candidates registered for the respective exam will be alerted by e-mail when this occurs. The candidate may submit his or her appeals to the CAS Office by mail, fax, or e-mail at appeals@casact.org.

If the candidate believes that there is a correct solution that is not contained in the Examiner's Report, the candidate must provide this alternative solution and specific reasoning in support of this claim with their appeal. With this information, the CAS Syllabus & Examination Committee can research the answer properly and reply to the candidate. An example of an invalid appeal would be the following: "I am appealing my score of 5 on Exam 9, please recheck my examination." Another example of an invalid appeal would be: "On question number 2, I believe I should get full credit because I answered the following..." An example of a valid appeal would take the form: "On question 5, a correct answer that does not appear amongst the sample answers in the Examiner's Report is the following..."

The examination part chairperson reviews each valid appeal and makes a recommendation to the CAS Syllabus & Examination Committee chairperson. The examination part chairperson and the CAS Syllabus & Examination Committee chairperson then jointly decide for each valid appeal whether or not the alternative solution provided is indeed a solution that is worthy of credit but was not given credit at the time of grading. Please note that each valid appeal is reviewed and decided upon without reviewing the actual exam paper of the candidate who appealed; candidates should understand this when submitting appeals and ensure the argument in the appeal itself is self-contained, without referencing the candidate's actual exam paper.

Note the Examiner's Reports do not necessarily contain all solutions for which credit was given, e.g., a solution that was rarely used by candidates and considered inferior to other solutions may be awarded credit but excluded from the Examiner's Report to make the document more efficient and effective for candidates using the report to study for future exams. Therefore, an appeal may properly provide a correct alternative answer that was not included in the Examiner's Report, but would have received credit in the grading process. Such appeals would not result in any review of exam papers.

In some cases, the Examiner's Report may be adjusted as a result of the appeals process, either to include additional solutions that were identified or additional explanation concerning items that were not awarded credit. Such adjustments are not made for every appeal, however, as the intent of the Examiner's Report is to educate candidates on the most common responses and not on every single response.



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In those instances where an appeal identifies a solution that is worthy of credit but that was not awarded credit during the grading process, a subset of exam papers is re-graded. That subset would only include the exam papers of candidates who were close enough to the pass mark such that the points in question for the item appealed can potentially change the grade from fail to pass. Any candidates whose grades change from fail to pass as a result of such appeals would be contacted directly by the CAS Syllabus & Examination Committee chairperson with this information. No points are ever deducted from a candidate's score as a result of an appeal. The CAS does not adjust failing scores for candidates who receive additional credit due to an appeal but for which the additional points did not change their grade from fail to pass.

Responses from the CAS Syllabus & Examination Committee chairperson are e-mailed by the CAS Office to all candidates that submit valid appeals with the decision on each appeal, in terms of whether or not the solution presented was worthy of credit, whether or not credit was given for such a solution during the grading process, and whether or not any papers were re-graded as a result of the appeal. These responses will typically be provided within four to eight weeks from the closing of the appeals window. Note that such responses will not include explanations as to why credit was not awarded for the solution presented, as this is not intended to be an educational exercise. **The decision of the CAS Syllabus & Examination Committee chairperson is final.**

No appeals will be considered after the deadlines.

Confidentiality of Examination Records

The fact that a candidate has passed a particular examination is considered public knowledge. Any further information as to examinations taken by candidates and scores received by candidates is available only to the candidates themselves, to CAS Syllabus & Examination Committee officials if required for committee purposes, and to the CAS Office, unless the candidate requests in writing that such information be provided to someone else. However, if any action is taken against a candidate as a result of his or her conduct (as described in the section on Examination Discipline), the Casualty Actuarial Society, at its sole discretion, may disclose such information to any other bona fide actuarial organization that has a legitimate interest in such results and/or actions. The candidate authorizes and consents to the Society using and disclosing (including, but not limited to, disclosing to the third-party contractors and service-providers of the Society) personally identifiable information about the candidate as necessary and appropriate for the purposes of registering the candidate for the exam, conducting the exam, determining the results of the exam, and communicating with the candidate regarding the results of the exam.



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Transition Programs

The CAS generally reviews and makes revisions to the study material on an annual basis. Occasionally, a major topic will be added to or deleted from the syllabus. A major topic is defined as a series of learning objectives comprising a segment of an examination. When a major topic is added, the CAS Syllabus & Examination Committee will determine if a transition program is appropriate. A transition program is generally appropriate when candidates are in a position to lose credit for a segment of an examination.

A transition program usually will provide candidates with at least two opportunities to complete the requirements for that examination. The completion of the requirements will result in the achievement of credit for that entire examination. The failure to fulfill the requirements for that complete examination could result in the expiration of credit for that deleted topic at the end of the transition period. The CAS Board of Directors must approve any transition program.

Current Education Structure

1. The CAS Board of Directors approved the following transition rules for the **2018 education structure**.

To receive credit for the new Exam Modern Actuarial Statistics-I (MAS-I), the candidate must have credit for Exam 5-Statistics and Probabilistic Models by January 1, 2018. To receive credit for the new Exam Modern Actuarial Statistics-II (MAS-II), the candidate must have credit for Exam 4-Construction and Evaluation of Actuarial Models by July 1, 2018. If the candidate has not completed Exam 5 and Exam 4 by these dates, the candidate will need to pass both Exams MAS-I and MAS-II.

Candidate Credit		Candidate Credit under Examination Structure Implemented in January 2018		Action Required to Earn Credit for new Exams MAS-I and MAS-II
Exam 5 by 1/1/2018*	Exam 4 by 7/1/2018**	Exam MAS-I	Exam MAS-II	
x	x	x	x	Credit granted. No candidate action required.
x		x		Complete Exam 4 examination requirement by 7/1/2018 or pass Exam MAS-II.
	x		x	Pass Exam 5 before 1/1/2018 or pass Exam MAS-I.
				Candidate must pass both Exam MAS-I and Exam MAS-II.

* Credit for Exam 5 must be achieved through an examination administered prior to January 1, 2018.

** Credit for Exam 4 must be achieved through an examination administered prior to July 1, 2018 or through



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course work completed by 12/31/2018 under the CIA's University Accreditation Program. See [Waiver of Examinations Rules](#) for the various ways a candidate can be granted a waiver by the CAS for its Exam 4 examination requirement.

The CAS has approved the following transitional waiver policies for examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS Syllabus and the syllabi of each of the aforementioned actuarial organizations. The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities.

- If a candidate has passed all three Exams CT4, CT5, and CT6 or A202, A203, and A204 by 8/31/2016, they will receive credit for CAS Exam S and subsequently CAS Exam MAS-I. See #1 under Older Transition Rules Applicable to the Current Education Structure below for additional details.
- If a candidate has passed both Exams CT4 and CT6 or A202 and A204 by 7/1/2018, they will receive credit for CAS Exam 4 and subsequently CAS Exam MAS-II.

2. The CAS Board of Directors approved the following transition rules for the **2018 education structure**.

Credit Prior to July 1, 2018	Credit in Education Structure Implemented in July 2018
VEE-Corporate Finance	VEE-Accounting and Finance
VEE-Economics	VEE-Economics

3. The CAS Board of Directors approved the following transition rule for the **2018 education structure**.

Credit Prior to July 1, 2018	Credit in Education Structure Implemented in July 2018
Exam 3F - Models for Financial Economics	Exam 3F - Financial Economics

Older Transition Rules Applicable to the Current Education Structure

1. The CAS Board of Directors approved the following transition rules for the education structure that was implemented in the Fall of 2015.

To receive credit for the new Exam S on Statistics and Probabilistic Models during the transition, the candidate must have credit for Exams ST and LC[†] and the VEE-Applied Statistical Methods educational requirement.

At the time of transition, if a candidate has credit for either Exam ST or Exam LC, but not both, the candidate will be allowed to take just the exam for which he or she is missing credit in order to obtain partial credit for the new exam. This option will be available for a transition period of two sittings, i.e., Fall 2015 and Spring 2016.

Credit for the VEE-Applied Statistical Methods educational requirement will also be accepted for those candidates who complete it by August 31, 2016. If the candidate has not completed Exam ST, Exam LC, and



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the VEE-Applied Statistical Methods educational requirement by this date, the candidate will need to pass the full version of Exam S to receive credit.

Candidates with credit for neither Exam ST nor Exam LC on August 31, 2015 will not be permitted to sit for Exam ST or Exam LC during the transition period and will need to pass the full version of Exam S to receive credit.

The following table summarizes the above:

Candidate Credit on August 31, 2015			Action Required by August 31, 2016 to Earn Credit for new Exam S
Exam ST	Exam LC	VEE-Applied Statistical Methods	
x	x	x	Credit granted. No candidate action required.
x	x		Complete VEE-Applied Statistical Methods.
x		x	Pass Exam LC.
x			Pass Exam LC and complete VEE-Applied Statistical Methods.
	x	x	Pass Exam ST.
	x		Pass Exam ST and complete VEE-Applied Statistical Methods.
		x	Candidate must take full version of Exam S.
			Candidate must take full version of Exam S.

The CAS has also granted waivers for Exam LC to candidates who have:

- Passed SOA Exam MLC;
- Passed the Institute and Faculty of Actuaries (U.K.), Actuaries Institute (Australia), or Institute of Actuaries of India Subject CT5; or
- Passed the Actuarial Society of South Africa Course A203; or
- Received a waiver granted by the Canadian Institute of Actuaries University Accreditation Program.

For those candidates who have credit for Exam ST by August 31, 2015, the CAS will continue to grant the above Exam LC waivers through August 31, 2016.



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The CAS has approved the following transitional waiver policy for examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS Syllabus and the syllabi of each of the aforementioned actuarial organizations. The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities.

Candidate Credit on August 31, 2015		Action Required by August 31, 2016 to Earn Credit for new Exam S
CT5 or A203	CT4 and CT6 or A202 and A204	
x	x	Credit granted. No candidate action required.
x		Pass CT4 and CT6 or A202 and A204.
	x	Pass CT5 or A203.
		Candidate must take full version of Exam S.

2. The CAS Board of Directors approved the following transition rules for the education structure that was implemented in January 2014:

Credit in 2013*	Credit in Education Structure Implemented in 2014
Exam 3L	Exams LC and ST
SOA Exam MLC	Exams LC and ST

***Note:** Credit for Exam 3L or SOA Exam MLC must have been achieved through an examination administered prior to January 2014.

In addition, the CAS Board of Directors approved the following waiver that will continue beyond January 2014:

Credit	Credit in Education Structure Implemented in 2014
SOA Exam MLC	Exam LC



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-
4. The CAS Board of Directors approved the following transition rules for the education structure that was implemented in January 2011:

Credit in 2010	Credit in Education Structure Implemented in 2011
Exam 5	Half of Exam 5 (section on Basic Techniques for Ratemaking)* and Online Course 1
Exam 6	Half of Exam 5 (section on Estimating Claim Liabilities)* and Exam 7 on Estimation of Policy Liabilities, Insurance Company Valuation, and Enterprise Risk Management
Exam 7	Nation-specific Exam 6 on Regulation and Financial Reporting and Online Course 2
Exam 8	Exam 9 on Financial Risk and Rate of Return
Exam 9	Exam 8 on Advanced Ratemaking

***Note:** To receive credit for the new Exam 5 on Basic Techniques for Ratemaking and Estimating Claim Liabilities, the candidate must have credit for both old Exams 5 and 6. At the time of transition, if a candidate has credit for only one of the required exams (either old Exam 5 or Exam 6), the candidate will be allowed to take just the part of the exam for which he or she is missing credit (i.e., either the Basic Techniques for Ratemaking section or the Estimating Claim Liabilities section of the new exam) in order to obtain credit for the new exam. This option will be available for a transition period of two sittings after the official conversion to the new education structure (i.e., May 2011 and May 2012). If the candidate does not have credit for both halves of Exam 5 at the end of the transition period, the candidate would have to pass the full version of Exam 5 to receive credit.

5. The CAS Board of Directors approved the following transition rule for the revision to Exam 3 that was implemented in January 2008:

Credit in 2007	Credit in Education Structure Implemented in 2008
Exam 3	Exams 3F and 3L

6. The CAS Board of Directors approved the following transition rules for the revised education structure that was implemented in January 2005:

Credit in 2004	Credit in Education Structure Implemented in 2005
Exam 1	Exam 1
Exam 2	Exam 2, VEE-Economics, VEE-Corporate Finance
Exam 3	Exam 3 [Exams 3F and 3L]
Exam 4	Exam 4, VEE-Applied Statistical Methods



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7. The following rules apply for candidates with unused credit from exams administered prior to 2000:

Pre-2000 Credit	Credit in Education Structure Implemented in 2014
Exam 2 (Probability & Statistics) and Exam 4B (Credibility Theory and Loss Distributions)	Exam ST
Pre-2000 Credit	Credit in Education Structure Implemented in 2011
Exam 3B	Online Course 1
Pre-2000 Credit	Credit in Education Structure Implemented in 2005
Exam 3A	VEE-Applied Statistical Methods
Exam 4A	Exam 2
Exam 4B	Exam 4
Exam 5A	VEE-Economics
Exam 5B	VEE-Corporate Finance

CAS Course on Professionalism

The CAS Course on Professionalism is designed to present candidates with real situations that contain ethical and professional issues for the actuary. Volunteer members of the CAS facilitate small group discussions of actual case studies. Although grades are not given for the course, candidates must actively participate in order to receive credit. Successful completion of this course is required before a candidate can become a member of the Casualty Actuarial Society.

Candidates are urged to register for this course as soon as they are eligible. To be eligible for the CAS Course on Professionalism, the candidate should refer to the CAS website:

- For the US/Canada Course on Professionalism - <http://www.casact.org/admissions/index.cfm?fa=cop>
- For the Asia Course on Professionalism - <http://www.casact.org/admissions/index.cfm?fa=cop-asia>

Dates for the course will be posted in the CAS Course on Professionalism page of the CAS website (<http://www.casact.org/education/index.cfm?fa=prof>). Each course has a limited number of participants; early registration is recommended. Facility information and course times are provided when registration for specific courses is announced.



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CAS Membership Requirements

Associateship

Candidates for Associateship in the Casualty Actuarial Society must fulfill the examination requirements by successful completion of, or credit for, Exams 1, 2, 3F, 4 (prior to July 1, 2018), MAS-I, MAS-II (after July 1, 2018), 5, and 6; have credit for Online Courses 1/CA1 and 2/CA2; have credit by Validation by Educational Experience (VEE) for the required topics of corporate finance (accounting and finance after July 1, 2018) and economics; and successful completion of, or credit for, the CAS Course on Professionalism. Exam 6 is nation specific and passage of any one of the CAS-approved nation-specific exams fulfills the Associateship requirements.

After completing all the prescribed requirements, all prospective Associate members must submit a [formal application](#) to the Casualty Actuarial Society. The application form and list of application requirements are available on the CAS website in the Join/Renew section. Obtaining the two letters of reference is the prospective member's responsibility. If no member of the CAS is familiar with the prospective Associate and his or her work history, references from members of the American Academy of Actuaries, the Canadian Institute of Actuaries, the Society of Actuaries, other actuarial organizations that are part of the International Actuarial Association, or senior executives where the candidate is employed may be substituted. For further information on alternative acceptable references, please contact the CAS Office. An application for membership will not be processed without these references. Candidates must have completed all educational requirements prior to submitting an application for CAS membership.

After all requirements are met and a completed application has been submitted to the CAS, each candidate is voted on by the CAS Executive Council. Upon approval of the CAS Executive Council, the candidate will be admitted as an Associate of the Casualty Actuarial Society (ACAS). Candidates approved by the Executive Council will be notified by letter from the CAS president. Members may indicate their designation as an Associate of the Casualty Actuarial Society by using the initials "A.C.A.S." after their names only after they have received official notification of acceptance as an Associate from the CAS.

Fellowship

In addition to fulfilling all the requirements of Associateship, successful completion of, or credit for, all Fellowship examinations is required to fulfill the requirements for Fellowship and to be designated as a Fellow of the Casualty Actuarial Society (FCAS). Candidates who are admitted to the CAS as Fellows rather than Associates may indicate their designation as a Fellow of the Casualty Actuarial Society by using the initials "F.C.A.S." after their names only after they have received official notification of acceptance as a Fellow from the CAS. Associates who complete their Fellowship requirements may use the "F.C.A.S." designation immediately following official notification of successful completion of all the Fellowship requirements as prescribed by the Board of Directors.

CERA Designation Requirements

Candidates for the CERA (Certified Enterprise Risk Analyst) designation must fulfill the educational requirements by successful completion of all CAS Associateship requirements, CAS Exams 7 and 9, the Enterprise Risk Management and Modeling Seminar (specifically designed for the CERA designation), and Exam ST9 of the Institute and Faculty of Actuaries (U.K.).

After completing all the prescribed requirements, all prospective CERA designees must submit a formal application



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to the Casualty Actuarial Society. The application form will be available in the CERA section of the CAS website (<http://www.casact.org/cera/>). Candidates must have completed all educational requirements prior to submitting an application for the CERA designation.

After all requirements are met and a completed application has been submitted to the CAS, each candidate is voted on by the CAS Executive Council and then submitted to the international Treaty Board for the CERA Global Credential for approval. Upon approval, the candidate will be granted the CERA designation. CERA designees may indicate their designation by using the initials “CERA” after their names only after they have received official notification from the CAS.

Waiver of Examinations

Actuarial Examinations

The CAS's **Basic Education Waiver Policy** addresses the extent to which the CAS will grant waivers of its basic education requirements including Exams 1, 2, and 3F, and Exam 4 prior to 7/1/2018; Online Courses 1 and 2; Course on Professionalism; and Validation by Educational Experience requirements, or their equivalents as defined by the Executive Council.

The Board of Directors agrees that an exam waiver should be considered for verified educational accomplishments, e.g., exams or university courses, required by another actuarial organization that substantially meet the learning objectives of a particular CAS exam with reasonably equivalent rigor and level of mastery of the material. The Board agrees that the alternative should not be required to cover every learning objective that is covered in the CAS *Syllabus* for the particular exam in order to consider a waiver and that other learning objectives covered by the alternative may be considered as substitutes.

In addition to actuarial exam requirements, the CAS may grant waivers for other basic education requirements provided that the educational experience is deemed equivalent in subject matter coverage and depth. For example, the CAS may accept a professionalism course offered by another actuarial organization provided that it is deemed equivalent to the CAS Course on Professionalism or the Executive Council provides a supplement to address any significant CAS requirement that may be lacking. Other examples where CAS requirements may be waived include Online Courses or Validation by Educational Experience requirements. In general, the CAS will not grant waivers for its upper-level exams, i.e., Exams 5-9.

The CAS will not grant waiver of all or any portion of its examination requirements for work experience or contribution to actuarial literature.

Under this Policy, the granting of waivers by the Executive Council will be based on the recommendation of the vice president-admissions.



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Canadian Institute of Actuaries

The CAS recognizes the exam waivers granted by the Canadian Institute of Actuaries University Accreditation Program for CAS Exams 2 and 3F, and CAS Exam 4 (see below). The CAS will only grant waivers for CIA UAP exam credits that were awarded based on work at universities in Canada. The list of candidates granted waivers by the CIA is provided to the CAS following the end of a semester. The CAS automatically updates its records. No further action is required of candidates.

Note:

- Under previous education structures, the CAS recognized the exam waivers for CAS Exams 3L and LC.
- If a candidate has been granted a waiver for CAS Exam 4 under the University Accreditation Program through course work completed by 12/31/2018, then they will receive credit for CAS Exam 4 and subsequently CAS Exam MAS-II.

China Association of Actuaries

The CAS recognizes the preliminary examinations sponsored by the China Association of Actuaries (CAA). Credit will be granted for examinations passed or waived as a cohort for CAA exams A1, A2, A3, A4, and A7. When a candidate submits credit for all five exams, they will be given credit for CAS Exams 1, 2, and 3F, CAS Exam 4 prior to 7/1/2018, and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance after 7/1/2018) and Economics. **Credit will not be given on an individual exam basis. Credit will only be given for an entire cohort of examinations.**

The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities, nor for credit granted to candidates not qualifying directly in obtaining membership through the normal qualification/examination process.

Credit will not be given to Fellows of the CAA who have attained their designation through mutual recognition rather than through the organization's standard credentialing process. Fellows by mutual recognition should pursue examination waivers based on their original credentials.

The CAS has approved the following waiver policy:

Submitted CAA Exam Cohort	Waiver Granted for CAS Exam/Educational Experience Cohort Equivalent
A1, A2, A3, A4, & A7	1, 2, and 3F, 4 (prior to 7/1/2018), VEE-Corporate Finance (prior to 7/1/2018), VEE-Accounting and Finance (after 7/1/2018), & VEE-Economics

Note: If a candidate has passed CAA Exams A1, A2, A3, A4, & A7 by 7/1/2018, then they will receive credit for CAS Exam 4 and subsequently CAS Exam MAS-II.



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Institute and Faculty of Actuaries (U.K.), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and Institute of Actuaries of India Examinations

The CAS recognizes some of the examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS *Syllabus* and the syllabi of each of the aforementioned actuarial organizations.

The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities, nor for credit granted to candidates not qualifying directly in obtaining membership through the normal qualification/examination process.

Credit will not be given to Fellows of these actuarial organizations who have attained their designation through mutual recognition rather than through the organization’s standard credentialing process. Fellows by mutual recognition should pursue examination waivers based on their original credentials.

The CAS has approved the following waiver policy:

Subject of the Institute and Faculty of Actuaries (U.K.), Actuaries Institute (Australia), and Institute of Actuaries of India	Subject of the Actuarial Society of South Africa	Waiver Granted for CAS Exam/Educational Experience
CT2	A103	VEE-Corporate Finance (prior to 7/1/2018) or VEE-Accounting and Finance (after 7/1/2018)
CT7	A102	VEE-Economics
CT3	A101	Exam 1
CT1	A201	Exam 2
CT8	A205	Exam 3F
CT3, CT4, and CT6 (passed after 9/1/2016)	A101, A202, and A204 (passed after 9/1/2016)	Exam MAS-I

Note: The CAS has approved the following **transitional waiver policies** for examinations sponsored by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), and the Institute of Actuaries of India. Credit will be granted for examinations passed or waived in accordance with examination equivalencies between the CAS *Syllabus* and the syllabi of each of the aforementioned actuarial organizations. The CAS will not grant credit for examinations waived on account of academic records achieved in U.S. universities.

- If a candidate has passed all three Exams CT4, CT5, and CT6 or A202, A203, and A204 by 8/31/2016, they will receive credit for CAS Exam S and subsequently CAS Exam MAS-I.



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- If a candidate has passed both Exams CT4 and CT6 or A202 and A204 by 7/1/2018, they will receive credit for CAS Exam 4 and subsequently CAS Exam MAS-II.

Society of Actuaries

The CAS recognized the SOA exams listed in the chart below. Candidates who check the “Property and Casualty” field on their preliminary exam application will have the results of their exams automatically updated in the CAS candidate database. Candidates who did not check the “Property and Casualty” field can have their exam results verified and updated in the CAS candidate database by completing the [online form](#).

The CAS recognizes the following exams and the transition rules adopted by the SOA for the changes to their examinations in 2017:

SOA Exam	Waiver Granted for CAS Exam
P (Probability)	1
FM (Financial Mathematics)	2
MFE (Models for Financial Economics)	3F (prior to 7/1/2018)
IFM (Investments and Financial Markets)	3F (after 7/1/2018)
C (Construction of Actuarial Models)	4 (prior to 7/1/2018)

CAS Exam Requirements of SOA Members

An actuary who achieved Fellowship or Associateship of the SOA by completing the qualification requirements of the SOA, not solely in recognition of membership of another actuarial association, has CAS examination credit for:

- Exam 1
- Exam 2
- Exam 3F
- Exam 4 (prior to 7/1/2018)
- VEE-Corporate Finance or VEE-Accounting and Finance (after 7/1/2018)
- VEE-Economics

Therefore, the remaining exams/courses required of an ASA or FSA to achieve ACAS are:

- Online Course 1
- Online Course 2
- Exam MAS-I†
- Exam MAS-II††
- Exam 5
- Exam 6
- CAS Course on Professionalism

† If a SOA Member completed SOA Exam MLC and VEE-Applied Statistics prior to 2014, credit for CAS Exam 5 would be granted under Transition Rules and subsequently Exam MAS-I.

†† If a SOA Member completed SOA Exam C prior to 7/1/2018, they will receive credit for CAS Exam 4 and subsequently Exam MAS-II.



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Important Notes:

- The syllabus material covered on CAS Exam 7 is still required in addition to ACAS to sign a Statement of Actuarial Opinion, NAIC Property and Casualty Annual Statement, in the United States.
- At this time, there is no waiver of any other CAS exams based on the SOA's General Insurance (GI) examination process.

Members of Other Actuarial Organizations

For individuals of actuarial organizations that are a member of the International Association of Actuaries (IAA), the CAS will grant waivers for its preliminary examinations/educational requirements as defined by the Executive Council (CAS Exams 1, 2, and 3F, CAS Exam 4 prior to 7/1/2018; and Validation by Educational Experience requirements) provided that the organization's individual member achieved the highest possible designation in that organization and has been practicing as a professional actuary for at least two years subsequent to obtaining the qualification.

Candidates of Other Actuarial Organizations

Actuarial organizations that are full members of the IAA and have an exam-based admissions requirement may request that the CAS grant waivers to its individual candidates for the CAS preliminary examinations/educational requirements - as a cohort of CAS Exams 1, 2, and 3F, CAS Exam 4 prior to 7/1/2018, and Validation by Educational Experience requirements - based on credit for their examinations that meet certain IAA requirements. An actuarial organization should contact the CAS Examinations Coordinator for the requirements to obtain this approval. All organization submissions are subject to the approval of the vice president-admissions and Executive Council.

Online Courses and VEE

Online Courses: The CAS will grant a waiver of CAS Online Course 1, Risk Management and Insurance Operations, to those who have the Chartered Property Casualty Underwriter (CPCU) designation.

Validation by Educational Experience: Unlike other CAS admissions requirements, the Validation by Educational Experience (VEE) requirements are generally fulfilled outside an actuarial organization. Candidates requesting waiver of any VEE requirements based on actuarial exams should follow the procedure for requesting a waiver. Most candidates, however, will fulfill the VEE requirements through approved educational experiences and must submit the Application for Validation by Educational Experience Credit. Details are provided in the VEE section of this *Syllabus*.

Waiver Request Process

For a waiver of a CAS admissions requirement that has an approved waiver policy stated above, candidates should present their request to the CAS Examinations Coordinator with appropriate evidence that demonstrates the passing of (or score on) the educational equivalent for which a waiver is requested.

Requests for waivers for CAS admissions requirements for which there currently is no approved waiver policy are considered on a case-by-case basis. Candidates must present their requests to the CAS Examinations Coordinator and include with their applications documented evidence that demonstrates the asserted equivalence, as well as the appropriate educational policy material of their local actuarial organization or appropriate educational



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SYLLABUS OF BASIC EDUCATION

2018

Examination Rules

organization. If such material is not included, the CAS Examinations Coordinator will request it from the candidates. The vice president-admissions will review all such requests and, when appropriate, recommend action to the Executive Council.

Please address all waiver requests to: CAS Examinations Coordinator, Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203, U.S.A.



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D. CAS Code of Professional Ethics for Candidates

The purpose of the Casualty Actuarial Society (CAS) Code of Professional Ethics for Candidates (Candidate Code) is to require actuarial candidates to adhere to the high standards of conduct, practice, and qualifications of the actuarial profession, thereby supporting the actuarial profession in fulfilling its responsibility to the public. An actuarial candidate shall comply with the Candidate Code. An actuarial candidate who commits a material violation of the provisions of the Candidate Code shall be subject to the counseling and discipline procedures of the CAS.

“Actuarial candidates” are those persons who have registered for a CAS specific exam but have yet to fulfill all of the requirements for admission into the CAS. In situations where actuarial candidates perform actuarial work, their “principal” is defined as their client or employer. “Actuarial services” are professional services provided to a principal by an individual acting in the capacity of an actuary. Such services include the rendering of advice, recommendations, findings, or opinions based upon actuarial considerations.

Rule 1: An actuarial candidate shall act honestly, with integrity and competence, to uphold the reputation of the actuarial profession.

Rule 2: An actuarial candidate shall not engage in any professional conduct involving dishonesty, fraud, deceit, or misrepresentation or commit any act that reflects adversely on the actuarial profession.

Rule 3: An actuarial candidate shall perform actuarial services with courtesy and professional respect and shall cooperate with others in the principal’s interest.

Rule 4: An actuarial candidate shall adhere to the CAS Policy on Examination Discipline.

Rule 5: Actuarial candidates are not authorized to use membership designations of the CAS until they are admitted to membership by the CAS Executive Council.

Rule 6: An actuarial candidate shall not disclose to another party any confidential information unless authorized to do so by the principal or required to do so by law, statute, or regulation. Confidential information includes information of a proprietary nature and information that is legally restricted from circulation.

Rule 7: An actuarial candidate shall respond promptly, truthfully, and fully to any request for information by, and cooperate fully with, appropriate counseling and disciplinary body of the CAS in connection with any disciplinary, counseling or other proceeding of such body relating to the Candidate Code. The actuarial candidate’s responsibility to respond shall be subject to applicable restrictions listed in Rule 6 and those imposed by law, statute, or regulation.

(The CAS Board of Directors approved the code above on November 12, 2006, effective with the Spring 2008 exam sitting.)

A copy of the Casualty Actuarial Society Rules of Procedure for Disciplinary Actions Involving Candidates is available in the Exams & Admissions section of the CAS website under “Candidate’s Code of Ethics.”



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2018 SYLLABUS UPDATES (as of 05/31/2018)

The following are the changes made to the *Syllabus of Basic Education* after its initial publication.

2018 Spring Examinations

Exam MAS-I—Modern Actuarial Statistics-I

For *An Introduction to Statistical Learning, with Application in R* by Gareth James et al., an updated printing will be used. In addition, the reading will be available on a web page titled Complete Online Text References.

ST9 Exam Administration for CERA Designation

The April administration for Exam ST9 of the Institute and Faculty of Actuaries (U.K.) has been changed to April 19, 2018.

Exam 9—Financial Risk and Rate of Return

The text reference for “Riskiness Leverage Models” by R.E. Kreps has been revised to include a link to an authored-developed spreadsheet that replicates the exhibits in the paper.

2018 Fall Examinations

Exam MAS-I—Modern Actuarial Statistics-I

Three revisions have been made to Section C. Extended Linear Models: (1) one of the Knowledge Statements for Learning Objective C.2 has been revised; (2) a new Knowledge Statement for Learning Objective C.4 has been added; and (3) the sections for the reading *An Introduction to Statistical Learning, with Application in R* by Gareth James et al. have been revised. In addition, the text reference for the reading *An Introduction to Statistical Learning, with Application in R* by Gareth James et al. has been clarified.

Note: *This Syllabus is subject to change in the future.*

The Syllabus for each examination is defined in the form of Learning Objectives, Knowledge Statements, and Readings. The Learning Objectives present the learning goals for the underlying subjects being tested and set forth, usually in broad terms, what the candidate should be able to do in actual practice. The Knowledge Statements describe the body of knowledge corresponding to the exam subject and are illustrative of the scope of each Learning Objective. The Readings are recommended resources that support the Learning Objectives and may assist candidates to prepare for the examination. The CAS is not responsible for any errors or omissions found in the content of the resources identified in the Readings.



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The syllabus for this exam is defined in the form of learning objectives that set forth, usually in broad terms, what the candidate should be able to do in actual practice.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*. The options for obtaining credit for this exam are listed below and in Examination Rules, C. Grades and Accreditation, [Waivers of Examinations](#) section of the *Syllabus*.

The purpose of the syllabus for this examination is to develop knowledge of the fundamental probability tools for quantitatively assessing risk. The application of these tools to problems encountered in actuarial science is emphasized. A thorough command of the supporting calculus is assumed. Additionally, a very basic knowledge of insurance and risk management is assumed.

A. General Probability

LEARNING OBJECTIVES

1. Use and apply the following concepts in a risk management context:
 - Set functions including set notation and basic elements of probability
 - Mutually exclusive events
 - Addition and multiplication rules
 - Independence of events
 - Combinatorial probability
 - Conditional probability
 - Bayes Theorem / Law of total probability



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B. Univariate Probability Distributions

This section includes binomial, negative binomial, geometric, hypergeometric, Poisson, uniform, exponential, gamma, and normal distributions.

LEARNING OBJECTIVES

1. Use and apply the following concepts in a risk management context:
 - Probability functions and probability density functions
 - Cumulative distribution functions
 - Mode, median, percentiles, and moments
 - Variance and measures of dispersion
 - Moment generating functions
 - Transformations

C. Multivariate Probability Distributions

This section includes the bivariate normal distribution.

LEARNING OBJECTIVES

1. Use and apply the following concepts in a risk management context:
 - Joint probability functions and joint probability density functions
 - Joint cumulative distribution functions
 - Central Limit Theorem
 - Conditional and marginal probability distributions
 - Moments for joint, conditional, and marginal probability distributions
 - Joint moment generating functions
 - Variance and measures of dispersion for conditional and marginal probability distributions
 - Covariance and correlation coefficients
 - Transformations and order statistics
 - Probabilities and moments for linear combinations of independent random variables



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Options for Obtaining Exam 1 Credit

The CAS will grant credit for Exam 1 to those who have successfully completed one of the following examinations:

Organization	Examination
Actuarial Society of South Africa	A101, Probability and Mathematical Statistics
Actuaries Institute (Australia)	CT3, Probability and Mathematical Statistics
China Association of Actuaries	See note below ¹
Institute of Actuaries of India	CT3, Probability and Mathematical Statistics
Institute and Faculty of Actuaries (U.K.)	CT3, Probability and Mathematical Statistics
Society of Actuaries	P, Probability

1. The CAS will grant exam waivers based on exams administered by the China Association of Actuaries as a cohort for CAS Exams 1, 2, 3F, and 4 (prior to July 1, 2018) and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance subsequent to July 1, 2018) and Economics. See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation.

To obtain credit, candidates should follow the procedures outlined on the [Waivers of Examination](#) page of the CAS website.



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The syllabus for this exam is defined in the form of learning objectives that set forth, usually in broad terms, what the candidate should be able to do in actual practice.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*. The options for obtaining credit for this exam are listed below and in Examination Rules, C. Grades and Accreditation, [Waivers of Examinations](#) section of the *Syllabus*.

The purpose of the syllabus for this examination is to develop knowledge of the fundamental concepts of financial mathematics, and how those concepts are applied in calculating present and accumulated values for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, asset/liability management, investment income, capital budgeting, and valuing contingent cash flows. The candidate will also be given an introduction to financial instruments, including derivatives, and the concept of no-arbitrage as it relates to financial mathematics.

The Financial Mathematics Exam assumes a basic knowledge of calculus and an introductory knowledge of probability.

A. Interest Theory

LEARNING OBJECTIVES

1. For time value of money, define and recognize the definitions of the following terms:
 - Interest rate (rate of interest)
 - Simple interest
 - Compound interest
 - Accumulation function
 - Future value
 - Present value/net present value
 - Discount factor
 - Discount rate (rate of discount)
 - Convertible m-thly
 - Nominal rate
 - Effective rate
 - Inflation and real rate of interest
 - Force of interest
 - Equation of value



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LEARNING OBJECTIVES

2. For time value of money, the candidate will be able to do the following:
 - Given any two of interest rate, present value, or future value, calculate the third based on simple or compound interest.
 - Given any one of the effective interest rate, the nominal interest rate convertible m -thly, the effective discount rate, the nominal discount rate convertible m -thly, or the force of interest, calculate all of the other items.
 - Write the equation of value given a set of cash flows and an interest rate.
3. For annuities with payments that are not contingent, define and recognize the definitions of the following terms:
 - Annuity-immediate
 - Annuity-due
 - Perpetuity
 - Payable m -thly, or Payable continuously
 - Level payment annuity
 - Arithmetic increasing/decreasing payment annuity
 - Geometric increasing/decreasing payment annuity
 - Term of annuity
4. For annuities with payments that are not contingent, the candidate will be able to do the following:
 - Given an annuity with level payments, immediate (or due), payable m -thly, (or payable continuously), and any three of present value, future value, interest rate, payment, and term calculate the remaining two items.
 - Given an annuity with non-level payments, immediate (or due), payable m -thly, (or payable continuously), the pattern of payment amounts, and any three of present value, future value, interest rate, payment amounts, and term of annuity calculate the remaining two items.
5. For loans, define and recognize the definitions of the following terms:
 - Principal
 - Interest
 - Term of loan
 - Outstanding balance
 - Final payment (drop payment, balloon payment)
 - Amortization
 - Sinking fund



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LEARNING OBJECTIVES

6. For loans, the candidate will be able to do the following:
- Given any four of term of loan, interest rate, payment amount, payment period, principal, calculate the remaining items.
 - Calculate the outstanding balance at any point in time.
 - Calculate the amount of interest and principal repayment in a given payment.
 - Given the quantities, except one, in a sinking fund arrangement calculate the missing quantity.
7. For bonds, define and recognize the definitions of the following terms:
- Price
 - Redemption value
 - Par Value/Face value
 - Coupon, Coupon rate
 - Term of bond
 - Yield rate
 - Callable/non-callable
 - Book value
 - Accumulation of discount/Amortization of premium
8. For bonds, the candidate will be able to do the following:
- Given any four of price, redemption value, yield rate, coupon rate, and term of bond, calculate the remaining item.
9. For general cash flows and portfolios, define and recognize the definitions of the following terms:
- Yield rate/rate of return
 - Dollar-weighted rate of return/Time-weighted rate of return
 - Current value
 - Duration (Macaulay, modified and effective)
 - Convexity
 - Portfolio and investment year allocation methods
 - Spot rate
 - Forward rate
 - Yield curve
 - Stock price, stock dividend



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LEARNING OBJECTIVES

10. For general cash flows and portfolios, the candidate will be able to do the following:
- Calculate the current value of a set of cash flows.
 - Calculate the portfolio yield rate.
 - Calculate the dollar-weighted and time-weighted rate of return.
 - Calculate the duration and convexity of a set of cash flows.
 - Calculate either Macaulay or modified duration given the other.
 - Use duration and convexity to approximate the change in present value due to a change in interest rate.
 - Calculate the price of a stock using the dividend discount model.
11. For immunization, define and recognize the definitions of the following terms:
- Cash-flow matching
 - Immunization (including full immunization)
 - Redington immunization
12. For immunization, the candidate will be able to do the following:
- Construct an investment portfolio to fully immunize a set of liability cash flows.
 - Construct an investment portfolio to match present value and duration of a set of liability cash flows.
 - Construct an investment portfolio to exactly match a set of liability cash flows.

B. Financial Economics

LEARNING OBJECTIVES

1. For general derivatives, define and recognize the definitions of the following terms:
- Derivative, Underlying asset, Over-the-counter market
 - Ask price, Bid price, Bid-ask spread
 - Short selling, Short position, Long position
 - Stock index
 - Spot price
 - Net profit/payoff
 - Credit risk
 - Marking-to-market
 - Margin, Maintenance margin, Margin call
2. For general derivatives, evaluate an investor's margin position based on changes in asset values.



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LEARNING OBJECTIVES

3. For options, define and recognize the definitions of the following terms:

- Call option, Put option
- Expiration, Expiration date
- Strike price/Exercise price
- European option, American option, Bermudan option
- In-the-money, At-the-money, Out-of-the-money
- Covered call, Naked writing
- Dividends
- Put-call parity

4. For options, evaluate the payoff and profit of basic derivative contracts.

5. For hedging and investment strategies, define and recognize the definitions of the following terms:

- Hedging, Arbitrage
- Diversifiable risk, Nondiversifiable risk
- Synthetic forwards
- Spreads (including bull, bear, box, and ratio spreads)
- Collars (including zero-cost collars), Paylater strategy
- Straddles (including strangles, written straddles and butterfly spreads)
- Convertible bond, Mandatorily convertible bond

6. For hedging and investment strategies, the candidate will be able to:

- Explain how derivative securities can be used as tools to manage financial risk.
- Explain the reasons to hedge and not to hedge.
- Evaluate the payoff and profit of hedging strategies.

7. For forwards and futures, define and recognize the definitions of the following terms:

- Forward contract, Prepaid forward contract
- Outright purchase, Fully leveraged purchase
- Implied repo rate
- Cost of carry
- Lease rate
- Futures contract



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LEARNING OBJECTIVES

8. For forwards and futures, the candidate will be able to:
- Determine forward price from prepaid forward price.
 - Explain the relationship between forward price and futures price.
 - Explain the relationship between forward price and future stock price.
 - Use the concept of no-arbitrage to determine the theoretical value of futures and forwards.
 - Given any four of call premium, put premium, forward price, strike price and interest rate, calculate the remaining item using the put-call parity formula.
9. For swaps, define and recognize the definitions of the following terms:
- Swap, Prepaid swap
 - Swap term, Swap spread, Notional Amount
 - Simple commodity swap, Interest rate swap
 - Deferred swap
10. Use the concept of no-arbitrage to determine the theoretical values of swaps.



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Options for Obtaining Exam 2 Credit

The CAS will grant credit for Exam 2 to those who have successfully completed one of the following examinations:

Organization	Examination
Actuarial Society of South Africa	A201, Financial Mathematics
Actuaries Institute (Australia)	CT1, Financial Mathematics
Canadian Institute of Actuaries (CIA)	University Accreditation Program credit for Financial Mathematics ¹
China Association of Actuaries	See note below ²
Institute of Actuaries of India	CT1, Financial Mathematics
Institute and Faculty of Actuaries (U.K.)	CT1, Financial Mathematics
Society of Actuaries	Exam FM, Financial Mathematics ³

1. For credit granted through the CIA's University Accreditation Program, the list of candidates granted waivers by the CIA is provided to the CAS following the end of a semester. The CAS automatically updates its records. No further action is required of candidates.

2. The CAS will grant exam waivers based on exams administered by the China Association of Actuaries as a cohort for CAS Exams 1, 2, 3F, and 4 (prior to July 1, 2018) and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance subsequent to July 1, 2018) and Economics. See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation.

3. The CAS will recognize the transition rules adopted by the SOA effective with the June 2017 administration of their revised Exam FM. These rules can be located on the [Waivers of Examination](#) page of the CAS website.

To obtain credit otherwise, candidates should follow the procedures outlined on the [Waivers of Examination](#) page of the CAS website.



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The syllabus for this exam is defined in the form of learning objectives that set forth, usually in broad terms, what the candidate should be able to do in actual practice.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*. The options for obtaining credit for this exam are listed below and in Examination Rules, C. Grades and Accreditation, [Waivers of Examinations](#) section of the *Syllabus*.

The purpose of the syllabus is to develop the candidate’s knowledge of the theoretical basis of certain actuarial models and the application of those models to insurance and other financial risks. A thorough knowledge of calculus, probability, and interest theory is assumed.

A. Interest Rate Models

LEARNING OBJECTIVES

1. Evaluate features of the Vasicek and Cox-Ingersoll-Ross bond price models.
2. Explain why the time-zero yield curve in the Vasicek and Cox-Ingersoll-Ross bond price models cannot be exogenously prescribed.
3. Construct a Black-Derman-Toy binomial model matching a given time-zero yield curve and a set of volatilities.

B. Rational Valuation of Derivative Securities

LEARNING OBJECTIVES

1. Use put-call parity to determine the relationship between prices of European put and call options and to identify arbitrage opportunities.
2. Calculate the value of European and American options using the binomial model.
3. Calculate the value of European options using the Black-Scholes option-pricing model.
4. Identify the situations where the values of European and American options are the same.
5. Interpret the option Greeks.
6. Explain the cash flow characteristics of the following exotic options: Asian, barrier, compound, gap, and exchange.
7. Explain the properties of a lognormal distribution and explain the Black-Scholes formula as an expected value for a lognormal distribution.
8. Explain what it means to say that stock prices follow a diffusion process.
9. Apply Itô’s lemma in the one-dimensional case.



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C. Simulation

LEARNING OBJECTIVES

1. Simulate lognormal stock prices.
2. Use variance reduction techniques to accelerate convergence.

D. Risk Management Techniques

LEARNING OBJECTIVES

1. Explain and demonstrate how to control risk using the method of delta-hedging.

Options for Obtaining Exam 3F Credit

The CAS will grant credit for Exam 3F to those who have successfully completed one of the following examinations:

Organization	Examination
Actuarial Society of South Africa	A205, Financial Economics
Actuaries Institute (Australia)	CT8, Financial Economics
Canadian Institute of Actuaries	University Accreditation Program credit for Models for Financial Economics ¹
China Association of Actuaries	See note below ²
Institute of Actuaries of India	CT8, Financial Economics
Institute and Faculty of Actuaries (U.K.)	CT8, Financial Economics
Society of Actuaries	MFE, Models for Financial Economics ³

1. For credit granted through the CIA's University Accreditation Program, the list of candidates granted waivers by the CIA is provided to the CAS following the end of a semester. The CAS automatically updates its records. No further action is required of candidates.

2. The CAS will grant exam waivers based on exams administered by the China Association of Actuaries **as a cohort** for CAS Exams 1, 2, 3F, and 4 (prior to July 1, 2018) and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance subsequent to July 1, 2018) and Economics. See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation.

3. The CAS will recognize the transition rules adopted by the SOA effective with the July 2017 administration of their revised Exam MFE. These rules can be located on the [Waivers of Examination](#) page of the CAS website.

To obtain credit otherwise, candidates should follow the procedures outlined on the [Waivers of Examination](#) page of the CAS website.



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SYLLABUS OF BASIC EDUCATION
Fall 2018
Financial Economics – Exam 3F

The syllabus for this basic education requirement is defined in the form of learning objectives that set forth, usually in broad terms, what the candidate should be able to do in actual practice.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*. The options for obtaining credit for this basic education requirement are listed below and in Examination Rules, C. Grades and Accreditation, [Waivers of Examinations](#) section of the *Syllabus*.

The purpose of the syllabus is to develop the candidate’s knowledge of investment and financial markets. A thorough knowledge of calculus, probability, and interest theory is assumed.

A. Investment Markets

LEARNING OBJECTIVES

1. Understand mean-variance portfolio theory and use it to calculate risk-return relationships for assets and portfolios.
2. Understand asset-pricing models, including the capital asset pricing model, and factor models.
3. Understand the different levels of market efficiency, and how behavioral finance explains market anomalies and inefficiencies.

B. Corporate Finance

LEARNING OBJECTIVES

1. Calculate and interpret different measures of investment risk, and understand their application in project analysis and capital budgeting.
2. Explain the key elements of capital structure considerations.

C. Financial Derivatives: Forwards and Futures

LEARNING OBJECTIVES

1. Understand the characteristics of forwards, and calculate prices, payoffs, and profits.
2. Understand the characteristics of futures and how they differ from forwards, including margins and marking-to-market.



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D. Financial Derivatives: Options

LEARNING OBJECTIVES

1. Understand the characteristics and cash flows of financial options.
2. Calculate the value of European and American options using the binomial model.
3. Calculate the value of European options using the Black-Scholes option-pricing model
4. Identify the situations where the values of European and American options are the same.
5. Interpret the option Greeks (i.e., option price partial derivatives).
6. Explain and demonstrate how to control risk using the method of delta-hedging.
7. Explain the cash flow characteristics of exotic options.
8. Explain the properties of a lognormal distribution and explain the Black-Scholes formula as an expected value for a lognormal distribution.

Options for Obtaining Exam 3F Credit

The CAS will grant credit for basic education requirement for Exam 3F to those who have successfully completed one of the following examinations:

Organization	Examination
Actuarial Society of South Africa	A205, Financial Economics
Actuaries Institute (Australia)	CT8, Financial Economics
Canadian Institute of Actuaries	University Accreditation Program credit for Models for Financial Economics ¹
China Association of Actuaries	See note below ²
Institute of Actuaries of India	CT8, Financial Economics
Institute and Faculty of Actuaries (U.K.)	CT8, Financial Economics
Society of Actuaries	IFM, Investment and Financial Markets

1. For credit granted through the CIA's University Accreditation Program, the list of candidates granted waivers by the CIA is provided to the CAS following the end of a semester. The CAS automatically updates its records. No further action is required of candidates.

2. The CAS will grant exam waivers based on exams administered by the China Association of Actuaries **as a cohort** for CAS Exams 1, 2, 3F, and 4 (prior to July 1, 2018) and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance subsequent to July 1, 2018) and Economics. See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation.

To obtain credit otherwise, candidates should follow the procedures outlined on the [Waivers of Examination](#) page of the CAS website.



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SYLLABUS OF BASIC EDUCATION
SPRING 2018
Construction and Evaluation of
Actuarial Models – Exam 4

The syllabus for this exam is defined in the form of learning objectives that set forth, usually in broad terms, what the candidate should be able to do in actual practice.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*. The options for obtaining credit for this exam are listed below and in Examination Rules, C. Grades and Accreditation, [Waivers of Examinations](#) section of the *Syllabus*.

The syllabus for this examination provides an introduction to modeling and covers important actuarial methods that are useful in modeling. A thorough knowledge of calculus, probability, and mathematical statistics is assumed.

The candidate will be introduced to useful frequency and severity models beyond those covered in Exam 3F. The candidate will be required to understand the steps involved in the modeling process and how to carry out these steps in solving business problems. The candidate should be able to: (1) analyze data from an application in a business context; (2) determine a suitable model including parameter values; and (3) provide measures of confidence for decisions based upon the model. The candidate will be introduced to a variety of tools for the calibration and evaluation of the models.

The candidate is expected to be familiar with survival, severity, frequency and aggregate models, and use statistical methods to estimate parameters of such models given sample data. The candidate is further expected to identify steps in the modeling process, understand the underlying assumptions implicit in each family of models, recognize which assumptions are applicable in a given business application, and appropriately adjust the models for impact of insurance coverage modifications.

Specifically, the candidate is expected to be able to perform the tasks listed below.



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A. Severity Models

LEARNING OBJECTIVES

1. Calculate the basic distributional quantities:
 - Moments
 - Percentiles
 - Generating functions
2. Describe how changes in parameters affect the distribution.
3. Recognize classes of distributions and their relationships.
4. Apply the following techniques for creating new families of distributions:
 - Multiplication by a constant
 - Raising to a power
 - Exponentiation
 - Mixing
5. Identify the applications in which each distribution is used and reasons why.
6. Apply the distribution to an application, given the parameters.
7. Calculate various measures of tail weight and interpret the results to compare the tail weights.

B. Frequency Models

LEARNING OBJECTIVES

1. For the Poisson, Mixed Poisson, Binomial, Negative Binomial, Geometric distribution and mixtures thereof:
 - Describe how changes in parameters affect the distribution.
 - Calculate moments.
 - Identify the applications for which each distribution is used and reasons why.
 - Apply the distribution to an application given the parameters.
 - Apply the zero-truncated or zero-modified distribution to an application given the parameters.

C. Aggregate Models

LEARNING OBJECTIVES

1. Compute relevant parameters and statistics for collective risk models.
2. Evaluate compound models for aggregate claims.
3. Compute aggregate claims distributions.



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D. For Severity, Frequency and Aggregate Models

LEARNING OBJECTIVES

1. Evaluate the impacts of coverage modifications:
 - Deductibles
 - Limits
 - Coinsurance
2. Calculate Loss Elimination Ratios.
3. Evaluate effects of inflation on losses.

E. Risk Measures

LEARNING OBJECTIVES

1. Calculate VaR, and TVaR and explain their use and limitations.

F. Construction of Empirical Models

LEARNING OBJECTIVES

1. Estimate failure time and loss distributions using:
 - Kaplan-Meier estimator, including approximations for large data sets
 - Nelson-Åalen estimator
 - Kernel density estimators
2. Estimate the variance of estimators and confidence intervals for failure time and loss distributions.
3. Apply the following concepts in estimating failure time and loss distribution:
 - Unbiasedness
 - Consistency
 - Mean squared error

G. Construction and Selection of Parametric Models

LEARNING OBJECTIVES

1. Estimate the parameters of failure time and loss distributions using:
 - Maximum likelihood
 - Method of moments
 - Percentile matching
 - Bayesian procedures
2. Estimate the parameters of failure time and loss distributions with censored and/or truncated data using maximum likelihood.



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LEARNING OBJECTIVES

3. Estimate the variance of estimators and the confidence intervals for the parameters and functions of parameters of failure time and loss distributions.
4. Apply the following concepts in estimating failure time and loss distributions:
 - Unbiasedness
 - Asymptotic unbiasedness
 - Consistency
 - Mean squared error
 - Uniform minimum variance estimator
5. Determine the acceptability of a fitted model and/or compare models using:
 - Graphical procedures
 - Kolmogorov-Smirnov test
 - Anderson-Darling test
 - Chi-square goodness-of-fit test
 - Likelihood ratio test
 - Schwarz Bayesian Criterion

H. Credibility

LEARNING OBJECTIVES

1. Apply limited fluctuation (classical) credibility including criteria for both full and partial credibility.
2. Perform Bayesian analysis using both discrete and continuous models.
3. Apply Bühlmann and Bühlmann-Straub models and understand the relationship of these to the Bayesian model.
4. Apply conjugate priors in Bayesian analysis and in particular the Poisson-gamma model.
5. Apply empirical Bayesian methods in the nonparametric and semiparametric cases.

I. Simulation

LEARNING OBJECTIVES

1. Simulate both discrete and continuous random variables using the inversion method.
2. Estimate the number of simulations needed to obtain an estimate with a given error and a given degree of confidence.
3. Use simulation to determine the p-value for a hypothesis test.
4. Use the bootstrap method to estimate the mean squared error of an estimator.
5. Apply simulation methods within the context of actuarial models.



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SYLLABUS OF BASIC EDUCATION
SPRING 2018
Construction and Evaluation of
Actuarial Models – Exam 4

Options for Obtaining Exam 4 Credit

The CAS will grant credit for Exam 4 to those who have successfully completed one of the following examinations:

Organization	Examination
Actuarial Society of South Africa	A202, Models, and A204, Statistical Methods
Actuaries Institute (Australia)	CT4, Models, and CT6, Statistical Methods
Canadian Institute of Actuaries	University Accreditation Program credit for Construction and Evaluation of Actuarial Models ¹
China Association of Actuaries	See note below ²
Institute of Actuaries of India	CT4, Models, and CT6, Statistical Methods
Institute and Faculty of Actuaries (U.K.)	CT4, Models, and CT6, Statistical Methods
Society of Actuaries	C, Construction and Evaluation of Actuarial Models Exam

1. For credit granted through the CIA's University Accreditation Program, the list of candidates granted waivers by the CIA is provided to the CAS following the end of a semester. The CAS automatically updates its records. No further action is required of candidates.

2. The CAS will grant exam waivers based on exams administered by the China Association of Actuaries **as a cohort** for CAS Exams 1, 2, 3F, and 4 (prior to July 1, 2018) and Validation by Educational Experience requirements -- Corporate Finance (Accounting and Finance subsequent to July 1, 2018) and Economics. See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation.

To obtain credit otherwise, candidates should follow the procedures outlined on the [Waivers of Examination](#) page of the CAS website.



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SYLLABUS OF BASIC EDUCATION
2018

Basic Techniques for Ratemaking and
Estimating Claim Liabilities – Exam 5

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings. In the Spring of 2018, Exam 5 is administered as a technology-based examination. **In the Fall of 2018, Exam 5 is administered in a pencil/paper format.**

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.

Materials for Study, 2018 Exam 5 (revised 08/14/2018)

Exam 5-1

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A. Basic Techniques for Ratemaking

Range of weight for Section A: 45-55 percent

This section introduces the general principles of ratemaking as well as specific details regarding data requirements, calculations, key assumptions, and implementation-related issues. Candidates require a thorough understanding of basic ratemaking so that they will be able to analyze data, select appropriate techniques, and develop solutions to problems. This section addresses the advantages and disadvantages of the various ratemaking techniques as they are applied to specific situations and different lines of business. Classification of insureds for the purpose of risk stratification and other important ratemaking topics, such as coinsurance and catastrophe provisions, are also examined in this section.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe, analyze, or design the information requirements for ratemaking related to exposures and demonstrate the use of exposures in ratemaking.</p> <p>Range of weight: 2-6 percent</p>	<p>a. Definition of exposure base</p> <p>b. Characteristics of exposure bases</p> <p>c. Selection of exposure base</p> <p>d. Organization of data: calendar year, policy year, accident year</p> <p>e. Written exposure versus earned exposure versus in-force exposure</p> <p>f. Role of exposures in the ratemaking process</p> <p>g. Influence of changes in exposures</p>
READINGS	
<ul style="list-style-type: none">Werner & Modlin, Chapters 1, 3-4	



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SYLLABUS OF BASIC EDUCATION
2018

Basic Techniques for Ratemaking and
Estimating Claim Liabilities – Exam 5

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Describe, analyze, or design the information requirements for ratemaking related to premiums and demonstrate the use of premiums in ratemaking.</p> <p>Range of weight: 5-9 percent</p>	<ul style="list-style-type: none">a. Organization of data: calendar year, policy year, accident yearb. Written premium versus earned premium versus in-force premiumc. Relationship between earned premium and earned exposured. Policy termse. Effect of law changesf. Effect of rate changesg. Determinations of and application of premium trendh. Adjustment for coverage and benefit level changesi. Distributional shiftsj. Parallelogram methodk. Extension of exposures
READINGS	
<ul style="list-style-type: none">• ASOP 13• Werner & Modlin, Chapters 1, 3, 5, and Appendices A-D	



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SYLLABUS OF BASIC EDUCATION
2018

Basic Techniques for Ratemaking and
Estimating Claim Liabilities – Exam 5

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Describe, analyze, or design the information requirements for ratemaking related to loss and loss adjustment expenses and demonstrate the use of loss and loss adjustment expenses in ratemaking.</p> <p>Range of weight: 8-14 percent</p>	<ul style="list-style-type: none"> a. Organization of the data: calendar year, policy year, accident year, report year b. Policy provisions c. Occurrence coverage d. Claims-made coverage: <ul style="list-style-type: none"> • Report lag • Coverage triggers • Principles of claims-made policies • Retroactive date • Tail coverage e. Reported losses versus paid losses f. Claim counts g. Loss adjustment expense (allocated and unallocated expenses) h. Loss development i. Frequency trend j. Severity trend k. Pure premium trend l. Approaches to determining trend (e.g., exponential and linear analyses) m. Relationship between trend and loss development n. Effect of law changes o. Effect of changes in mix of business p. Adjustment for coverage and benefit level changes q. Credibility criteria and formulae r. Large loss adjustment s. Reinsurance recoveries t. Reinsurance costs u. Catastrophe adjustment
<p>READINGS</p>	
<ul style="list-style-type: none"> • ASOP 13 • Werner & Modlin, Chapters 1, 3, 6, 12, 16, and Appendices A-D 	



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SYLLABUS OF BASIC EDUCATION
2018

Basic Techniques for Ratemaking and
Estimating Claim Liabilities – Exam 5

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Calculate the underwriting expense provisions underlying the overall rate level indication.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Expense categories (e.g., commission, general, other acquisition, taxes, licenses, and fees)</p> <p>b. Sources of data and selection criteria</p> <p>c. Profit and contingency provisions</p> <p>d. Net cost of reinsurance</p> <p>e. Cost of capital</p> <p>f. Fixed expenses and variable expenses</p> <p>g. Differences in procedures for loss adjustment expenses versus underwriting expenses</p> <p>h. Permissible loss ratio</p>
<p>READINGS</p>	
<ul style="list-style-type: none"> • Werner & Modlin, Chapters 1, 7, and Appendices A-D 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>5. Calculate the overall rate level indication using the pure premium and loss ratio methods and argue the merits of each.</p> <p>Range of weight: 3-6 percent</p>	<p>a. Statement of Principles, CAS</p> <p>b. Assumptions of each method</p> <p>c. Mechanics associated with each method (including organization of the data)</p> <p>d. When each method works and when it does not</p>
<p>READINGS</p>	
<ul style="list-style-type: none"> • CAS Ratemaking Principles • Werner & Modlin, Chapters 1, 8, and Appendices A-D 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>6. Describe, analyze, and validate the considerations beyond the calculated cost-based estimate of the rate when selecting a final rate change to implement.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Calculated cost-based rate</p> <p>b. Regulatory constraints</p> <p>c. Operational constraints</p> <p>d. Marketing constraints:</p> <ul style="list-style-type: none"> • Competitive comparisons • Close ratios • Retention ratios • Growth • Distributional analysis • Policyholder dislocation analysis <p>e. Lifetime value analysis</p> <p>f. Optimized pricing</p> <p>g. Underwriting cycles</p>
READINGS	
<ul style="list-style-type: none"> • Werner & Modlin, Chapter 13 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>7. Explain the purpose for segregating data into homogeneous groups and summarize the considerations for determining such groups.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Risk Classification Standard of Practice</p> <p>b. Criteria for selection of classification grouping</p> <p>c. Credibility</p> <p>d. Adverse Selection</p> <p>e. Practicality</p>
READINGS	
<ul style="list-style-type: none"> • ASOP 12 • Werner & Modlin, Chapter 9 	



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SYLLABUS OF BASIC EDUCATION
2018

Basic Techniques for Ratemaking and
Estimating Claim Liabilities – Exam 5

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>8. Develop rating differentials for classification and territory and relativities for deductibles and increased limits.</p> <p>Range of weight: 10-14 percent</p>	<p>a. Formulae and process for each rating differential or relativity</p> <p>b. Credibility and complements of credibility</p> <p>c. Off balance</p> <p>d. Capping of change</p> <p>e. Loss elimination</p> <p>f. Basic limits versus total limits</p> <p>g. Layers of loss</p> <p>h. Expense adjustments</p> <p>i. Fundamentals of univariate and multivariate relativity analyses</p>
READINGS	
<ul style="list-style-type: none">Werner & Modlin, Chapters 9-12, 15 and Appendices E-F	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>9. Assess the considerations for implementing rates to achieve an organization's goals.</p> <p>Range of weight: 0-3 percent</p>	<p>a. Rating algorithms</p> <p>b. Rating variables and differentials</p> <p>c. Fixed expenses, if applicable</p> <p>d. Expense fee calculation</p> <p>e. Calculation of final base rates</p> <p>f. Minimum premiums</p> <p>g. Non-pricing solutions</p>
READINGS	
<ul style="list-style-type: none">Werner & Modlin, Chapter 14	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
10. Calculate premium for policies with coinsurance provisions. Range of weight: 0-5 percent	a. Definition of coinsurance b. Insurance to value c. Common policy provisions d. Layers of loss e. Coverage issues f. Guaranteed replacement cost g. Formulae for coinsurance
READINGS	
<ul style="list-style-type: none">• Werner & Modlin, Chapter 11	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
11. Perform basic individual risk rating calculations. Range of weight: 0-5 percent	a. Purpose of individual risk rating b. Schedule rating c. Manual rating d. Retrospective rating e. Experience modification f. Composite loss-rated risks g. Experience period h. Credibility i. Layers of loss
READINGS	
<ul style="list-style-type: none">• Werner & Modlin, Chapter 15	



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B. Estimating Claim Liabilities

Range of weight for Section B: 45-55 percent

This section explores basic techniques that actuaries use to estimate unpaid claims for both insurance entities and also for non-insurance entities that retain risk. The CAS Principles and the American Academy of Actuaries' Standards of Practice related to the estimation of unpaid claims are also examined in this section.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe, analyze, and validate the information requirements for estimating unpaid claims.</p> <p>Range of weight: 2-6 percent</p>	<p>a. Types of data and their sources</p> <p>b. Role of homogeneity and credibility of data in the process of estimating unpaid claims</p> <p>c. Fundamentals of different types of insurance (e.g., long tail versus short tail lines of business, low frequency versus high frequency lines)</p> <p>d. Organization of data: calendar year, accident year, policy year, underwriting year, report year</p> <p>e. Insurer's environment</p> <p>f. Importance of accurate estimates of unpaid claims</p>
READINGS	
<ul style="list-style-type: none"> • Friedland, Chapters 1, 3, and 4 • CAS Unpaid Claims Principles • ASOP 43 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Build and analyze claim development triangles.</p> <p>Range of weight: 2-6 percent</p>	<p>a. Purposes of the development triangle</p> <p>b. Development triangle as a diagnostic tool</p> <p>c. Examples and uses of diagnostic development triangles:</p> <ul style="list-style-type: none"> • Claim and claim count • Ratio of premium to claims • Average values triangles • Ratios of claims and counts
READINGS	
<ul style="list-style-type: none"> • Friedland, Chapters 5-6 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Construct and appraise unpaid claims estimates using each of the following estimation techniques:</p> <ul style="list-style-type: none"> • Development technique, including case outstanding technique • Expected claim technique • Bornhuetter-Ferguson technique • Cape Cod technique • Frequency-Severity techniques • Benktander technique <p>Range of weight: 14-20 percent</p>	<ul style="list-style-type: none"> a. Standards of Practice, ASOP 43 b. Statement of Principles, CAS c. The claim process d. Assumptions of each estimation technique e. Mechanics associated with each technique (including organization of the data) f. Reporting and payment patterns g. When each techniques works and when it does not h. Key terms: case outstanding, paid claims, reported claims, incurred but not reported, ultimate claims, claims related expenses, reported and closed claim counts, claim counts closed with no payment, insurance recoverables, exposures, experience period, maturity or age, and components of unpaid claim estimates
<p>READINGS</p>	
<ul style="list-style-type: none"> • Friedland, Chapters 1-12, and 15 • CAS Unpaid Claims Principles • ASOP 43 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Assess the influence of operating changes on the estimation of unpaid claims.</p> <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none"> a. How internal operating changes affect estimates of unpaid claims: <ul style="list-style-type: none"> • Claims processing • Underwriting and policy provisions • Marketing • Coding of claim counts and/or claim related expenses • Treatment of recoveries such as policyholder deductibles and salvage and subrogation • Reinsurance
<p>READINGS</p>	
<ul style="list-style-type: none"> • Friedland, Part 3 (Chapters 6-15) 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>5. Adjust data and/or estimation techniques for changes in the:</p> <ul style="list-style-type: none">• Internal environment (e.g., claims processes that result in shift in the adequacy of case outstanding or shift in settlement rates, change in mix of business, change in rate level)• External environment (e.g., inflationary or legal environment) <p>Range of weight: 5-9 percent</p>	<ul style="list-style-type: none">a. Effect on estimation techniques due to change in: rate levels, claim ratio, mix of businessb. Use of trend factors and tort reform factors in estimation techniquesc. Identification of changes in case outstanding adequacyd. Adjustment for changes in case outstanding adequacye. Identification of changes in rate of claims settlementf. Adjustment for changes in rate of claims settlementg. Berquist-Sherman techniquesh. Adjustment for large losses
READINGS	
<ul style="list-style-type: none">• Friedland, Chapters 7-14	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>6. Estimate recoveries.</p> <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none">a. Salvage and subrogationb. Reinsurancec. Key assumptions of estimation techniques
READINGS	
<ul style="list-style-type: none">• Friedland, Chapter 14	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
7. Estimate unpaid claim adjustment expenses. Range of weight: 2-7 percent	a. Organization of the data b. Estimation of unpaid ALAE c. Estimation of unpaid ULAE d. Key assumptions of estimation techniques e. Strengths and weaknesses of the estimation techniques for claim related expenses
READINGS	
• Friedland, Chapters 1, 3, 16, and 17	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
8. Appraise and validate the results of the estimation process for adequacy and reasonableness. Range of weight: 4-8 percent	a. Components of evaluation: <ul style="list-style-type: none">• Multiple methods• Explanation of differences• Test statistics (e.g., claim ratios, severities, pure premiums, frequencies, indicated unpaid claims) b. Monitoring and interim valuations
READINGS	
• Friedland, Chapter 15	



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Complete Text References for Exam 5

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 12, Risk Classification (for all Practice Areas)," revised in 2005, updated for deviation language in 2011.	ASOP 12	A7	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 13, Trending Procedures in Property/Casualty Insurance," revised in 2009, updated for deviation language in 2011.	ASOP 13	A2, A3	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 43, Property/Casualty Unpaid Claim Estimates," adopted in 2007, updated for deviation language in 2011.	ASOP 43	B1, B3	OP
Friedland, J.F., <i>Estimating Unpaid Claims Using Basic Techniques</i> , Casualty Actuarial Society, Third Version, July 2010. The Appendices are excluded.	Friedland	B1-B8	OP
<i>Statement of Principles Regarding Property and Casualty Insurance Ratemaking</i> , Casualty Actuarial Society, May 1988.	CAS Ratemaking Principles	A5	OP
<i>Statement of Principles Regarding Property and Casualty Unpaid Claims Estimates</i> , Casualty Actuarial Society, adopted November 2014, released May 2015.	CAS Unpaid Claims Principles	B1, B3	OP
Werner, G, and Modlin, C., <i>Basic Ratemaking</i> , Casualty Actuarial Society, Fifth Edition, May 2016. The Appendices are an integral part of the textbook and will be used for creating questions. Chapter 2 is excluded.	Werner & Modlin	A1-A11	OP



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Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the 2018 Study Kit.
SKU	Material included in both the 2018 CAS Study Kit and the 2018 Update to the 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexmadriver.com ; website: www.actexmadriver.com .

Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
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Actuarial Standards Board, American Academy of Actuaries, 475 N. Martingale Road, Suite 600, Schaumburg, IL 60173; telephone: (847) 706-3513; fax: (847) 706-3599; website: www.actuarialstandardsboard.org .
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Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .



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The Actuarial Institute of Chinese Taipei (AICT) uses the Casualty Actuarial Society examinations for its property-casualty actuaries. The CAS Board of Directors approved specific AICT exams (i.e., current AICT Exam 6GA3 on Actuarial Standard of Practice and Accounting and Exam 6GB3 on Insurance Regulations and Discipline) as fulfilling the nation-specific requirement for CAS membership effective January 1, 2010.

In the 2011 transition to a revised basic education structure, learning objectives from the 2010 nation-specific exams were mapped to both the new Exam 6 on Regulation and Financial Reporting and new Online Course 2 on Insurance Accounting, Coverage Analysis, Insurance Law, and Insurance Regulation. Because the AICT continues to cover material from both new Exam 6 and new Online Course 2, candidates who have passed both AICT Exams 6GA3 and 6GB3 will be granted credit for both CAS Exam 6-Taipei and Online Course 2.

For details on the administration of the AICT examinations, please contact:

Actuarial Institute of Chinese Taipei
6F, No.420, Sec. 1
Keelung Road, XingYi District
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Telephone: (02) 2758-0265
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E-mail: airc.org@gmail.com

Website in Chinese:

- Exam information: www.airc.org.tw/exam/202
- Past exam lineage: www.airc.org.tw/exam/download

Website in English:

- Exam information: en.airc.org.tw
- Past exam lineage: en.airc.org.tw/exam/download

Applying for CAS Exam Credit

If a candidate has passed both parts of the AICT nation-specific exam (current AICT Exams 6GA3 and 6GB3) after January 1, 2010, then the candidate may apply for exam credit with the CAS. To receive credit for CAS Exam 6-Taipei and Online Course 2, the candidate should submit a written request to the Actuaries' Resource Center (arc@casact.org). The request must include the candidate's full legal name, contact information (including mailing address and telephone number), date of birth, and the administration (month/year of exam) that each of the AICT nation-specific exam parts was passed. The Actuaries' Resource Center will verify the exam information with the AICT and then update the candidate's record to reflect the credit as appropriate.



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The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the Spring 2018 Exam 6-Canada Study Kit that may be purchased from the CAS Online Store. The Spring 2018 Update to the Fall 2017 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Materials for Study, Spring 2018 Exam 6-C

Exam 6C-1

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Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.

The inherent nature of the material addressed in this nation-specific exam makes it subject to continual development and change. It is expected that the candidates will respond to exam questions based on the current syllabus presented below. Recognizing the changing nature of law, regulation, and financial reporting requirements, however, the CAS Syllabus & Examination Committee will strive to acknowledge candidates who also respond with the current state in their solutions to examination questions.

In addition, this exam assumes that the candidate has completed Online Course 2. Online Course 2 contains fundamental background material for both Section A (Regulation of Insurance and Canadian Insurance Law) and Section C (Financial Reporting and Solvency).



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A. Regulation of Insurance and Canadian Insurance Law

Range of weight for Section A: 15-20 percent

Candidates should understand the role of the insurance business as a supplier of a vital service. Because of the essential and highly technical nature of insurance, a system of regulatory controls has been established requiring insurers to demonstrate that they are providing fair and reliable services in accordance with the statutes and regulations of each jurisdiction.

The material in this section encompasses Canadian and U.S. insurance legislation and regulations including their historical development. Judicial decisions affect insurance regulation and insurance benefits to the extent they interpret the law and thereby modify regulatory behavior. Candidates are presented with a number of Canadian cases that have contributed to the development of legal precedents in the area of insurance.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe the historical development of insurance legislation and regulations, including the division of responsibility between federal and provincial/state regulators.</p> <p>Range of weight: 2-6 percent</p>	<ul style="list-style-type: none">a. British North America Actb. Privy Councilc. Federal and provincial regulation of insuranced. Office of the Superintendent of Financial Institutionse. Foreign and provincial insurance companiesf. Nature of Canadian insurance regulationsg. History of U.S. insurance regulation
READINGS	
<ul style="list-style-type: none">• Baer and Rendall• KPMG PACICC• Mayhall• McDonald• Noonan	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Discuss the current state of insurance regulation in Canada.</p> <p>Range of weight: 5-8 percent</p>	<ul style="list-style-type: none">a. Motor vehicle injury compensation systemsb. Rate regulation in Canada and its effectsc. Legislative/Regulatory requirements with respect to Automobile Insurance in Ontario (mandatory insurance coverages, claims settlement practices, underwriting practices, rates, and risk classification)d. Required and prohibited elements of a rate and risk classification system in Ontario Automobile Insurancee. Situations where a certificate of the actuary is requiredf. Key elements of actuarial analysis required by insurance regulations in Ontario Automobile Insuranceg. Elements of actuarial analysis that an actuary must certify (certificate of the actuary)h. Use of credit scoring in ratemaking and underwriting practicesi. Market conductj. Solvency
READINGS	
<ul style="list-style-type: none">• AAA Credit Scores• Alberta• Alberta TNC• CIA CSOP (Ratemaking, Section 2600)• FSCO Coverages• FSCO Private Auto• FSCO Reg. 664• FSCO UBI• IBC Code of Conduct• KPMG et al.• KPMG PACICC• KPMG Regulatory Oversight• OSFI Supervisory Framework	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Discuss the issues, outcome, rationale and implications of landmark decisions for the insurance industry.</p> <p>Range of weight: 5-8 percent</p>	<p>a. Specific landmark court decisions cited in the Readings section</p> <p>b. Canadian cap for non-pecuniary general damages</p> <ul style="list-style-type: none">• Trilogy of Supreme Court of Canada decisions• Limits on damages• Current state of cap• Exceptions to cap
READINGS	
<ul style="list-style-type: none">• Baer and Rendall• BC Credit• Davidson• Landmark Legal• McDonald	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Describe the litigation environment with respect to insurance.</p> <p>Range of weight: 2-6 percent</p>	<p>a. Trends in tort litigation, including tort reform and class action suits</p> <p>b. Mass torts (e.g., asbestos); examples of the impact of latent liability can have on P&C insurance companies</p> <p>c. Types of litigation costs</p> <p>d. Canadian litigation system vs. other systems</p>
READINGS	
<ul style="list-style-type: none">• AAA Mass Torts• ATRA• Harris• KPMG et al.	



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B. Government and Industry Insurance Programs

Range of weight for Section B: 15-20 percent

This section focuses on the identification of major Canadian insurance programs administered by government agencies and insurance industry organizations. The candidates are expected to have an understanding of the objectives, operations, and effectiveness of the following insurance programs:

- Agricultural Insurance
- Employment insurance
- Flood insurance
- Guaranty funds including the Canadian Property and Casualty Insurance Compensation Corporation ("PACICC")
- Health care insurance
- Residual personal insurance markets, e.g., auto, property
- Terrorism Risk Insurance
- Workers compensation insurance

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe the origin and purpose of specific government and insurance industry programs. Range of weight: 5-7 percent	a. Reason for inception b. Major historical developments c. Philosophy of program
2. Describe the operations and risk transfer process for each government and insurance industry program listed in the introduction to Section B and their interactions with the voluntary private insurance sector. Range of weight: 5-7 percent	a. Funding mechanisms and sources of funding b. Allocation/assignment of exposures and associated costs c. Automobile residual market participation ratios d. Eligibility provisions e. Claim settlement and insurance coverage provisions f. Welfare (subsidization) versus insurance principles g. Private response to gap in government program h. Government response to gap in private program



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<p>3. Evaluate the effectiveness of a government and insurance industry program (actual, as listed in the introduction to Section B, or hypothetical).</p> <p>Range of weight: 5-7 percent</p>	<p>a. How to measure performance of programs:</p> <ul style="list-style-type: none">• Solvency• Efficiencies• Stability• Viability and long term prospects <p>b. How well program meets its purpose</p> <p>c. Effect of external factors (e.g., economic conditions, weather, regulation, etc.)</p>
<p>READINGS</p>	
<ul style="list-style-type: none">• Agricultural Programs• Dibra and Leadbetter• Dutil• Government Insurers Study Note• IBC Flood• KPMG et al.• Morneau Shepell• PACICC• Webel 1• Webel 2	



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C. Financial Reporting and Solvency

Range of weight for Section C: 55-60 percent

This section addresses financial reporting and solvency issues. The intent is to address Canadian and global issues related to the reporting of financial results for property and casualty insurers. The core of the syllabus focuses on Canadian issues with an overview of relevant differences in other countries.

Candidates should have detailed knowledge of the contents, purposes, and recent changes in the Canadian Annual Return, including recent guidelines issued by the Office of the Superintendent of Financial Institutions (OSFI) and the provincial regulatory authorities. Specifically, candidates are expected to be knowledgeable of the sections of the Canadian Annual Return related to financial statements (such as the balance sheet and income statement), capital statements, insurance, and reinsurance.

This section is complemented by readings on solvency monitoring systems such as the Minimum Capital Test (MCT), Dynamic Capital Adequacy Testing (DCAT), and ORSA.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe the elements and prepare the schedules of the Canadian Annual Return.</p> <p>Range of weight: 25-30 percent</p>	<p>a. Financial statements prepared in accordance with IFRS</p> <ul style="list-style-type: none"> • Financial position • Net income • Comprehensive Income • Changes in equity • OSFI annual return • Notes to financial statements <p>b. Valuation of policy liabilities in accordance with accepted actuarial practice in Canada</p> <ul style="list-style-type: none"> • Claim Liabilities • Premium Liabilities <p>c. Reinsurance accounting issues</p> <ul style="list-style-type: none"> • Risk transfer • Effect of different types of reinsurance on financial statements. • Commutation <p>d. Calculation of excess (deficiency) ratio of net claim liabilities</p> <p>e. Calculation of Earthquake Reserves</p>



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READINGS

- Blanchard and Klann
- CCIR Instructions
- CAS Financial Reporting
- CIA Accounting Standards
- CIA CSOP
- CIA Disclosure
- CIA Discounting
- CIA Duration
- CIA Materiality
- CIA MfAD
- CIA Premium Liabilities
- CIA Reinsurance Treatment
- CIA Runoff
- CIA Subsequent Events
- CIA Taxes
- CIA Valuation
- Freihaut and Vendetti
- OSFI Annual Return I
- OSFI Annual Return II
- OSFI Earthquake
- OSFI Memorandum



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Evaluate the financial health of an insurance entity based on various solvency frameworks.</p> <p>Range of weight: 25-30 percent</p>	<p>a. MCT</p> <p>b. DCAT</p> <p>c. Stress testing</p> <p>d. Internal target capital ratios</p> <p>e. MSA ratios</p> <p>f. Key financial measures used by rating agencies</p> <p>g. Rules-based and principles-based solvency regulation (ORSA, MCT and Solvency II)</p> <p>h. A.M. Best rating system</p>
READINGS	
<ul style="list-style-type: none">• AM Best Understanding BCAR• AM Best Catastrophe• CIA CSOP• CIA DCAT• CIA Valuation• Feldblum• ICP 17• MSA• OSFI Annual Return I• OSFI Annual Return II• OSFI Corporate Governance• OSFI MCT• OSFI Stress Testing• OSFI Target Capital• OSFI ORSA	



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D. Professional Responsibilities of the Actuary in Financial Reporting

Range of weight for Section D: 10-15 percent

This section focuses on the professional responsibilities of the appointed actuary related to the reporting of financial results by property and casualty insurers in Canada. The candidate will be required to understand the various statutory requirements of the appointed actuary under the Insurance Companies Act and the provincial insurance acts related to financial reporting and general corporate governance.

The material in this section encompasses sections of federal and provincial insurance laws and regulations, regulatory guidelines, and professional standards of practice and educational notes issued by the Canadian Institute of Actuaries that are related to the financial reporting of general insurers.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Explain the responsibilities of an actuary as defined by standards of practice, regulators, and insurance laws for financial reporting. Range of weight: 10-15 percent	a. Statutory Actuarial Opinion b. Contents of Statutory Reports of the Actuary c. Standards of Practice d. Educational Notes e. Insurance Companies Act f. Actuary and auditor relationship g. Regulatory requirements
READINGS	
<ul style="list-style-type: none"> • CIA Accounting Standards • CIA CSOP • CIA DCAT • CIA Disclosure • CIA Discounting • CIA Duration • CIA Materiality • CIA MfAD • CIA Runoff • CIA Subsequent Events • CIA Taxes • CIA Valuation • ICA • KPMG PACICC • OSFI AA • OSFI Earthquake • OSFI Memorandum 	



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Complete Text References for Exam 6-Canada

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Alberta Treasury Board and Finance, "Alberta Standard Automobile Insurance Policy Form – Transportation Network S.P.F. No. 9," June 28, 2016, pp. 1-4.	Alberta TNC	A2	OP
A.M. Best Company, Inc., <i>A.M. Best Methodology</i> , "Understanding BCAR For Canadian Property/Casualty Insurers," June 24, 2016.	AM Best Understanding BCAR	C2	OP
A.M. Best Company, Inc., <i>A.M. Best Methodology</i> , "Catastrophe Analysis in A.M. Best Ratings," November 3, 2011.	AM Best Catastrophe	C2	OP
American Academy of Actuaries Mass Torts Subcommittee, "Overview of Asbestos Claims Issues and Trends," Mass Torts Subcommittee monograph, August 2007, pages 1-11. Candidates will not be responsible for material in the exhibits.	AAA Mass Torts	A4	OP
American Academy of Actuaries, "NAIC Public Hearing on Credit-Based Insurance Scores," April 30, 2009.	AAA Credit Scores	A2	OP
"ATRA Tort Reform Record," CAS Study Note, December 19, 2012.	ATRA	A4	SK
"Auto Insurance Grid Rate Calculator," Alberta Automobile Insurance Rate Board. Candidates are only responsible for the information displayed under the sections titles "Background" and "Grid Premium for Basic Coverage."	Alberta	A2	OP
Baer, M.G. and Rendall, J.A., <i>Cases on the Canadian Law of Insurance</i> , Sixth Edition, Carswell, 2000, pp. 67-91, 93-100, 302-304, 518-529, 821-827, and 829-831. Candidates are responsible for the following cases: <i>Glenn v. Scottish Union and National Insurance Company Ltd.</i> (Chapter 1); <i>Regal Films Corporation Ltd. v. Glens Falls Insurance Company</i> (Chapter 2); <i>Fletcher v. MPIC</i> (Chapter 8); <i>Broadhurst and Ball v. American Home</i> ; and <i>Dillon v. Guardian Insurance</i> (Chapter 11).	Baer and Rendall	A1, A3	SK
Blanchard, R.S. and Klann, J., "Basic Reinsurance Accounting—Selected Topics," CAS Study Note, October 2012.	Blanchard and Klann	C1	OP



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Spring 2018

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Citation	Abbreviation	Learning Objective	Source
Canadian Council of Insurance Regulators, <i>Annual Statement Instructions P&C-1, 2017</i> , Sections I, III, IV, V, and VI. Candidates will be responsible for detailed instructions for the pages listed in OSFI Annual Return I and OSFI Annual Return II. NOTE: Please use the 2017 edition that has been archived on the CAS Web Site with permission for educational purposes.	CCIR Instructions	C1	OP
Canadian Institute of Actuaries, <i>Consolidated Standards of Practice, 1620, 1630, 2200, 2400, 2500, and 2600</i> , January 2018.	CIA CSOP	A2, C1, C2, D1	OP
Canadian Institute of Actuaries, "Educational Note: Consideration of Future Income Taxes in the Valuation of Policy Liabilities," July 2005.	CIA Taxes	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Discounting and Cash Flow Considerations for P&C Insurers," May 2016. Candidates are responsible for the Excel illustrations attached to the Educational Note.	CIA Discounting	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Duration Considerations for P&C Insurers," March 2017. Candidates are responsible for the Excel illustrations attached to the Educational Note.	CIA Duration	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Dynamic Capital Adequacy Testing," November 2013. Candidates are not responsible for details related to life insurance companies.	CIA DCAT	C2, D1	OP
Canadian Institute of Actuaries, "Educational Note: Evaluation of the Runoff of P&C Claim Liabilities when the Liabilities are Discounted in Accordance with Accepted Actuarial Practice," June 2011.	CIA Runoff	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Guidance to the Appointed Actuary for Property and Casualty Insurers," August 2016.	CIA Valuation	C1, C2, D1	OP
Canadian Institute of Actuaries, "Educational Note: Implications of CICA Accounting Standards 3855 and 1530," January 2007.	CIA Accounting Standards	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Margins for Adverse Deviations for Property-Casualty Insurance," December 2009.	CIA MfAD	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Premium Liabilities," July 2016. Candidates are responsible for the Excel illustrations attached to the Educational Note.	CIA Premium Liabilities	C1	OP



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Exam 6 – Canada

Citation	Abbreviation	Learning Objective	Source
Canadian Institute of Actuaries, "Educational Note: Subsequent Events," October 2015.	CIA Subsequent Events	C1, D1	OP
Canadian Institute of Actuaries, "Report: Materiality," October 2007. Candidates are not responsible for material in the Appendix.	CIA Materiality	C1, D1	OP
Canadian Institute of Actuaries, "Report of the CIA Task Force on the Appropriate Treatment of Reinsurance," October 2007. Candidates will be responsible for the following sections: Key Principles of Risk Transfer (pp. 11-12), Qualitative Assessment (pp. 13), Limitations of Risk Transfer (pp. 15-18) and Other Issues (pp. 18-23).	CIA Reinsurance Treatment	C1	OP
Canadian Institute of Actuaries, "Research Paper: Disclosure Requirements IFRS 4–Insurance Contracts for P&C Insurers," October 2010.	CIA Disclosure	C1, D1	OP
Canadian Underwriter, "B.C. judge quashes order requiring insurer to review all credit score consent forms obtained since 2004," May 2013.	BC Credit	A3	OP
Chevalier, Sarah, "Agricultural Risk Management Programs in Canada," October 2014. Note that the table on page 6 is for reference only.	Agricultural Programs	B1-B3	SK
Davidson, J., "The Cap on Non Pecuniary General Damages: Where is it Going and How Does it Affect Litigation?"	Davidson	A3	OP
Dibra, S. and Leadbetter, D., "Why insurers fail: The dynamics of property and casualty insurance insolvency in Canada," Property and Casualty Insurance Compensation Corporation, 2007, excluding pp. 9-13, 33-40.	Dibra and Leadbetter	B1-B3	OP
Dutil, R., "Facility Association," CAS Study Note, May 2008.	Dutil	B1-B3	OP
Feldblum, S., "Rating Agencies," CAS Study Note, October 3, 2011, pp. 1-7 and 14-19, including Appendix A. Candidates are not responsible for Section 4, Appendices B-D, and the endnotes.	Feldblum	C2	OP
Financial Services Commission of Ontario, "Private Passenger Automobile Filing Guidelines–Major," October 2016, pp. 1-5 (excluding filing format), 11-21 (starting from Section 3), and Appendix B2.	FSCO Private Auto	A2	OP
Financial Services Commission of Ontario, "Regulation 664 of the Revised Regulations of Ontario 1990 Automobile Insurance made under the Ontario Insurance Act," amended version as of 26 th August 2015.	FSCO Reg. 664	A2	OP



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Citation	Abbreviation	Learning Objective	Source
Financial Services Commission of Ontario, "Usage-Based Automobile Insurance Pricing in Ontario," Bulletin A-05/13, October 2013.	FSCO UBI	A2	OP
Financial Services Commission of Ontario, "What do the coverages mean?," October 2014.	FSCO Coverages	A2	OP
Freihaut, D. and Vendetti, P., "Common Pitfalls and Practical Considerations in Risk Transfer Analysis," Casualty Actuarial Society <i>E-Forum</i> , Spring 2009. Appendices A and B are for information only and will not be directly tested.	Freihaut and Vendetti	C1	OP
Germani, W., et al., "Government Insurers Study Note," CAS Study Note, April 2017, pp. 1-5, excluding Crop Insurance.	Government Insurers Study Note	B1-B3	OP
Harris, C., "Tort Reform Tension," Canadian Underwriter.ca, August 2005.	Harris	A4	OP
Insurance Bureau of Canada, "Code of Conduct for Insurers' use of Credit Information (CODE)."	IBC Code of Conduct	A2	OP
Insurance Bureau of Canada, "The financial management of flood risk," 2015.	IBC Flood	B1-B3	OP
"Insurance Companies Act," Chapter 47, Sections 165(1), 165(2), 203, 331(1), 331(2), 331(4), 346, 357-370, 464, 465, 476-478, 517, 581, 625-632, 641, 664, 665, 667(1), 667(2), and 674 (updated to July 1, 2013).	ICA	D1	SK
International Association of Insurance Supervisors, "Insurance Core Principles, Standards, Guidance and Assessment Methodology," November 2015. ICP 17 Capital Adequacy. The candidate is responsible for all standards for capital adequacy (17.1 to 17.18) but not for the related guidance statements.	ICP 17	C2	OP
KPMG, Eckler Partners Ltd. & Exactor Insurance Services, Inc., "Motor Vehicle Insurance in British Columbia – At the Crossroads, Volume II: Options and Choices," Section II excluding Section F.	KPMG et al.	A2, A4, B1-B3	SK
KPMG, "Property and Casualty Insurance Compensation Corporation (PACICC), The P&C Actuary's Role in Solvency Monitoring," excluding pp. 2-3 and excluding Part 7.	KPMG PACICC	A1, A2, D1	OP
KPMG, "Research Report – Best Practices for Actuarial Involvement in the Regulatory Oversight of Property and Casualty Insurance Rates," December 2012, pp. 21-31.	KPMG Regulatory Oversight	A2	SK



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Citation	Abbreviation	Learning Objective	Source
“Landmark Legal Insurance Cases in Canada” which covers the following cases: Whiten v. Pilot Insurance Co.; Somersall v. Friedman; Somersall v. Scottish and York; Sansalone v. Wawanesa Mutual Insurance Co.; Nichols v. American Home Assurance Co.; Amos v. Insurance Corporation of British Columbia; KP Pacific Holdings Ltd. v. Guardian Insurance Co. of Canada; Alie v. Bertrand & Frere Construction Company Limited; British Columbia v. Imperial Tobacco Canada Ltd.; Resurface Corp. v. Hanke; and Morrow v. Zhang (Sections I, II, III, IV, VI (E), VII, VIII, and IX.); PIPEDA Report of Findings #2012-005; Kusnierz v. Economical Mutual Insurance Company; Aviva Canada Inc. v. Pastore.	Landmark Legal	A3	SK
Mayhall, III, Van R. “A Brief Chronicle of Insurance Regulation in the United States, Parts 1 and II.”	Mayhall	A1	OP
McDonald, B.R., <i>Life Insurance Laws of Canada (Common Law Provinces)</i> , Life Underwriters Association of Canada, 1995, pp. A1-1, A2-1 to A2-9, B1-1 to B1-2, B2-1 to B2-3, and B4-1 to B4-3. Candidates are responsible for all cases cited in this text.	McDonald	A1, A3	SK
<i>Morneau Shepell Handbook of Canadian Pension and Benefit Plans</i> , Fifteenth Edition, 2011, CCH Canadian Limited, Chapters 15-17. Candidates will not be responsible for specific values and figures included in the text.	Morneau Shepell	B1-B3	SK
MSA Research, Inc., “MSA Report on Property & Casualty, Canada, 2016,” Section 3, pp. 1-10.	MSA	C2	SKU
Noonan, B., “Protecting the Pledge,” <i>Foundations of Regulation, Best’s Review</i> , October 2005.	Noonan	A1	OP
Odomirok, K.C., et al., <i>Financial Reporting Through the Lens of a Property/Casualty Actuary</i> , Casualty Actuarial Society, 2014, Edition 4, Chapters 1-5, 25, 27, and 28.	CAS Financial Reporting	C1	OP
Office of the Superintendent of Financial Institutions Canada, “Corporate Governance,” January 2013, Section VI and Annex B only.	OSFI Corporate Governance	C2	OP
Office of the Superintendent of Financial Institutions Canada, “Earthquake Exposure Sound Practices Guideline” Guideline B-9, February 2013.	OSFI Earthquake	C1, D1	OP
Office of the Superintendent of Financial Institutions Canada, Guideline E-15, “Appointed Actuary: Legal Requirements, Qualifications, and Peer Review,” September 2012.	OSFI AA	D1	OP



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Citation	Abbreviation	Learning Objective	Source																														
Office of the Superintendent of Financial Institutions Canada Guideline E-18, "Stress Testing," December 2009.	OSFI Stress Testing	C2	OP																														
Office of the Superintendent of Financial Institutions Canada Guideline, "Minimum Capital Test (MCT) for Federally Regulated Property and Casualty Insurance Companies, Effective January 1, 2016." Candidates are not responsible for the following sections: <table border="1"> <tr> <td>1.2.2.</td> <td>2.1.1.1.</td> <td>3</td> <td>4.6.</td> <td>5.1.1.5.</td> <td>6.1.1.</td> </tr> <tr> <td>1.2.3.</td> <td>2.1.2.</td> <td></td> <td></td> <td>5.1.1.6.</td> <td>6.2.1.</td> </tr> <tr> <td></td> <td>2.1.3.</td> <td></td> <td></td> <td>5.2.2.</td> <td>6.2.2.</td> </tr> <tr> <td></td> <td>App. 2-A</td> <td></td> <td></td> <td>5.3.4.1.</td> <td>6.2.3.</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>5.3.4.2.</td> <td>6.3.</td> </tr> </table> <p>Candidates are not responsible for risk factors relating to insurance, market, or credit risk.</p>	1.2.2.	2.1.1.1.	3	4.6.	5.1.1.5.	6.1.1.	1.2.3.	2.1.2.			5.1.1.6.	6.2.1.		2.1.3.			5.2.2.	6.2.2.		App. 2-A			5.3.4.1.	6.2.3.					5.3.4.2.	6.3.	OSFI MCT	C2	OP
1.2.2.	2.1.1.1.	3	4.6.	5.1.1.5.	6.1.1.																												
1.2.3.	2.1.2.			5.1.1.6.	6.2.1.																												
	2.1.3.			5.2.2.	6.2.2.																												
	App. 2-A			5.3.4.1.	6.2.3.																												
				5.3.4.2.	6.3.																												
Office of the Superintendent of Financial Institutions Canada Guideline, "Regulatory Capital and Internal Capital Targets," November 2015.	OSFI Target Capital	C2	OP																														
Office of the Superintendent of Financial Institutions Canada, "Memorandum for the Appointed Actuary's Report on Property and Casualty Insurance Business," 2016.	OSFI Memorandum	C1, D1	OP																														
Office of the Superintendent of Financial Institutions Canada, "Own Risk and Solvency Assessment," November 2015.	OSFI ORSA	C2	OP																														
Office of the Superintendent of Financial Institutions Canada, "Supervisory Framework," December 2010.	OSFI Supervisory Framework	A2	OP																														
Office of the Superintendent of Financial Institutions Canada, Sample Return, 2017 (Q1), Approved by the Canadian Council of Insurance Regulators – P&C-1, pp. 20.10, 20.20, 20.30, 20.42, 20.45, 20.54, 30.61, 30.62, 30.64, 30.66, 30.71, 30.73, 30.75, 30.77, 30.79, 40.07, 60.30, 70.60, 70.61, and 80.10. NOTE: Please use the 2017 edition that has been archived on the CAS Web Site for educational purposes. Candidates may wish to review illustrations of sample Annual Return schedules (please use the link provided on the CAS Web Site). These illustrations are for information only and will not be directly tested.	OSFI Annual Return I	C1, C2	OP																														



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Citation	Abbreviation	Learning Objective	Source
Office of the Superintendent of Financial Institutions Canada, Annual Supplement, 2017, Approved by the Canadian Council of Insurance Regulators – P&C-1, pp. 10.60, 60.40, and 60.41. NOTE: Please use the 2017 edition that has been archived on the CAS Web Site for educational purposes. Candidates may wish to review illustrations of sample Annual Return schedules (please use the link provided on the CAS Web Site). These illustrations are for information only and will not be directly tested.	OSFI Annual Return II	C1, C2	OP
Property and Casualty Insurance Compensation Corporation, "Guide to Compensation Plan for Property and Casualty Insurers," May 2010.	PACICC	B1-B3	OP
Webel, B., "Terrorism Risk Insurance: Issue Analysis and Overview of Current Program," Congressional Research Service, July 23, 2014, pp. 5-11.	Webel 1	B1-B3	OP
Webel, B., "Terrorism Risk Insurance Legislation the 114th Congress: Issue Summary and Side-by-Side Analysis," Congressional Research Service, January 20, 2015, Summary page and pp. 1-3.	Webel 2	B1-B3	OP



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Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the Spring 2018 Study Kit.
SKU	Material included in both the Spring 2018 CAS Study Kit and the Spring 2018 Update to the Fall 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

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ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexmadriver.com ; website: www.actexmadriver.com .
Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
A.M. Best Company, Inc. Ambest Road, Oldwick, New Jersey, 00858 U.S.A; Website: www.ambest.com
American Academy of Actuaries, 1100 Seventeenth Street NW, Seventh Floor, Washington, DC 20036; telephone: (202) 223-8196; website: www.actuary.org .
American Institute for Chartered Property Casualty Underwriters, Order Department, P.O. Box 3016, 720 Providence Road, Malvern, PA 19355-0716; telephone: (610) 644-2100; fax: (610) 640-9576.
Baer, M.G.; and Rendall, J.A., <i>Cases on the Canadian Law of Insurance</i> , Fifth Edition, 1995, Carswell, Attention: Customer and Order Services, One Corporate Plaza, 2075 Kennedy Road, Scarborough, Ontario M1T 3V4, Canada; telephone: (416) 609-3800 or (800) 387-5164; fax: (416) 298-5082; website: www.carswell.com .
Canadian Institute of Actuaries, Secretariat, Suite 820, 360 Albert Street, Ottawa, Ontario K1R 7X7, Canada; telephone: (613) 236-8196; fax: (613) 233-4552; website: www.actuaries.ca .
Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .
Facility Association, 151 Yonge Street, 18th Floor, Toronto, Ontario M5C 2W7, Canada; telephone: (416) 863-1750 or (800) 268-9572; fax: (416) 868-0894.



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Financial Institutions Act, "Insurance Companies Act," Chapter 47, The Federal Publication, 388 King Street West, Toronto, Ontario M5V 1K2, Canada; telephone: (416) 860-1611.

Financial Services Commission of Ontario, 5160 Yonge Street, P.O. Box 85, North York, Ontario M2N 6L9, Canada; telephone: (416) 250-7250; fax: (416) 590-7070; website: www.ontarioinsurance.com.

Insurance Bureau of Canada, 240 Duncan Mill Road, Suite 700, Toronto, Ontario M3B 1Z4, Canada; telephone: (416) 445-5912; fax: (416) 445-2183.

Morneau Shepell Handbook of Canadian Pension and Benefit Plans, Fifteenth Edition, 2011, CCH Canadian Limited, 90 Shepherd East, Suite 300, North York, Ontario M2N 6X1, Canada; telephone: (416) 224-2248; fax: (800) 461-4131.

Office of the Superintendent of Financial Institutions Canada, 255 Albert Street, Ottawa, Ontario K1A 0H2 Canada; telephone: (613) 990-7788; fax: (613) 952-8219; website: www.osfi-bsif.gc.ca.



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The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the Fall 2018 Exam 6-Canada Study Kit that may be purchased from the CAS Online Store. The Fall 2018 Update to the Spring 2018 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.



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Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.

The inherent nature of the material addressed in this nation-specific exam makes it subject to continual development and change. It is expected that the candidates will respond to exam questions based on the current syllabus presented below. Recognizing the changing nature of law, regulation, and financial reporting requirements, however, the CAS Syllabus & Examination Committee will strive to acknowledge candidates who also respond with the current state in their solutions to examination questions.

In addition, this exam assumes that the candidate has completed Online Course 2. Online Course 2 contains fundamental background material for both Section A (Regulation of Insurance and Canadian Insurance Law) and Section C (Financial Reporting and Solvency).



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A. Regulation of Insurance and Canadian Insurance Law

Range of weight for Section A: 15-20 percent

Candidates should understand the role of the insurance business as a supplier of a vital service. Because of the essential and highly technical nature of insurance, a system of regulatory controls has been established requiring insurers to demonstrate that they are providing fair and reliable services in accordance with the statutes and regulations of each jurisdiction.

The material in this section encompasses Canadian and U.S. insurance legislation and regulations including their historical development. Judicial decisions affect insurance regulation and insurance benefits to the extent they interpret the law and thereby modify regulatory behavior. Candidates are presented with a number of Canadian cases that have contributed to the development of legal precedents in the area of insurance.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe the historical development of insurance legislation and regulations, including the division of responsibility between federal and provincial/state regulators.</p> <p>Range of weight: 2-6 percent</p>	<ul style="list-style-type: none">a. British North America Actb. Privy Councilc. Federal and provincial regulation of insuranced. Office of the Superintendent of Financial Institutionse. Foreign and provincial insurance companiesf. Nature of Canadian insurance regulationsg. History of U.S. insurance regulation
READINGS	
<ul style="list-style-type: none">• Baer and Rendall• KPMG PACICC• Mayhall• McDonald	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Discuss the current state of insurance regulation in Canada.</p> <p>Range of weight: 5-8 percent</p>	<ul style="list-style-type: none"> a. Motor vehicle injury compensation systems b. Rate regulation in Canada and its effects c. Legislative/Regulatory requirements with respect to Automobile Insurance in Ontario (mandatory insurance coverages, claims settlement practices, underwriting practices, rates, and risk classification) d. Required and prohibited elements of a rate and risk classification system in Ontario Automobile Insurance e. Situations where a certificate of the actuary is required f. Key elements of actuarial analysis required by insurance regulations in Ontario Automobile Insurance g. Elements of actuarial analysis that an actuary must certify (certificate of the actuary) h. Use of credit scoring in ratemaking and underwriting practices i. Market conduct j. Solvency
<p>READINGS</p>	
<ul style="list-style-type: none"> • AAA Credit Scores • Alberta TNC • CIA CSOP (Ratemaking, Section 2600) • EY • FSCO Coverages • FSCO Private Auto • FSCO Reg. 664 • FSCO UBI • IBC Code of Conduct • KPMG PACICC • KPMG Regulatory Oversight • Marshall • OSFI Supervisory Framework 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Discuss the issues, outcome, rationale and implications of landmark decisions for the insurance industry.</p> <p>Range of weight: 5-8 percent</p>	<p>a. Specific landmark court decisions cited in the Readings section</p>
READINGS	
<ul style="list-style-type: none">• Baer and Rendall• Davidson• Landmark Legal• McDonald	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Describe the litigation environment with respect to insurance.</p> <p>Range of weight: 2-6 percent</p>	<p>b. Trends in tort litigation, including tort reform and class action suits</p> <p>c. Mass torts (e.g., asbestos); examples of the impact of latent liability can have on P&C insurance companies</p> <p>d. Types of litigation costs</p> <p>e. Canadian litigation system vs. other systems</p>
READINGS	
<ul style="list-style-type: none">• ATRA• EY• Harris	



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B. Government and Industry Insurance Programs

Range of weight for Section B: 15-20 percent

This section focuses on the identification of major Canadian insurance programs administered by government agencies and insurance industry organizations. The candidates are expected to have an understanding of the objectives, operations, and effectiveness of the following insurance programs:

- Agricultural Insurance
- Employment insurance
- Flood insurance
- Guaranty funds including the Canadian Property and Casualty Insurance Compensation Corporation (“PACICC”)
- Health care insurance
- Residual personal insurance markets, e.g., auto, property
- Terrorism Risk Insurance
- Workers compensation insurance

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe the origin and purpose of specific government and insurance industry programs. Range of weight: 5-7 percent	a. Reason for inception b. Major historical developments c. Philosophy of program
2. Describe the operations and risk transfer process for each government and insurance industry program listed in the introduction to Section B and their interactions with the voluntary private insurance sector. Range of weight: 5-7 percent	a. Funding mechanisms and sources of funding b. Allocation/assignment of exposures and associated costs c. Automobile residual market participation ratios d. Eligibility provisions e. Claim settlement and insurance coverage provisions f. Welfare (subsidization) versus insurance principles g. Private response to gap in government program h. Government response to gap in private program



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<p>3. Evaluate the effectiveness of a government and insurance industry program (actual, as listed in the introduction to Section B, or hypothetical).</p> <p>Range of weight: 5-7 percent</p>	<p>a. How to measure performance of programs:</p> <ul style="list-style-type: none">• Solvency• Efficiencies• Stability• Viability and long term prospects <p>b. How well program meets its purpose</p> <p>c. Effect of external factors (e.g., economic conditions, weather, regulation, etc.)</p>
<p>READINGS</p>	
<ul style="list-style-type: none">• Agricultural Programs• Dibra and Leadbetter• Dutil• EY• Government Insurers Study Note• IBC Flood• Morneau Shepell• PACICC• Webel 1• Webel 2	



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C. Financial Reporting and Solvency

Range of weight for Section C: 55-60 percent

This section addresses financial reporting and solvency issues. The intent is to address Canadian and global issues related to the reporting of financial results for property and casualty insurers. The core of the syllabus focuses on Canadian issues with an overview of relevant differences in other countries.

Candidates should have detailed knowledge of the contents, purposes, and recent changes in the Canadian Annual Return, including recent guidelines issued by the Office of the Superintendent of Financial Institutions (OSFI) and the provincial regulatory authorities. Specifically, candidates are expected to be knowledgeable of the sections of the Canadian Annual Return related to financial statements (such as the balance sheet and income statement), capital statements, insurance, and reinsurance.

This section is complemented by readings on solvency monitoring systems such as the Minimum Capital Test (MCT), Dynamic Capital Adequacy Testing (DCAT), and ORSA.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe the elements and prepare the schedules of the Canadian Annual Return.</p> <p>Range of weight: 25-30 percent</p>	<p>a. Financial statements prepared in accordance with IFRS</p> <ul style="list-style-type: none"> • Financial position • Net income • Comprehensive Income • Changes in equity • OSFI annual return • Notes to financial statements <p>b. Valuation of policy liabilities in accordance with accepted actuarial practice in Canada</p> <ul style="list-style-type: none"> • Claim Liabilities • Premium Liabilities <p>c. Reinsurance accounting issues</p> <ul style="list-style-type: none"> • Risk transfer • Effect of different types of reinsurance on financial statements. • Commutation <p>d. Calculation of excess (deficiency) ratio of net claim liabilities</p> <p>e. Calculation of Earthquake Reserves</p>



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SYLLABUS OF BASIC EDUCATION

Fall 2018

Regulation and Financial Reporting (Nation Specific)

Exam 6 – Canada

READINGS

- Blanchard and Klann
- CCIR Instructions
- CAS Financial Reporting
- CIA Accounting Standards
- CIA CSOP
- CIA Disclosure
- CIA Discounting
- CIA Duration
- CIA Materiality
- CIA MfAD
- CIA Premium Liabilities
- CIA Reinsurance Treatment
- CIA Runoff
- CIA Subsequent Events
- CIA Taxes
- CIA Valuation
- Freihaut and Vendetti
- OSFI Annual Return I
- OSFI Annual Return II
- OSFI Earthquake
- OSFI Memorandum



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SYLLABUS OF BASIC EDUCATION

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Regulation and Financial Reporting (Nation Specific)

Exam 6 – Canada

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Evaluate the financial health of an insurance entity based on various solvency frameworks.</p> <p>Range of weight: 25-30 percent</p>	<ul style="list-style-type: none">a. MCTb. DCATc. Stress testingd. Internal target capital ratiose. MSA ratiosf. Key financial measures used by rating agenciesg. Rules-based and principles-based solvency regulation (ORSA, MCT, and Solvency II)h. A.M. Best rating system
READINGS	
<ul style="list-style-type: none">• AM Best Understanding BCAR• AM Best Catastrophe• CIA CSOP• CIA DCAT• CIA Valuation• Feldblum• IFOA• MSA• OSFI Annual Return I• OSFI Annual Return II• OSFI Corporate Governance• OSFI MCT• OSFI Stress Testing• OSFI Target Capital• OSFI ORSA	



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D. Professional Responsibilities of the Actuary in Financial Reporting

Range of weight for Section D: 10-15 percent

This section focuses on the professional responsibilities of the appointed actuary related to the reporting of financial results by property and casualty insurers in Canada. The candidate will be required to understand the various statutory requirements of the appointed actuary under the Insurance Companies Act and the provincial insurance acts related to financial reporting and general corporate governance.

The material in this section encompasses sections of federal and provincial insurance laws and regulations, regulatory guidelines, and professional standards of practice and educational notes issued by the Canadian Institute of Actuaries that are related to the financial reporting of general insurers.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Explain the responsibilities of an actuary as defined by standards of practice, regulators, and insurance laws for financial reporting. Range of weight: 10-15 percent	a. Statutory Actuarial Opinion b. Contents of Statutory Reports of the Actuary c. Standards of Practice d. Educational Notes e. Insurance Companies Act f. Actuary and auditor relationship g. Regulatory requirements
READINGS	
<ul style="list-style-type: none"> • CIA Accounting Standards • CIA CSOP • CIA DCAT • CIA Disclosure • CIA Discounting • CIA Duration • CIA Materiality • CIA MfAD • CIA Models • CIA Runoff • CIA Subsequent Events • CIA Taxes • CIA Valuation • ICA • KPMG PACICC • OSFI AA • OSFI Earthquake • OSFI Memorandum 	



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Complete Text References for Exam 6-Canada

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Alberta Treasury Board and Finance, "Alberta Standard Automobile Insurance Policy Form – Transportation Network S.P.F. No. 9," June 28, 2016, pp. 1-4.	Alberta TNC	A2	OP
A.M. Best Company, Inc., <i>A.M. Best Methodology</i> , "Understanding BCAR For Canadian Property/Casualty Insurers," June 24, 2016.	AM Best Understanding BCAR	C2	OP
A.M. Best Company, Inc., <i>A.M. Best Methodology</i> , "Catastrophe Analysis in A.M. Best Ratings," October 13, 2017.	AM Best Catastrophe	C2	OP NEW
American Academy of Actuaries, "NAIC Public Hearing on Credit-Based Insurance Scores," April 30, 2009.	AAA Credit Scores	A2	OP
"ATRA Tort Reform Record," CAS Study Note, December 19, 2012.	ATRA	A4	SK
Baer, M.G. and Rendall, J.A., <i>Cases on the Canadian Law of Insurance</i> , Sixth Edition, Carswell, 2000, pp. 67-91, 93-100, 302-304, 518-529, 821-827, and 829-831. Candidates are responsible for the following cases: <i>Glenn v. Scottish Union and National Insurance Company Ltd.</i> (Chapter 1); <i>Fletcher v. MPIC</i> (Chapter 8); and <i>Dillon v. Guardian Insurance</i> (Chapter 11).	Baer and Rendall	A1, A3	SK
Blanchard, R.S. and Klann, J., "Basic Reinsurance Accounting – Selected Topics," CAS Study Note, October 2012.	Blanchard and Klann	C1	OP
Canadian Council of Insurance Regulators, <i>Annual Statement Instructions P&C-1</i> , 2017, Sections I, III, IV, V, and VI. Candidates will be responsible for detailed instructions for the pages listed in OSFI Annual Return I and OSFI Annual Return II. NOTE: Please use the 2017 edition that has been archived on the CAS Web Site with permission for educational purposes.	CCIR Instructions	C1	OP
Canadian Institute of Actuaries, Consolidated Standards of Practice, 1520, 2200, 2400, 2500, and 2600, February 22, 2018.	CIA CSOP	A2, C1, C2, D1	OP NEW
Canadian Institute of Actuaries, "Educational Note: Consideration of Future Income Taxes in the Valuation of Policy Liabilities," July 2005.	CIA Taxes	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Discounting and Cash Flow Considerations for P&C Insurers," May 2016. Candidates are responsible for the Excel illustrations attached to the Educational Note.	CIA Discounting	C1, D1	OP



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SYLLABUS OF BASIC EDUCATION

Fall 2018

Regulation and Financial Reporting (Nation Specific)

Exam 6 – Canada

Citation	Abbreviation	Learning Objective	Source
Canadian Institute of Actuaries, "Educational Note: Duration Considerations for P&C Insurers," March 2017. Candidates are responsible for the Excel illustrations attached to the Educational Note.	CIA Duration	C1, D1	OP
Canadian Institute of Actuaries, "Second Revision of Educational Note: Dynamic Capital Adequacy Testing," November 2017. Candidates are not responsible for details related to life insurance companies.	CIA DCAT	C2, D1	OP NEW
Canadian Institute of Actuaries, "Educational Note: Evaluation of the Runoff of P&C Claim Liabilities when the Liabilities are Discounted in Accordance with Accepted Actuarial Practice," June 2011.	CIA Runoff	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: 2017 Guidance to the Appointed Actuary for Property and Casualty Insurers," October 2017.	CIA Valuation	C1, C2, D1	OP NEW
Canadian Institute of Actuaries, "Educational Note: Implications of CICA Accounting Standards 3855 and 1530," January 2007.	CIA Accounting Standards	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Margins for Adverse Deviations for Property-Casualty Insurance," December 2009.	CIA MfAD	C1, D1	OP
Canadian Institute of Actuaries, "Educational Note: Premium Liabilities," July 2016. Candidates are responsible for the Excel illustrations attached to the Educational Note.	CIA Premium Liabilities	C1	OP
Canadian Institute of Actuaries, "Educational Note: Subsequent Events," October 2015.	CIA Subsequent Events	C1, D1	OP
Canadian Institute of Actuaries, "Report: Materiality," October 2007. Candidates are not responsible for material in the Appendix.	CIA Materiality	C1, D1	OP
Canadian Institute of Actuaries, "Report of the CIA Task Force on the Appropriate Treatment of Reinsurance," October 2007. Candidates will be responsible for the following sections: Key Principles of Risk Transfer (pp. 11-12), Qualitative Assessment (pp. 13), Limitations of Risk Transfer (pp. 15-18) and Other Issues (pp. 18-23).	CIA Reinsurance Treatment	C1	OP
Canadian Institute of Actuaries, "Research Paper: Disclosure Requirements IFRS 4–Insurance Contracts for P&C Insurers," October 2010.	CIA Disclosure	C1, D1	OP
Canadian Institute of Actuaries, "Use of Models Educational Note," January 2017.	CIA Models	D1	OP NEW



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Regulation and Financial Reporting (Nation Specific)

Exam 6 – Canada

Citation	Abbreviation	Learning Objective	Source
Chevalier, Sarah, "Agricultural Risk Management Programs in Canada," October 2014. Note that the table on page 6 is for reference only.	Agricultural Programs	B1-B3	SK
Davidson, J., "The Cap on Non Pecuniary General Damages: Where is it Going and How Does it Affect Litigation?"	Davidson	A3	OP
Dibra, S. and Leadbetter, D., "Why insurers fail: The dynamics of property and casualty insurance insolvency in Canada," Property and Casualty Insurance Compensation Corporation, 2007, excluding pp. 9-13, 33-40.	Dibra and Leadbetter	B1-B3	OP
Dutil, R., "Facility Association," CAS Study Note, May 2008.	Dutil	B1-B3	OP
EY, "ICBC Affordable and effective auto insurance – A new road forward for British Columbia," July 2017, Sections 1-4.	EY	A2, A4, B1-B3	OP NEW
Feldblum, S., "Rating Agencies," CAS Study Note, October 3, 2011, pp. 1-7 and 14-19, including Appendix A. Candidates are not responsible for Section 4, Appendices B-D, and the endnotes.	Feldblum	C2	OP
Financial Services Commission of Ontario, "Private Passenger Automobile Filing Guidelines–Major," October 2016, pp. 1-5 (excluding filing format), 11-21 (starting from Section 3), and Appendix B2.	FSCO Private Auto	A2	OP
Financial Services Commission of Ontario, "Regulation 664 of the Revised Regulations of Ontario 1990 Automobile Insurance made under the Ontario Insurance Act," amended version as of 4 th July 2016.	FSCO Reg. 664	A2	OP NEW
Financial Services Commission of Ontario, "Usage-Based Automobile Insurance Pricing in Ontario," Bulletin A-05/13, October 2013.	FSCO UBI	A2	OP
Financial Services Commission of Ontario, "What do the coverages mean?," October 2014.	FSCO Coverages	A2	OP
Freihaut, D. and Vendetti, P., "Common Pitfalls and Practical Considerations in Risk Transfer Analysis," Casualty Actuarial Society <i>E-Forum</i> , Spring 2009. Appendices A and B are for information only and will not be directly tested.	Freihaut and Vendetti	C1	OP
Germani, W., et al., "Government Insurers Study Note," CAS Study Note, April 2017, pp. 1-5, excluding Crop Insurance.	Government Insurers Study Note	B1-B3	OP
Harris, C., "Tort Reform Tension," Canadian Underwriter.ca, August 2005.	Harris	A4	OP



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SYLLABUS OF BASIC EDUCATION
Fall 2018

Regulation and Financial Reporting (Nation Specific)
Exam 6 – Canada

Citation	Abbreviation	Learning Objective	Source
Institute & Faculty of Actuaries General Insurance Reserving Oversight Committee's Working Party on Solvency II Technical Provisions, "Solvency II Technical Provisions for General Insurers," Institute and Faculty of Actuaries, August 2013, Sections 6.4 and 6.5.	IFOA	C2	OP NEW
Insurance Bureau of Canada, "Code of Conduct for Insurers' use of Credit Information (CODE)."	IBC Code of Conduct	A2	OP
Insurance Bureau of Canada, "The financial management of flood risk," 2015.	IBC Flood	B1-B3	OP
"Insurance Companies Act," Chapter 47, Sections 165(1), 165(2), 203, 331(1), 331(2), 331(4), 346, 357-370, 464, 465, 476-478, 517, 581, 625-632, 641, 664, 665, 667(1), 667(2), and 674 (updated to 12 th December 2017).	ICA	D1	SKU NEW
KPMG, "Property and Casualty Insurance Compensation Corporation (PACICC), The P&C Actuary's Role in Solvency Monitoring," excluding pp. 2-3, excluding Part 7, and excluding the Appendix.	KPMG PACICC	A1, A2, D1	OP
KPMG, "Research Report – Best Practices for Actuarial Involvement in the Regulatory Oversight of Property and Casualty Insurance Rates," December 2012, pp. 21-31.	KPMG Regulatory Oversight	A2	SK
"Landmark Legal Insurance Cases in Canada" which covers the following cases: <i>Whiten v. Pilot Insurance Co.</i> ; <i>Somersall v. Friedman</i> ; <i>Somersall v. Scottish and York</i> ; <i>Sansalone v. Wawanesa Mutual Insurance Co.</i> ; <i>Nichols v. American Home Assurance Co.</i> ; <i>Amos v. Insurance Corporation of British Columbia</i> ; <i>KP Pacific Holdings Ltd. v. Guardian Insurance Co. of Canada</i> ; <i>Alie v. Bertrand & Frere Construction Company Limited</i> ; <i>Resurface Corp. v. Hanke</i> ; <i>Morrow v. Zhang</i> (Sections I, II, III, IV, VI (E), VII, VIII, and IX.); <i>PIPEDA Report of Findings #2012-005</i> ; <i>Kusnierz v. Economical Mutual Insurance Company</i> ; <i>Aviva Canada Inc. v. Pastore</i> ; <i>Belanger v. Sudbury</i> ; and <i>Precision Plating Ltd. v. Axa Pacific Insurance Co.</i>	Landmark Legal	A3	SKU NEW
Marshall, D., "Fair Benefits Fairly Delivered," April 2017, pp. 8-12.	Marshall	A2	OP NEW
Mayhall, III, Van R. "A Brief Chronicle of Insurance Regulation in the United States, Parts 1 and II."	Mayhall	A1	OP
McDonald, B.R., <i>Life Insurance Laws of Canada (Common Law Provinces)</i> , Life Underwriters Association of Canada, 1995, pp. A1-1, A2-1 to A2-9, B1-1 to B1-2, B2-1 to B2-3, and B4-1 to B4-3. Candidates are responsible for all cases cited in this text.	McDonald	A1, A3	SK



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Citation	Abbreviation	Learning Objective	Source																														
<i>Morneau Shepell Handbook of Canadian Pension and Benefit Plans</i> , 16 th edition, LexisNexis Canada, 2016, Chapters 17-19. Candidates will not be responsible for specific values and figures included in the text.	Morneau Shepell	B1-B3	SKU NEW																														
MSA Research, Inc., "MSA Report on Property & Casualty, Canada, 2017," Section 3, pp. 1-10.	MSA	C2	SKU NEW																														
Odomirok, K.C., et al., <i>Financial Reporting Through the Lens of a Property/ Casualty Actuary</i> , Casualty Actuarial Society, 2014, Edition 4, Chapters 1-5, 25, 27, and 28.	CAS Financial Reporting	C1	OP																														
Office of the Superintendent of Financial Institutions Canada, "Draft Corporate Governance Guideline," November 2017, Section V and Annex B only.	OSFI Corporate Governance	C2	OP NEW																														
Office of the Superintendent of Financial Institutions Canada, "Earthquake Exposure Sound Practices Guideline" Guideline B-9, February 2013.	OSFI Earthquake	C1, D1	OP																														
Office of the Superintendent of Financial Institutions Canada, Guideline E-15, "Appointed Actuary: Legal Requirements, Qualifications, and Peer Review," September 2012.	OSFI AA	D1	OP																														
Office of the Superintendent of Financial Institutions Canada Guideline E-18, "Stress Testing," December 2009.	OSFI Stress Testing	C2	OP																														
Office of the Superintendent of Financial Institutions Canada Guideline, "Minimum Capital Test (MCT) for Federally Regulated Property and Casualty Insurance Companies, Effective January 1, 2018." Candidates are not responsible for the following sections: <table border="1"> <tr> <td>1.2.2.</td> <td>2.1.1.1.</td> <td>3</td> <td>4.6.</td> <td>5.1.1.5.</td> <td>6.1.1.</td> </tr> <tr> <td></td> <td>2.1.2.</td> <td></td> <td></td> <td>5.1.1.6.</td> <td>6.2.1.</td> </tr> <tr> <td></td> <td>2.1.3.</td> <td></td> <td></td> <td>5.2.2.</td> <td>6.2.2.</td> </tr> <tr> <td></td> <td>App. 2-A</td> <td></td> <td></td> <td>5.3.4.1.</td> <td>6.2.3.</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>5.3.4.2.</td> <td>6.3.</td> </tr> </table> Candidates are not responsible for risk factors relating to insurance, market, or credit risk.	1.2.2.	2.1.1.1.	3	4.6.	5.1.1.5.	6.1.1.		2.1.2.			5.1.1.6.	6.2.1.		2.1.3.			5.2.2.	6.2.2.		App. 2-A			5.3.4.1.	6.2.3.					5.3.4.2.	6.3.	OSFI MCT	C2	OP
1.2.2.	2.1.1.1.	3	4.6.	5.1.1.5.	6.1.1.																												
	2.1.2.			5.1.1.6.	6.2.1.																												
	2.1.3.			5.2.2.	6.2.2.																												
	App. 2-A			5.3.4.1.	6.2.3.																												
				5.3.4.2.	6.3.																												
Office of the Superintendent of Financial Institutions Canada Guideline, "Regulatory Capital and Internal Capital Targets," December 2017.	OSFI Target Capital	C2	OP NEW																														
Office of the Superintendent of Financial Institutions Canada, "Memorandum for the Appointed Actuary's Report on Property and Casualty Insurance Business," 2017.	OSFI Memorandum	C1, D1	OP NEW																														
Office of the Superintendent of Financial Institutions Canada, "Own Risk and Solvency Assessment," December 2017.	OSFI ORSA	C2	OP NEW																														



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Citation	Abbreviation	Learning Objective	Source
Office of the Superintendent of Financial Institutions Canada, "Supervisory Framework," December 2010.	OSFI Supervisory Framework	A2	OP
Office of the Superintendent of Financial Institutions Canada, Sample Return, 2018 (Q1), Approved by the Canadian Council of Insurance Regulators – P&C-1, pp. 20.10, 20.20, 20.30, 20.42, 20.45, 20.54, 30.61, 30.62, 30.64, 30.66, 30.71, 30.73, 30.75, 30.77, 30.79, 40.07, 60.30, 70.60, 70.61, and 80.10. NOTE: Please use the 2018 edition that has been archived on the CAS Web Site for educational purposes. Candidates may wish to review illustrations of sample Annual Return schedules (please use the link provided on the CAS Web Site). These illustrations are for information only and will not be directly tested.	OSFI Annual Return I	C1, C2	OP NEW
Office of the Superintendent of Financial Institutions Canada, Annual Supplement, 2018, Approved by the Canadian Council of Insurance Regulators – P&C-1, pp. 10.60, 60.40, and 60.41. NOTE: Please use the 2018 edition that has been archived on the CAS Web Site for educational purposes. Candidates may wish to review illustrations of sample Annual Return schedules (please use the link provided on the CAS Web Site). These illustrations are for information only and will not be directly tested.	OSFI Annual Return II	C1, C2	OP NEW
Property and Casualty Insurance Compensation Corporation, "Guide to Compensation Plan for Property and Casualty Insurers," May 2010.	PACICC	B1-B3	OP
Webel, B., "Terrorism Risk Insurance: Issue Analysis and Overview of Current Program," Congressional Research Service, July 23, 2014, pp. 5-11.	Webel 1	B1-B3	OP
Webel, B., "Terrorism Risk Insurance Legislation the 114th Congress: Issue Summary and Side-by-Side Analysis," Congressional Research Service, January 20, 2015, Summary page and pp. 1-3.	Webel 2	B1-B3	OP



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Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the Fall 2018 Study Kit.
SKU	Material included in both the Fall 2018 CAS Study Kit and the Fall 2018 Update to the Spring 2018 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

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Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
A.M. Best Company, Inc. Ambest Road, Oldwick, New Jersey, 00858 U.S.A; Website: www.ambest.com
American Academy of Actuaries, 1100 Seventeenth Street NW, Seventh Floor, Washington, DC 20036; telephone: (202) 223-8196; website: www.actuary.org .
American Institute for Chartered Property Casualty Underwriters, Order Department, P.O. Box 3016, 720 Providence Road, Malvern, PA 19355-0716; telephone: (610) 644-2100; fax: (610) 640-9576.
Baer, M.G.; and Rendall, J.A., <i>Cases on the Canadian Law of Insurance</i> , Fifth Edition, 1995, Carswell, Attention: Customer and Order Services, One Corporate Plaza, 2075 Kennedy Road, Scarborough, Ontario M1T 3V4, Canada; telephone: (416) 609-3800 or (800) 387-5164; fax: (416) 298-5082; website: www.carswell.com .
Canadian Institute of Actuaries, Secretariat, Suite 820, 360 Albert Street, Ottawa, Ontario K1R 7X7, Canada; telephone: (613) 236-8196; fax: (613) 233-4552; website: www.actuaries.ca .
Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .



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SYLLABUS OF BASIC EDUCATION

Fall 2018

Regulation and Financial Reporting (Nation Specific)

Exam 6 – Canada

Facility Association, 151 Yonge Street, 18th Floor, Toronto, Ontario M5C 2W7, Canada; telephone: (416) 863-1750 or (800) 268-9572; fax: (416) 868-0894.

Financial Institutions Act, "Insurance Companies Act," Chapter 47, The Federal Publication, 388 King Street West, Toronto, Ontario M5V 1K2, Canada; telephone: (416) 860-1611.

Financial Services Commission of Ontario, 5160 Yonge Street, P.O. Box 85, North York, Ontario M2N 6L9, Canada; telephone: (416) 250-7250; fax: (416) 590-7070; website: www.ontarioinsurance.com.

Insurance Bureau of Canada, 240 Duncan Mill Road, Suite 700, Toronto, Ontario M3B 1Z4, Canada; telephone: (416) 445-5912; fax: (416) 445-2183.

Morneau Shepell Handbook of Canadian Pension and Benefit Plans, Sixteenth Edition, 2016, LexisNexis Canada, 111 Gordon Baker Road, Suite 900, Toronto, Ontario M2H 3R1, Canada; telephone: (800) 668-6481.

Office of the Superintendent of Financial Institutions Canada, 255 Albert Street, Ottawa, Ontario K1A 0H2 Canada; telephone: (613) 990-7788; fax: (613) 952-8219; website: www.osfi-bsif.gc.ca.



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SYLLABUS OF BASIC EDUCATION

Fall 2017 and Spring 2018

Regulation and Financial Reporting (Nation Specific)
Exam 6 – United States

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the Fall 2017-Spring 2018 Exam 6-US Study Kit that may be purchased from the CAS Online Store. The 2017 Update to the Fall 2016-Spring 2017 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.

Materials for Study, Fall 2017/Spring 2018 Exam 6-US

Exam 6U-1

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SYLLABUS OF BASIC EDUCATION

Fall 2017 and Spring 2018

Regulation and Financial Reporting (Nation Specific)
Exam 6 – United States

Section A of this examination covers insurance regulation with regards to property-casualty coverages, ratemaking, pricing, and solvency, and U.S. tort law as it affects the property-casualty business. Section B covers markets, coverages, and private and governmental programs for the property-casualty business in the United States. Section C covers the aspects of statutory, Generally Accepted Accounting Principles (GAAP), and International Financial Reporting Standards (IFRS) insurance accounting and taxation as these affect reserving and statutory reporting in the United States. Section D covers the professional responsibilities of the appointed actuary according to the Property and Casualty Annual Statement Instructions issued by the National Association of Insurance Commissioners (NAIC). Section E presents the general concepts of reinsurance accounting to the candidate.

The inherent nature of the material addressed in this nation-specific exam makes it subject to continual development and change. It is expected that the candidates will respond to exam questions based on the current syllabus presented below. Recognizing the changing nature of law, regulation, and financial reporting requirements, however, the CAS Syllabus & Examination Committee will strive to acknowledge candidates who also respond with the current state in their solutions to examination questions.

In addition, this exam assumes that the candidate has completed Online Course 2. Online Course 2 contains fundamental background material for Section A (Regulation of Insurance and United States Insurance Law), Section C (Financial Reporting and Taxation), and Section E (Reinsurance Accounting Principles).



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A. Regulation of Insurance and United States Insurance Law

Range of weight for Section A: 15-20 percent

Candidates should understand that insurers are regulated by various governmental agencies because insurance is a valuable public service. An understanding of the dual U.S. state and federal regulatory system is required, along with the various state systems of regulation. The major areas of regulation for rate, contract terms, and solvency should be understood, as should the role of antitrust law as it pertains to insurance regulation.

Regulation as it affects insurance ratemaking in the U.S. is covered. Regulatory and political aspects of risk classification are also covered. Some learning objectives extend the topic to regulation and governmental actions designed to enhance the availability of insurance.

This section also covers the regulation for solvency in the U.S., including financial ratios tested by the National Association of Insurance Commissioners, Insurance Regulatory Information System (IRIS) tests and guaranty fund mechanisms set up by the various states. Also covered are risk-based capital calculations from the statutory blank and how they are used to monitor solvency.

U.S. tort law, while not a strictly actuarial subject, affects many areas of an actuary's work. The judicial role in the development of tort law is also covered.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe the historic development and the current state of insurance regulation. Range of weight: 3-7 percent	a. Basis of insurance regulation b. Functions of NAIC c. Antitrust provisions d. Rate regulation
READINGS	
<ul style="list-style-type: none"> • Kucera • McCarty • NAIC Price • NAIC Solvency Regulatory Framework • NAIC Telematics • Porter 1 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Discuss the historic development of solvency regulation; describe current programs used to monitor solvency.</p> <p>Range of weight: 3-7 percent</p>	<p>a. Solvency, including RBC, insolvency, insurance department examination, and NAIC regulatory tests such as IRIS</p> <p>b. Receivership</p>
<p>READINGS</p>	
<ul style="list-style-type: none"> • CAS Financial Reporting • NAIC IRIS • NAIC Solvency Regulatory Framework • Porter 1 • Porter 2 • Vaughan (Economic Crisis) 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Describe current regulation addressing specialized insurance topics.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Surplus Lines Companies</p> <p>b. Risk Retention Groups and Purchasing Groups</p> <p>c. Captives</p> <p>d. Admitted vs. Non-admitted Companies</p> <p>e. Rating Agencies</p>
<p>READINGS</p>	
<ul style="list-style-type: none"> • Baribeau • Feldblum (Rating Agencies) • GAO Report • NAIC Solvency Regulatory Framework • Porter 1 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Discuss the issues, outcome, rationale, and implications of landmark decisions and antitrust laws for the insurance industry including the division of responsibility between federal and state regulators. Range of weight: 3-7 percent	a. Federal and State Antitrust Laws (e.g. Sherman Antitrust) b. McCarran-Ferguson c. Southeastern Underwriters d. Dodd-Frank Act e. Gramm Leach Bliley Act f. Paul vs. Virginia
READINGS	
<ul style="list-style-type: none">• Baribeau• NAIC Solvency Regulatory Framework• Porter 1• Vaughan (Economic Crisis)	



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B. Government and Industry Insurance Programs

Range of weight for Section B: 10-15 percent

This section focuses on the identification of major United States insurance programs administered by government agencies and insurance industry organizations. The candidates are expected to have an understanding of the objectives, operations, and effectiveness of the following insurance programs:

- Automobile Plans, e.g., MD Fund
- Crop Insurance
- Flood insurance
- Government Backstops, e.g., TRIA and Florida Hurricane Catastrophe Fund
- Guaranty funds
- Residual markets, e.g., auto, workers compensation, property
- Workers compensation, including its interaction with Medicare

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe the origin and purpose of government and industry insurance programs. Range of weight: 3-7 percent	a. Reason for inception b. Major historical development c. Philosophy of program
2. Describe the operations and risk transfer process for government/industry programs and their interaction with voluntary private insurance sector. Range of weight: 3-7 percent	a. Funding mechanisms/sources b. Allocation/assignment of exposures and associated costs c. Claim settlement and insurance coverage provisions d. Welfare (subsidization) versus insurance principles
3. Evaluate the effectiveness of a government/industry program. Range of weight: 3-7 percent	a. Solvency b. Efficiencies c. Stability d. Viability/longer term prospects e. How well program meets its purpose



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READINGS

- Cook
- Government Insurers Study Note
- King
- Porter 2
- Webel 1
- Webel 2



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C. Financial Reporting and Taxation

Range of weight for Section C: 35-55 percent

This section addresses financial reporting, solvency, and taxation issues. Candidates should have detailed knowledge of the contents, purposes, and recent changes in the NAIC Annual Statement and the Insurance Expense Exhibits. Knowledge of federal income tax treatment, including loss reserve discounting, is expected.

Candidates may find it valuable to review an actual insurer's Annual Statement to gain a more complete understanding of the key schedules, particularly the Notes to Financial Statements and General Interrogatories Sections. A candidate may review the Annual Statement of the company for which the candidate works or the Annual Statement of a publicly held company. There are links to publicly available Annual Statements of a few U.S. insurers in the citation for the NAIC Annual Statement Examples in the Complete Text References section below. Candidates are not responsible for the details of the companies' Annual Statement.

Candidates should understand the details of, and the reasons for, the differences between Generally Accepted Accounting Principles (GAAP), Statutory Accounting Principles (SAP), and International Financial Reporting Standards (IFRS).

This section is complemented by readings on solvency monitoring systems such as Risk Based Capital (RBC) and the IRIS ratios.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe the elements of the Annual Statement. Complete specific schedules and exhibits and use them to evaluate the financial health of an insurance entity.</p> <p>Range of weight: 20-25 percent</p>	<p>a. Balance sheet b. Income statement c. Change in surplus d. Schedule P e. Insurance Expense Exhibit f. Notes to financial statements g. Reinsurance accounting including Schedule F h. Underwriting and Investment Exhibit i. Exhibit of Premiums and Losses (Statutory Page 14)</p>
READINGS	
<ul style="list-style-type: none"> • 2016 IEE • CAS Financial Reporting • Feldblum (Surplus) • NAIC Annual Statement • NAIC Annual Statement Examples • NAIC SSAP 5R, 9, 53, 55, 62R, and 65 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Using RBC formulas and IRIS ratios, evaluate an insurer's financial health. Range of weight: 10-15 percent	a. RBC formula b. Components of RBC c. IRIS ratios d. Interaction of RBC and IRIS Ratios
READINGS	
<ul style="list-style-type: none"> • CAS Financial Reporting • NAIC IRIS 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Differentiate between various accounting reporting principles and standards. Range of weight: 5-10 percent	a. U.S. Statutory Accounting Principles b. Generally Accepted Accounting Principles (SEC Filers) c. Adjustments to go from SAP to GAAP d. Fair Value of claims liabilities, including Risk Margins e. International Financial Reporting Standards f. Solvency II
READINGS	
<ul style="list-style-type: none"> • CAS Financial Reporting • NAIC APPM, Preamble • NAIC Solvency Regulatory Framework 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Discuss and calculate specific elements of income tax and evaluate their implications for a property/casualty insurer. Range of weight: 0-5 percent	a. Discounting b. Elements of income tax calculation c. Statutory book income versus taxable income d. Alternative minimum tax e. Investment income
READINGS	
<ul style="list-style-type: none"> • CAS Financial Reporting • Feldblum (Loss Reserve Discounting) 	



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D. Professional Responsibilities of the Actuary in Financial Reporting

Range of weight for Section D: 15-20 percent

This section focuses on the professional responsibilities of the appointed actuary related to the reporting of financial results by property/casualty insurance companies in the United States of America. The identification of the appointed actuary is described in the Property and Casualty Annual Statement Instructions issued by the NAIC.

The candidate will be required to understand the various statutory requirements of the appointed actuary, and the appropriate professional standards and educational notes issued by the American Academy of Actuaries that are related to the financial reporting of property and casualty insurance companies.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Explain the responsibilities of an actuary as defined by standards of practice, regulators, and insurance laws for financial reporting. Range of weight: 15-20 percent	a. Statutory Prescribed Statement of Actuarial Opinion b. Standards of Practice c. Actuarial Report d. Actuary and auditor relationship e. Materiality f. Actuarial Opinion Summary
READINGS	
<ul style="list-style-type: none">• AAA Materiality• ASOPs 20, 36, 41, and 43• CAS Financial Reporting• COPLFR P&C Practice Note	



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E. Reinsurance Accounting Principles

Range of weight for Section E: 5-10 percent

This section presents the general concepts of reinsurance accounting to the candidate. The candidate should become familiar with reinsurance accounting terminology and practice.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe reinsurance accounting terminology and practice, and evaluate considerations such as risk transfer testing and commutations. Range of weight: 5-10 percent	a. Identification and evaluation of insurance and financing components of the contracts b. Determination whether the contract qualifies for insurance accounting treatment or deposit accounting treatment (i.e., passes risk transfer), and understand impact on financial statements c. Commutations—definition, motivations of parties, and accounting and tax treatment
READINGS	
<ul style="list-style-type: none">• ASC 944-020-15• Blanchard and Klann• Freihaut & Vendetti• Klann• NAIC SSAP 62R	



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Complete Text References for Exam 6-US

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
2016 Insurance Expense Exhibit.	2016 IEE	C1	B NEW
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice, No. 20, Discounting of Property/Casualty Unpaid Claim Estimates," September 2011.	ASOP 20	D1	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 36, Statements of Actuarial Opinion Regarding Property/Casualty Loss and Loss Adjustment Expense Reserves," December 2010, updated for deviation language in May 2011.	ASOP 36	D1	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 41, Actuarial Communications," December 2010.	ASOP 41	D1	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 43, Property/Casualty Unpaid Claim Estimates," June 2007, updated for deviation language in May 2011.	ASOP 43	D1	OP
American Academy of Actuaries, Task Force on Materiality, "Materiality, Concepts on Professionalism," Discussion Paper, Professionalism Series, 2006, No. 8, June 2006.	AAA Materiality	D1	OP
Baribeau, A.G., "Demystifying the Regulatory Web," Actuarial Review, March/April 2016.	Baribeau	A3-A4	OP NEW
Blanchard, R.S.; and Klann, J., "Basic Reinsurance Accounting—Selected Topics," CAS Study Note, October 2012.	Blanchard and Klann	E1	OP
Committee on Property and Liability Financial Reporting, American Academy of Actuaries, "Property and Casualty Practice Note, Statements of Actuarial Opinion on P&C Loss Reserves as of December 31, 2016." Exclude Appendix I.1.3 NAIC Title SAO Instructions and Appendix IV. SSAPs. Note that SSAP 5R, 9, 53, 55, 62R and 65 found in Appendix IV are readings for Learning Objectives C1 and E1 for this exam.	COPLFR P&C Practice Note	D1	OP NEW
Cook, Mary Ann, ed., <i>Personal Insurance</i> , (Second Edition), The Institutes, 2013, pp. 2.13-2.15 and 7.32-7.36.	Cook	B1-B3	SKU



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Citation	Abbreviation	Learning Objective	Source
Feldblum, S., "IRS Loss Reserve Discounting," CAS Study Note, 2017, pp. 1-26, excluding Appendix and endnotes.	Feldblum (Loss Reserve Discounting)	C4	OP NEW
Feldblum, S., "Rating Agencies," CAS Study Note, October 3, 2011, pp. 1-7 and 14-15 (stop at Best's Capital Adequacy Ratio) and Appendix A. Candidates are not responsible for Section 4, Section 5 beginning at Best's Capital Adequacy Ratio on p. 15, Appendices B-D, and the endnotes.	Feldblum (Rating Agencies)	A3	OP
Feldblum, S., "Statutory Surplus: Computation, Pricing and Valuation," CAS Study Note, June 2003, including errata. Candidates are not responsible for the endnotes.	Feldblum (Surplus)	C1	OP
Financial Accounting Standards Board, Accounting Standards Codification 944, "Financial Guarantee Insurance Contracts," 2011, Section 15, Scope and Scope Exceptions, paragraphs 15-1 to 15-2; 15-5 to 15-7; 15-34 to 15-35; 15-41 to 15-44; and 15-49 to 15-54. Candidates are not responsible for material relating to long-duration contracts and/or life insurance.	ASC 944-020-15	E1	SK
Freihaut, D.; and Vendetti, P., "Common Pitfalls and Practical Considerations in Risk Transfer Analysis," Casualty Actuarial Society <i>E-Forum</i> , Spring 2009. Appendices A and B are for information only and will not be directly tested.	Freihaut & Vendetti	E1	OP
"GAO Report to Congressional Requesters, Risk Retention Groups, Clarifications Could Facilitate States' Implementation of the Liability Risk Retention Act," United States Government Accountability Office, GAO-12-16, December 2011, pp. 5-7 and 34-38.	GAO Report	A3	OP NEW
Germani, W., et al., "Government Insurers Study Note," CAS Study Note, April 2017, pp. 1-16.	Government Insurers Study Note	B1-B3	OP NEW
Karapiperis, Dimitri; Birnbaum, Birny; Brandenburg, Aaron; Castagna, Sandra; Greenberg, Allen; Harbage, Robin; and Obersteadt, Anne, <i>Usage-Based Insurance and Vehicle Telematics: Insurance Market and Regulatory Implications</i> , National Association of Insurance Commissioners, CIPR Study, March 2015, pp. 1-16 (excluding section on Tower Watson's DriveAbility) and 42-60.	NAIC Telematics	A1	OP
King, R. "The National Flood Insurance Program: Status and Remaining Issues for Congress," Congressional Research Service, February 6, 2013, pp. 1-32.	King	B1-B3	OP
Klann, J., "Reinsurance Commutation," 2013.	Klann	E1	OP



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Citation	Abbreviation	Learning Objective	Source
Kucera, J., "NAIC Public Hearing on Credit-Based Insurance Scores," American Academy of Actuaries, April 30, 2009.	Kucera	A1	OP
McCarty, K.M., "Testimony of Kevin M. McCarty, Florida Insurance Commissioner, Florida Office of Insurance Regulation and Representing the National Association of Insurance Commissioners, Regarding: 'The Impact of Credit-Based Insurance Scoring on the Availability and Affordability of Insurance,' May 21, 2008," Subcommittee on Oversight and Investigations of the House Committee on Financial Services, excluding Appendices 1 and 2.	McCarty	A1	OP
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2016, Preamble.	NAIC APPM, Preamble	C3	SKU NEW
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2016, Statement of Statutory Accounting Principles 5R, "Liabilities, Contingencies, and Impairment of Assets," paragraphs 1-12, 26-29, and 33-34. This material is available in Appendix IV.1 of the COPLFR P&C Practice Note.	NAIC SSAP 5R	C1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2016, Statement of Statutory Accounting Principles 9, "Subsequent Events," paragraphs 1-8. This material is available in Appendix IV.2 of the COPLFR P&C Practice Note.	NAIC SSAP 9	C1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2016, Statement of Statutory Accounting Principles 53, "Property Casualty Contracts—Premiums," paragraphs 1-18. This material is available in Appendix IV.4 of the COPLFR P&C Practice Note.	NAIC SSAP 53	C1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2016, Statement of Statutory Accounting Principles 55, "Unpaid Claims, Loss and Loss Adjustment Expenses," paragraphs 1-6 and 10-17. This material is available in Appendix IV.5 of the COPLFR P&C Practice Note.	NAIC SSAP 55	C1	OP NEW See COPLFR Practice Note



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Citation	Abbreviation	Learning Objective	Source
<p>National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i>, 2016, Statement of Statutory Accounting Principles 62R, “Property and Casualty Reinsurance,” paragraphs 1-90.</p> <p>This material is available in Appendix IV.8 of the COPLFR P&C Practice Note.</p>	NAIC SSAP 62R	C1, E1	OP NEW See COPLFR Practice Note
<p>National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i>, 2016, Statement of Statutory Accounting Principles 65, “Property and Casualty Contracts,” paragraphs 1-46.</p> <p>This material is available in Appendix IV.10 of COPLFR P&C Practice Note.</p>	NAIC SSAP 65	C1	OP NEW See COPLFR Practice Note
<p>National Association of Insurance Commissioners, “NAIC Insurance Regulatory Information System (IRIS) Ratios Manual,” 2016, Section II, Property/Casualty Ratios, pp. 5-26.</p>	NAIC IRIS	A2, C2	OP (Was in SKU)
<p>National Association of Insurance Commissioners, <i>Official 2016 NAIC Annual Statement Blanks, Property and Casualty</i>, (both individual and consolidated basis), pp. 2-13, Notes to the Financial Statement p. 14 (refer to the Odomirok paper for the Notes to cover); Schedules D (pp. SI03 through SI09), F (pp. 20-29), H (pp. 30-32), and P (pp. 33-93).</p> <p>Candidates will be expected to have knowledge of other sections of the annual statement that are discussed in other Syllabus readings. Candidates are not responsible for page numbers. [The “Notes to the Financial Statement” are cited for reference only. Candidates are responsible for the Notes as described in the Odomirok reading where the Notes are referenced by title. If the 2016 Annual Statement and the study materials differ, candidates may base their answers on either.]</p>	NAIC Annual Statement	C1	B NEW
<p>National Association of Insurance Commissioners Official Annual Statement Examples: The following companies post their annual statements online. Candidates may use these (or their own company’s statements) as illustrations to better understand the annual statement but are not responsible for any company-specific data: (1) Travelers and (2) the Liberty Mutual Group.</p>	NAIC Annual Statement Examples	C1	OP NEW
<p>National Association of Insurance Commissioners, Casualty Actuarial and Statistical Task Force, <i>Price Optimization White Paper</i>, November 2015, pp. 1-16.</p>	NAIC Price	A1	OP (Was in SKU)



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Citation	Abbreviation	Learning Objective	Source
NAIC White Paper, "The U.S. National State-Based System of Insurance Regulation and the Solvency Modernization Initiative," 2013, excluding appendices, Section 2 paragraphs 15-18, 26-28, 32-34, 41-42; Section 3 paragraphs 9, 13-15, 23-32 and 38-39; Section 4; and Section 5 paragraphs 9, 20-29, 30-45 and 61-86.	NAIC Solvency Regulatory Framework	A1-A4, C3	OP
Odomirok, K.C., et al., <i>Financial Reporting Through the Lens of a Property/ Casualty Actuary</i> , Casualty Actuarial Society, 2014, Edition 4, excluding Part VII [Canadian Introduction and Canadian Chapters 27-29 (pp. 335-362)] and Appendix II. Including Errata.	CAS Financial Reporting	A2, C1-C4, D1	OP
Porter, K., <i>Insurance Regulation</i> , Insurance Institute of America, 2008, Chapters 2 (exclude pp. 2.19-2.29), 3 (exclude pp. 3.21-3.25), 4 (exclude pp. 4.16-4.23), 5 (exclude pp. 5.12-5.22), 6 (pp. 6.11-6.17), 8 (pp. 8.3-8.6 and 8.12-8.15), and 12 (exclude pp. 12.12-12.17).	Porter 1	A1-A4	B
Porter, K., <i>Insurance Regulation</i> , Insurance Institute of America, 2008, Chapter 12 (pp. 12.12-12.17).	Porter 2	A2, B1-B3	B
Vaughan, T.M., "The Economic Crisis and Lessons from (and for) U.S. Insurance Regulation," <i>Journal of Insurance Regulation</i> , National Association of Insurance Commissioners, Fall/Winter, Volume 28, No. 1, 2009.	Vaughan (Economic Crisis)	A2, A4	SK
Webel, B., "Terrorism Risk Insurance: Issue Analysis and Overview of Current Program," Congressional Research Service, July 23, 2014, pp. 5-11.	Webel 1	B1-B3	OP NEW
Webel, B., "Terrorism Risk Insurance Legislation the 114th Congress: Issue Summary and Side-by-Side Analysis," Congressional Research Service, January 20, 2015, Summary page and pp. 1-3.	Webel 2	B1-B3	OP NEW



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Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the Fall 2017-Spring 2018 Study Kit.
SKU	Material included in both the Fall 2017-Spring 2018 CAS Study Kit and the 2017 Update to the Fall 2016-Spring 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexamdriver.com ; website: www.actexamdriver.com .
Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
<i>Actuarial Digest</i> , P.O. Box 1127, Ponte Vedra, FL 32004.
Actuarial Standards Board, American Academy of Actuaries, 475 N. Martingale Road, Suite 600, Schaumburg, IL 60173; telephone: (847) 706-3513; fax: (847) 706-3599; website: www.actuarialstandardsboard.org .
American Academy of Actuaries, 1850 M Street NW, Suite 300, Washington, D.C. 20036; telephone: (202) 223-8196; fax: (202) 872-1948; website: www.actuary.org
American Institute for Chartered Property Casualty Underwriters, Order Department, P.O. Box 3016, 720 Providence Road, Malvern, PA 19355-0716; telephone: (610) 644-2100; fax: (610) 640-9576.
<i>Association Form of the Annual Statement Blanks</i> , Bowne Insurance Services, 1717 Arch Street, 31st Floor, Philadelphia, PA 19103; telephone: (215) 988-5690 or (800) 234-6859.
Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .
Insurance Expense Exhibit, Bowne Insurance Services, 1717 Arch Street, 31st Floor, Philadelphia, PA 19103; telephone: (215) 988-5690 or (800) 223-3103.



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Insurance Institute of America, 720 Providence Road, Malvern, PA 19355-0770; telephone: (610) 644-2100.
<i>Journal of Insurance Regulation</i> , National Association of Insurance Commissioners, 120 W. 12th Street, #1100, Kansas City, MO 64105; telephone: (816) 842-3600.
<i>NAIC Annual Statement Blanks, Property and Casualty</i> may be obtained from Bowne Insurance Services, 1717 Arch Street, 31st Floor, Philadelphia, PA 19103; telephone: (215) 988-5690 or (800) 223-3103.
National Association of Insurance Commissioners, 120 W. 12th Street, #1100, Kansas City, MO 64105; telephone: (816) 842-3600.
RR Donnelley, Two Logan Square, 18th Floor, Philadelphia, PA 19103; telephone: (215) 988-5622 or (800) 234-6859 [for the <i>NAIC Annual Statement Blanks, Property and Casualty</i> and the <i>Insurance Expense Exhibit (P&C)</i>].



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The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the Fall 2018-Spring 2019 Exam 6-US Study Kit that may be purchased from the CAS Online Store. The 2018 Update to the Fall 2017-Spring 2018 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Materials for Study, Fall 2018/Spring 2019 Exam 6-US

Exam 6U-1

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Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.

Section A of this examination covers insurance regulation with regards to property-casualty coverages, ratemaking, pricing, and solvency, and U.S. tort law as it affects the property-casualty business. Section B covers markets, coverages, and private and governmental programs for the property-casualty business in the United States. Section C covers the aspects of statutory, Generally Accepted Accounting Principles (GAAP), and International Financial Reporting Standards (IFRS) insurance accounting and taxation as these affect reserving and statutory reporting in the United States. Section D covers the professional responsibilities of the appointed actuary according to the Property and Casualty Annual Statement Instructions issued by the National Association of Insurance Commissioners (NAIC). Section E presents the general concepts of reinsurance accounting to the candidate.

The inherent nature of the material addressed in this nation-specific exam makes it subject to continual development and change. It is expected that the candidates will respond to exam questions based on the current syllabus presented below. Recognizing the changing nature of law, regulation, and financial reporting requirements, however, the CAS Syllabus & Examination Committee will strive to acknowledge candidates who also respond with the current state in their solutions to examination questions.

In addition, this exam assumes that the candidate has completed Online Course 2. Online Course 2 contains fundamental background material for Section A (Regulation of Insurance and United States Insurance Law), Section C (Financial Reporting and Taxation), and Section E (Reinsurance Accounting Principles).



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A. Regulation of Insurance and United States Insurance Law

Range of weight for Section A: 15-20 percent

Candidates should understand that insurers are regulated by various governmental agencies because insurance is a valuable public service. An understanding of the dual U.S. state and federal regulatory system is required, along with the various state systems of regulation. The major areas of regulation for rate, contract terms, and solvency should be understood, as should the role of antitrust law as it pertains to insurance regulation.

Regulation as it affects insurance ratemaking in the U.S. is covered. Regulatory and political aspects of risk classification are also covered. Some learning objectives extend the topic to regulation and governmental actions designed to enhance the availability of insurance.

This section also covers the regulation for solvency in the U.S., including financial ratios tested by the National Association of Insurance Commissioners, Insurance Regulatory Information System (IRIS) tests and guaranty fund mechanisms set up by the various states. Also covered are risk-based capital calculations from the statutory blank and how they are used to monitor solvency.

U.S. tort law, while not a strictly actuarial subject, affects many areas of an actuary's work. The judicial role in the development of tort law is also covered.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe the historic development and the current state of insurance regulation. Range of weight: 3-7 percent	a. Basis of insurance regulation b. Functions of NAIC c. Antitrust provisions d. Rate regulation
READINGS	
<ul style="list-style-type: none"> • Kucera • McCarty • NAIC Price • NAIC Solvency Regulatory Framework • NAIC Telematics • Porter 1 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Discuss the historic development of solvency regulation; describe current programs used to monitor solvency.</p> <p>Range of weight: 3-7 percent</p>	<p>a. Solvency, including RBC, insolvency, insurance department examination, and NAIC regulatory tests such as IRIS</p> <p>b. Receivership</p>
READINGS	
<ul style="list-style-type: none"> • CAS Financial Reporting • NAIC IRIS • NAIC Solvency Regulatory Framework • Porter 1 • Porter 2 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Describe current regulation addressing specialized insurance topics.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Surplus Lines Companies</p> <p>b. Risk Retention Groups and Purchasing Groups</p> <p>c. Captives</p> <p>d. Admitted vs. Non-admitted Companies</p> <p>e. Rating Agencies</p>
READINGS	
<ul style="list-style-type: none"> • Baribeau • Feldblum (Rating Agencies) • GAO Report • NAIC Solvency Regulatory Framework • Porter 1 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Discuss the issues, outcome, rationale, and implications of landmark decisions and antitrust laws for the insurance industry including the division of responsibility between federal and state regulators. Range of weight: 3-7 percent	a. Federal and State Antitrust Laws (e.g. Sherman Antitrust) b. McCarran-Ferguson c. Southeastern Underwriters d. Dodd-Frank Act e. Gramm Leach Bliley Act f. Paul vs. Virginia
READINGS	
<ul style="list-style-type: none">• Baribeau• NAIC Solvency Regulatory Framework• Porter 1	



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B. Government and Industry Insurance Programs

Range of weight for Section B: 10-15 percent

This section focuses on the identification of major United States insurance programs administered by government agencies and insurance industry organizations. The candidates are expected to have an understanding of the objectives, operations, and effectiveness of the following insurance programs:

- Automobile Plans, e.g., MD Fund
- Crop Insurance
- Flood insurance
- Government Backstops, e.g., TRIA and Florida Hurricane Catastrophe Fund
- Guaranty funds
- Residual markets, e.g., auto, workers compensation, property
- Workers compensation, including its interaction with Medicare

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe the origin and purpose of government and industry insurance programs. Range of weight: 3-7 percent	a. Reason for inception b. Major historical development c. Philosophy of program
2. Describe the operations and risk transfer process for government/industry programs and their interaction with voluntary private insurance sector. Range of weight: 3-7 percent	a. Funding mechanisms/sources b. Allocation/assignment of exposures and associated costs c. Claim settlement and insurance coverage provisions d. Welfare (subsidization) versus insurance principles
3. Evaluate the effectiveness of a government/industry program. Range of weight: 3-7 percent	a. Solvency b. Efficiencies c. Stability d. Viability/longer term prospects e. How well program meets its purpose



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READINGS

- Cook
- Government Insurers Study Note
- Horn & Brown
- Porter 2
- Webel 1
- Webel 2



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C. Financial Reporting and Taxation

Range of weight for Section C: 35-55 percent

This section addresses financial reporting, solvency, and taxation issues. Candidates should have detailed knowledge of the contents, purposes, and recent changes in the NAIC Annual Statement and the Insurance Expense Exhibits. Knowledge of federal income tax treatment, including loss reserve discounting, is expected.

Candidates may find it valuable to review an actual insurer’s Annual Statement to gain a more complete understanding of the key schedules, particularly the Notes to Financial Statements and General Interrogatories Sections. A candidate may review the Annual Statement of the company for which the candidate works or the Annual Statement of a publicly held company. There are links to publicly available Annual Statements of a few U.S. insurers in the citation for the NAIC Annual Statement Examples in the Complete Text References section below. Candidates are not responsible for the details of the companies’ Annual Statement.

Candidates should understand the details of, and the reasons for, the differences between Generally Accepted Accounting Principles (GAAP), Statutory Accounting Principles (SAP), and International Financial Reporting Standards (IFRS).

This section is complemented by readings on solvency monitoring systems such as Risk Based Capital (RBC) and the IRIS ratios.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Describe the elements of the Annual Statement. Complete specific schedules and exhibits and use them to evaluate the financial health of an insurance entity.</p> <p>Range of weight: 20-25 percent</p>	<p>a. Balance sheet b. Income statement c. Change in surplus d. Schedule P e. Insurance Expense Exhibit f. Notes to financial statements g. Reinsurance accounting including Schedule F h. Underwriting and Investment Exhibit i. Exhibit of Premiums and Losses (Statutory Page 14)</p>
READINGS	
<ul style="list-style-type: none"> • 2017 IEE • CAS Financial Reporting • Feldblum (Surplus) • NAIC Annual Statement • NAIC Annual Statement Examples • NAIC SSAP 5R, 9, 53, 55, 62R, and 65 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Using RBC formulas and IRIS ratios, evaluate an insurer's financial health. Range of weight: 10-15 percent	a. RBC formula b. Components of RBC c. IRIS ratios d. Interaction of RBC and IRIS Ratios
READINGS	
<ul style="list-style-type: none"> • CAS Financial Reporting • NAIC IRIS 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Differentiate between various accounting reporting principles and standards. Range of weight: 5-10 percent	a. U.S. Statutory Accounting Principles b. Generally Accepted Accounting Principles (SEC Filers) c. Adjustments to go from SAP to GAAP d. Fair Value of claims liabilities, including Risk Margins e. International Financial Reporting Standards f. Solvency II
READINGS	
<ul style="list-style-type: none"> • CAS Financial Reporting • NAIC APPM, Preamble • NAIC Solvency Regulatory Framework 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Discuss and calculate specific elements of income tax and evaluate their implications for a property/casualty insurer. Range of weight: 0-5 percent	a. Discounting b. Elements of income tax calculation c. Statutory book income versus taxable income d. Alternative minimum tax e. Investment income
READINGS	
<ul style="list-style-type: none"> • CAS Financial Reporting • Feldblum (Loss Reserve Discounting) 	



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D. Professional Responsibilities of the Actuary in Financial Reporting

Range of weight for Section D: 15-20 percent

This section focuses on the professional responsibilities of the appointed actuary related to the reporting of financial results by property/casualty insurance companies in the United States of America. The identification of the appointed actuary is described in the Property and Casualty Annual Statement Instructions issued by the NAIC.

The candidate will be required to understand the various statutory requirements of the appointed actuary, and the appropriate professional standards and educational notes issued by the American Academy of Actuaries that are related to the financial reporting of property and casualty insurance companies.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Explain the responsibilities of an actuary as defined by standards of practice, regulators, and insurance laws for financial reporting. Range of weight: 15-20 percent	a. Statutory Prescribed Statement of Actuarial Opinion b. Standards of Practice c. Actuarial Report d. Actuary and auditor relationship e. Materiality f. Actuarial Opinion Summary
READINGS	
<ul style="list-style-type: none">• AAA Materiality• ASOPs 20, 36, 41, and 43• CAS Financial Reporting• COPLFR P&C Practice Note	



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E. Reinsurance Accounting Principles

Range of weight for Section E: 5-10 percent

This section presents the general concepts of reinsurance accounting to the candidate. The candidate should become familiar with reinsurance accounting terminology and practice.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe reinsurance accounting terminology and practice, and evaluate considerations such as risk transfer testing and commutations. Range of weight: 5-10 percent	a. Identification and evaluation of insurance and financing components of the contracts b. Determination whether the contract qualifies for insurance accounting treatment or deposit accounting treatment (i.e., passes risk transfer), and understand impact on financial statements c. Commutations—definition, motivations of parties, and accounting and tax treatment
READINGS	
<ul style="list-style-type: none">• ASC 944-020-15• Blanchard and Klann• Freihaut & Vendetti• Klann• NAIC SSAP 62R	



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Complete Text References for Exam 6-US

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
2017 Insurance Expense Exhibit.	2017 IEE	C1	B NEW
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice, No. 20, Discounting of Property/Casualty Unpaid Claim Estimates," September 2011.	ASOP 20	D1	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 36, Statements of Actuarial Opinion Regarding Property/Casualty Loss and Loss Adjustment Expense Reserves," December 2010, updated for deviation language in May 2011.	ASOP 36	D1	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 41, Actuarial Communications," December 2010.	ASOP 41	D1	OP
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 43, Property/Casualty Unpaid Claim Estimates," June 2007, updated for deviation language in May 2011.	ASOP 43	D1	OP
American Academy of Actuaries, Task Force on Materiality, "Materiality, Concepts on Professionalism," Discussion Paper, Professionalism Series, 2006, No. 8, June 2006.	AAA Materiality	D1	OP
Baribeau, A.G., "Demystifying the Regulatory Web," Actuarial Review, March/April 2016.	Baribeau	A3-A4	OP
Blanchard, R.S.; and Klann, J., "Basic Reinsurance Accounting–Selected Topics," CAS Study Note, October 2012.	Blanchard and Klann	E1	OP
Committee on Property and Liability Financial Reporting, American Academy of Actuaries, "A Public Policy Practice Note, Statements of Actuarial Opinion on Property & Casualty Loss Reserves, 2017." Exclude Appendix I.1.3 NAIC Title SAO Instructions and Appendix IV. SSAPs. Note that SSAP 5R, 9, 53, 55, 62R, and 65 found in Appendix IV are readings for Learning Objectives C1 and E1 for this exam.	COPLFR P&C Practice Note	D1	OP NEW
Cook, Mary Ann, ed., <i>Personal Insurance</i> , (Second Edition), The Institutes, 2013, pp. 2.13-2.15 and 7.32-7.36.	Cook	B1-B3	SK



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Citation	Abbreviation	Learning Objective	Source
Feldblum, S., "IRS Loss Reserve Discounting," CAS Study Note, 2017, pp. 1-26, excluding Appendix and endnotes.	Feldblum (Loss Reserve Discounting)	C4	OP
Feldblum, S., "Rating Agencies," CAS Study Note, October 3, 2011, pp. 1-7 and 14-15 (stop at Best's Capital Adequacy Ratio) and Appendix A. Candidates are not responsible for Section 4, Section 5 beginning at Best's Capital Adequacy Ratio on p. 15, Appendices B-D, and the endnotes.	Feldblum (Rating Agencies)	A3	OP
Feldblum, S., "Statutory Surplus: Computation, Pricing and Valuation," CAS Study Note, June 2003, including errata. Candidates are not responsible for the endnotes.	Feldblum (Surplus)	C1	OP
Financial Accounting Standards Board, Accounting Standards Codification 944, "Financial Guarantee Insurance Contracts," 2011, Section 15, Scope and Scope Exceptions, paragraphs 15-1 to 15-2; 15-5 to 15-7; 15-34 to 15-35; 15-41 to 15-44; and 15-49 to 15-54. Candidates are not responsible for material relating to long-duration contracts and/or life insurance.	ASC 944-020-15	E1	SK
Freihaut, D.; and Vendetti, P., "Common Pitfalls and Practical Considerations in Risk Transfer Analysis," Casualty Actuarial Society <i>E-Forum</i> , Spring 2009. Appendices A and B are for information only and will not be directly tested.	Freihaut & Vendetti	E1	OP
"GAO Report to Congressional Requesters, Risk Retention Groups, Clarifications Could Facilitate States' Implementation of the Liability Risk Retention Act," United States Government Accountability Office, GAO-12-16, December 2011, pp. 5-7 and 34-38.	GAO Report	A3	OP
Germani, W., et al., "Government Insurers Study Note," CAS Study Note, April 2017, pp. 1-16.	Government Insurers Study Note	B1-B3	OP
Horn, D. and Brown, J., "Introduction to the National Flood Insurance Program (NFIP)," Congressional Research Service, September 12, 2017, pp. 1 -25.	Horn & Brown	B1-B3	SKU NEW
Karapiperis, Dimitri; Birnbaum, Birny; Brandenburg, Aaron; Castagna, Sandra; Greenberg, Allen; Harbage, Robin; and Obersteadt, Anne, <i>Usage-Based Insurance and Vehicle Telematics: Insurance Market and Regulatory Implications</i> , National Association of Insurance Commissioners, CIPR Study, March 2015, pp. 1-16 (excluding section on Tower Watson's DriveAbility) and 42-60.	NAIC Telematics	A1	OP
Klann, J., "Reinsurance Commutation," 2013.	Klann	E1	OP



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Citation	Abbreviation	Learning Objective	Source
Kucera, J., "NAIC Public Hearing on Credit-Based Insurance Scores," American Academy of Actuaries, April 30, 2009.	Kucera	A1	OP
McCarty, K.M., "Testimony of Kevin M. McCarty, Florida Insurance Commissioner, Florida Office of Insurance Regulation and Representing the National Association of Insurance Commissioners, Regarding: 'The Impact of Credit-Based Insurance Scoring on the Availability and Affordability of Insurance,' May 21, 2008," Subcommittee on Oversight and Investigations of the House Committee on Financial Services, excluding Appendices 1 and 2.	McCarty	A1	OP
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2017, Preamble.	NAIC APPM, Preamble	C3	SKU NEW
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2017, Statement of Statutory Accounting Principles 5R, "Liabilities, Contingencies and Impairment of Assets," paragraphs 1-12, 26-29, and 33-34. This material is available in Appendix IV of the COPLFR P&C Practice Note.	NAIC SSAP 5R	C1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2017, Statement of Statutory Accounting Principles 9, "Subsequent Events," paragraphs 1-8. This material is available in Appendix IV of the COPLFR P&C Practice Note.	NAIC SSAP 9	C1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2017, Statement of Statutory Accounting Principles 53, "Property Casualty Contracts— Premiums," paragraphs 1-18. This material is available in Appendix IV of the COPLFR P&C Practice Note.	NAIC SSAP 53	C1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual</i> , 2017, Statement of Statutory Accounting Principles 55, "Unpaid Claims, Losses and Loss Adjustment Expenses," paragraphs 1-6 and 10-17. This material is available in Appendix IV of the COPLFR P&C Practice Note.	NAIC SSAP 55	C1	OP NEW See COPLFR Practice Note



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Citation	Abbreviation	Learning Objective	Source
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual, 2017, Statement of Statutory Accounting Principles 62R, "Property and Casualty Reinsurance,"</i> paragraphs 1-90. This material is available in Appendix IV of the COPLFR P&C Practice Note.	NAIC SSAP 62R	C1, E1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, <i>Accounting Practices and Procedures Manual, 2017, Statement of Statutory Accounting Principles 65, "Property and Casualty Contracts,"</i> paragraphs 1-46. This material is available in Appendix IV of COPLFR P&C Practice Note.	NAIC SSAP 65	C1	OP NEW See COPLFR Practice Note
National Association of Insurance Commissioners, "NAIC Insurance Regulatory Information System (IRIS) Ratios Manual," 2017, Section II, Property/Casualty Ratios, pp. 5-26.	NAIC IRIS	A2, C2	OP NEW
National Association of Insurance Commissioners, <i>Official 2017 NAIC Annual Statement Blanks, Property and Casualty</i> , (both individual and consolidated basis), pp. 2-13, Notes to the Financial Statement p. 14 (refer to the Odomirok paper for the Notes to cover); Schedules D (pp. SI03 through SI09), F (pp. 20-29), H (pp. 30-32), and P (pp. 33-93). Candidates will be expected to have knowledge of other sections of the annual statement that are discussed in other Syllabus readings. Candidates are not responsible for page numbers. [The "Notes to the Financial Statement" are cited for reference only. Candidates are responsible for the Notes as described in the Odomirok reading where the Notes are referenced by title. If the 2017 Annual Statement and the study materials differ, candidates may base their answers on either.]	NAIC Annual Statement	C1	B NEW
National Association of Insurance Commissioners Official Annual Statement Examples: The following companies post their annual statements online. Candidates may use these (or their own company's statements) as illustrations to better understand the annual statement but are not responsible for any company-specific data: (1) Travelers and (2) the Liberty Mutual Group.	NAIC Annual Statement Examples	C1	OP NEW
National Association of Insurance Commissioners, Casualty Actuarial and Statistical Task Force, <i>Price Optimization White Paper</i> , November 2015, pp. 1-16.	NAIC Price	A1	OP



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Citation	Abbreviation	Learning Objective	Source
<p>NAIC White Paper, “The U.S. National State-Based System of Insurance Regulation and the Solvency Modernization Initiative,” 2013. Candidates are not responsible for the following:</p> <ul style="list-style-type: none"> Section 2: paragraphs 15-18, 26-28, 32-34, 41-42, Appendix 1, and Appendix 2; Section 3: paragraphs 9, 13-15, 23-32, and 38-39; Section 4; and Section 5: paragraphs 9, 20-29, 30-45, and 61-86. 	NAIC Solvency Regulatory Framework	A1-A4, C3	OP
<p>Odomirok, K.C., et al., <i>Financial Reporting Through the Lens of a Property/ Casualty Actuary</i>, Casualty Actuarial Society, 2014, Edition 4, excluding Part VII [Canadian Introduction and Canadian Chapters 27-29 (pp. 335-362)] and Appendix II. Including Errata.</p>	CAS Financial Reporting	A2, C1-C4, D1	OP
<p>Porter, K., <i>Insurance Regulation</i>, Insurance Institute of America, 2008, Chapters 2 (exclude pp. 2.19-2.29), 3 (exclude pp. 3.21 starting at Other Interest Groups -3.25), 4 (exclude pp. 4.16-4.23), 5 (exclude pp. 5.12-5.22), 6 (pp. 6.11-6.17), 8 (pp. 8.3-8.6 and 8.12-8.15), and 12 (exclude pp. 12.12-12.17).</p>	Porter 1	A1-A4	B
<p>Porter, K., <i>Insurance Regulation</i>, Insurance Institute of America, 2008, Chapter 12 (pp. 12.12-12.17).</p>	Porter 2	A2, B1-B3	B
<p>Webel, B., “Terrorism Risk Insurance: Issue Analysis and Overview of Current Program,” Congressional Research Service, July 23, 2014, pp. 5-11.</p>	Webel 1	B1-B3	OP
<p>Webel, B., “Terrorism Risk Insurance Legislation the 114th Congress: Issue Summary and Side-by-Side Analysis,” Congressional Research Service, January 20, 2015, Summary page and pp. 1-3.</p>	Webel 2	B1-B3	OP



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Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the Fall 2018-Spring 2019 Study Kit.
SKU	Material included in both the Fall 2018-Spring 2019 CAS Study Kit and the 2018 Update to the Fall 2017-Spring 2018 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

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Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
<i>Actuarial Digest</i> , P.O. Box 1127, Ponte Vedra, FL 32004.
Actuarial Standards Board, American Academy of Actuaries, 475 N. Martingale Road, Suite 600, Schaumburg, IL 60173; telephone: (847) 706-3513; fax: (847) 706-3599; website: www.actuarialstandardsboard.org .
American Academy of Actuaries, 1850 M Street NW, Suite 300, Washington, D.C. 20036; telephone: (202) 223-8196; fax: (202) 872-1948; website: www.actuary.org
American Institute for Chartered Property Casualty Underwriters, Order Department, P.O. Box 3016, 720 Providence Road, Malvern, PA 19355-0716; telephone: (610) 644-2100; fax: (610) 640-9576.
<i>Association Form of the Annual Statement Blanks</i> , Bowne Insurance Services, 1717 Arch Street, 31st Floor, Philadelphia, PA 19103; telephone: (215) 988-5690 or (800) 234-6859.
Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .
Insurance Expense Exhibit, Bowne Insurance Services, 1717 Arch Street, 31st Floor, Philadelphia, PA 19103; telephone: (215) 988-5690 or (800) 223-3103.



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Insurance Institute of America, 720 Providence Road, Malvern, PA 19355-0770; telephone: (610) 644-2100.
<i>Journal of Insurance Regulation</i> , National Association of Insurance Commissioners, 120 W. 12th Street, #1100, Kansas City, MO 64105; telephone: (816) 842-3600.
<i>NAIC Annual Statement Blanks, Property and Casualty</i> may be obtained from Bowne Insurance Services, 1717 Arch Street, 31st Floor, Philadelphia, PA 19103; telephone: (215) 988-5690 or (800) 223-3103.
National Association of Insurance Commissioners, 120 W. 12th Street, #1100, Kansas City, MO 64105; telephone: (816) 842-3600.
RR Donnelley, Two Logan Square, 18th Floor, Philadelphia, PA 19103; telephone: (215) 988-5622 or (800) 234-6859 [for the <i>NAIC Annual Statement Blanks, Property and Casualty</i> and the <i>Insurance Expense Exhibit (P&C)</i>].



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Estimation of Policy Liabilities, Insurance Company
Valuation, and Enterprise Risk Management - Exam 7

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the 2018 Exam 7 Study Kit that may be purchased from the CAS Online Store. The 2018 Update to the 2017 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.



A. Estimation of Policy Liabilities

Range of weight for Section A: 65-75 percent

This section focuses on advanced techniques that the actuary may need to estimate reserves for unpaid claims. The candidate is expected to be well versed in the basic Principles and Standards of Practice for unpaid claim estimation. This section addresses how actuarial concepts are adapted to evaluate liabilities arising in complex risk transfer agreements common in excess insurance and reinsurance contracts. Emphasis is placed on developing ranges around a best estimate.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Calculate unpaid claim estimates using credibility models. Range of weight: 10-14 percent	a. Application of credibility b. Mechanics of the methods (including loss ratio based payout factors) c. Strengths and weaknesses d. Testing results for reasonableness
READINGS	
<ul style="list-style-type: none"> • Brosius • Hürlimann • Mack (2000) 	



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Estimation of Policy Liabilities, Insurance Company Valuation, and Enterprise Risk Management - Exam 7

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Estimate parameters and unpaid claims using claims development models related to loss reserving methods such as:</p> <ul style="list-style-type: none"> • Chain ladder • Cape Cod • Chain ladder plus calendar-year effects • Bornhuetter-Ferguson <p>3. Calculate the moments and percentiles of unpaid claim distributions implied by the models.</p> <p>Range of weight for Learning Objectives A.2 and A.3 collectively: 16-18 percent</p>	<ul style="list-style-type: none"> a. Key assumptions of the models and testing of assumptions b. Original Mack chain ladder assumptions c. Relationship of variance assumptions to methods of calculating development factors d. Row-factor, column-factor, and combined row-times column-factor models e. Calendar-year effects in development factor models and in row-column factor models f. Effect of trends and their interrelationship (e.g., calendar year, accident year, and development year trends) g. Testing for and eliminating insignificant parameters h. Testing whether the methods work and how well the models fit (including both one-tail and two-tail tests) i. Moments of the chain ladder unpaid claim estimate when factors are calculated based on different variance assumptions j. Simulation of parameter percentiles and unpaid claims percentiles when models assume a distribution of residuals fit by MLE
READINGS	
<ul style="list-style-type: none"> • Clark • Mack (1994) • Venter Factors 	



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Estimation of Policy Liabilities, Insurance Company Valuation, and Enterprise Risk Management - Exam 7

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Estimate unpaid claims for various layers of claims.</p> <p>Range of weight: 5-7 percent</p>	<p>a. Methods for estimating unpaid claims in a deductible layer, excess of a threshold, and excess of a retention but bounded by a limit</p> <p>b. Interrelationships between parameters and development patterns for forecasting deductible, unlimited excess, layer excess and total claims</p>
READINGS	
<ul style="list-style-type: none"> Sahasrabudde Siewert 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>5. Describe the various sources of risk and uncertainty that are associated with the determination of reserves. Calculate risk margins that consider these sources of risk and uncertainty.</p>	<p>a. Systemic risks and independent risks</p> <p>b. Limitations of quantitative risk assessment</p> <p>c. Risk correlations</p> <p>d. Testing and evaluation of risk models</p>
<p>6. Calculate the mean and prediction error of a reserve given an underlying statistical model.</p>	<p>a. Distributions and distribution-free models</p> <p>b. Comparison of Chain Ladder stochastic models</p>
<p>7. Derive predictive distributions using bootstrapping and simulation techniques.</p>	<p>a. Comparison of methods</p> <p>b. Simulation using bootstrapping</p> <p>c. Simulation from parameters</p> <p>d. Bayesian methods</p>
<p>8. Identify data issues and related model adjustments for reserving models.</p> <p>9. Test assumptions underlying reserve models.</p> <p>10. Develop a distribution of reserves using weights and multiple stochastic models.</p> <p>Range of weight for Learning Objectives A.5 through A.10 collectively: 22-24 percent</p>	<p>a. Bayesian methods</p> <p>b. Adjustments to various reserving techniques</p> <p>c. Comparison of ODP Bootstrap and GLM Bootstrap models</p>
READINGS	
<ul style="list-style-type: none"> Marshall et al. Shapland Verrall Meyers (2015) 	



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SYLLABUS OF BASIC EDUCATION

2018

Estimation of Policy Liabilities, Insurance Company
Valuation, and Enterprise Risk Management - Exam 7

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>11. Compare and contrast reinsurance and primary reserving procedures.</p> <p>12. Adjust primary methods and data to be used for reinsurance reserving.</p> <p>13. Calculate ceded loss reserves using appropriate methods.</p> <p>Range of weight for Learning Objectives A.11 through A.13 collectively: 6-9 percent</p>	<p>a. Reinsurance and primary reserving methods</p> <p>b. Effect on assumptions from differences in information available to reinsurers</p> <p>c. Stanard-Buhlmann (Cape Cod) method</p> <p>d. Underlying business characteristics of reinsurance contracts, e.g., concentration of exposures</p> <p>e. Data structures, e.g., Ground up versus Excess loss, Accident Year versus Treaty Year</p>
READINGS	
<ul style="list-style-type: none">• Patrik	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>14. Forecast Premium Reserves.</p> <p>Range of weight: 4-5 percent</p>	<p>a. Reserves for retrospective premiums</p>
READINGS	
<ul style="list-style-type: none">• Teng and Perkins	



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B. Insurance Company Valuation

Range of weight for Section B: 8-12 percent

This section focuses on methods used to determine the theoretical value of equity securities and extending the methodology to value property and casualty insurance companies. The candidate is expected to be proficient with the basic tools and techniques commonly used in the financial analysis of corporations as described in the knowledge requirements set forth for VEE-Corporate Finance.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Calculate the effect of loss and expense reserve requirements and regulatory or rating agency capital requirements on the free cash flow to equity for a P&C insurer.	a. Calculate the effect of loss and expense reserve requirements and regulatory or rating agency capital requirements on the free cash flow to equity for a P&C insurer.
2. Value the equity of a P&C insurer based on its expected future dividends, its free cash flow to equity, or its expected abnormal earnings	a. Dividend Discount Model (DDM) b. Free cash flow to equity for a P&C insurer c. Discounted Cash Flow (DCF) Valuation using free cash flow to equity (FCFE), including effect of alternative methods of estimating terminal values and reasons why this method is preferred over the free cash flow to the firm (FCFF) method for P&C insurers d. Abnormal Earnings (AE) Valuation, including effect of alternative methods of estimating terminal values e. Option Pricing
3. Value the equity of a firm using comparative or relative valuation methods based on multiples of selected financial variables obtained from either peer companies or from underlying fundamentals.	a. Comparative valuation ratios including price-earnings, price-sales, price-book, price-cash flow b. Relationship between the dividend discount model and the price-earnings (P-E) ratio c. Relationship between the abnormal earnings valuation model and the price-book value (P-BV) ratio
Range of weight for Learning Objectives B.1 through B.3 collectively: 8-12 percent	
READINGS	
<ul style="list-style-type: none"> • Goldfarb 	

C. Enterprise Risk Management

Range of weight for Section C: 15-25 percent

This section introduces the candidate to the concepts and basic techniques of Enterprise Risk Management (ERM). ERM seeks to integrate the entire landscape of risk that confronts a business. Topics include value of risk management and basic modeling concepts.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Demonstrate how insurance and financial risk can be analyzed quantitatively.	a. Definition of ERM and key elements of consideration b. ERM process and risk management c. ERM risk models evaluation d. Sources of risks and modeling of dependencies e. ERM in setting capital requirements
2. Describe the rationale for, methods for, and effect of managing insurance and financial risks.	a. IRM and other capital adequacy models b. An asset-liability modeling approach c. Reinsurance and Risk optimization
3. Demonstrate the properties of various risk measures and their limitations. 4. Describe how risk measures and risk modeling, including allocation, can affect strategic management.	a. VaR, TVaR, and XTVaR b. Expected policyholder deficit c. Probability transforms d. Generalized moments
5. Describe the use of enterprise-wide risk modeling and aggregation techniques. 6. Evaluate and select appropriate models to handle diverse risks, including stochastic approaches.	a. Incorporating the use of correlation b. Evaluation and selection of appropriate copulas as part of the process of modeling multi-variate risks c. Tail dependence and tail correlations d. Low frequency/high severity events e. Parameter, projection, estimation, and model risk
Range of weight for Learning Objectives C.1 through C.6 collectively: 13-17 percent	
READINGS	
<ul style="list-style-type: none"> Brehm et al., Chapter 1, Chapter 2 (Sections 2.1-2.5), Chapter 3 (Sections 3.1-3.3) 	



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SYLLABUS OF BASIC EDUCATION

2018

Estimation of Policy Liabilities, Insurance Company
Valuation, and Enterprise Risk Management - Exam 7

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
7. Describe operational risk and demonstrate possible mitigation and quantification methodology.	a. Types of operational risk b. Key risk indicators and operational risk modeling c. Types of strategic risks d. Examples of strategic risks e. Scenario planning
8. Describe approaches to modeling the underwriting cycle. Range of weight for Learning Objectives C.7 and C.8 collectively: 4-6 percent	a. Definition, characteristics, and drivers of the underwriting cycle b. Soft, behavioral, and technical modeling approaches c. Modeling components: supply and demand, capital flows
READINGS	
• Brehm et al., Chapter 4 and Chapter 5, Section 5.4	



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Complete Text References for Exam 7

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Brehm, P.; Gluck, S.; Kreps, R.; Major, J.; Mango, D.; Shaw, R.; Venter, G.; White, S.; and Witcraft, S., Guy Carpenter, "Enterprise Risk Analysis for Property & Liability Insurance Companies," Chapter 1, 2 (excluding Section 2.6), 3 (excluding Section 3.4), 4, and 5 (Section 5.4 only).	Brehm et al.	C1-C8	SKU
Brosius, E., "Loss Development Using Credibility," CAS Study Note, March 1993.	Brosius	A1	OP
Clark, D.R., "LDF Curve Fitting and Stochastic Reserving: A Maximum Likelihood Approach," <i>Casualty Actuarial Society Forum</i> , Fall 2003.	Clark	A2-A3	OP
Goldfarb, R. "P&C Insurance Company Valuation," CAS Study Note, October 2010.	Goldfarb	B1-B3	OP
Hürlimann, W., "Credible Loss Ratio Claims Reserves: The Benktander, Neuhaus and Mack Methods Revisited," <i>ASTIN Bulletin</i> 39(1), 2009, pp. 81-99. Candidates are not responsible for mathematical proofs. For candidates attempting to replicate the numerical examples in Section 7, corrected tables can be found via a link in the associated citation in the web page titled Complete Online Text References for Exam 7.	Hürlimann	A1	OP
Mack, T., "Measuring the Variability of Chain Ladder Reserve Estimates," <i>Casualty Actuarial Society Forum</i> , Spring 1994.	Mack (1994)	A2-A3	OP
Mack, T. "Credible Claims Reserve: The Benktander Method," <i>ASTIN Bulletin</i> , 2000, pp. 333-337.	Mack (2000)	A1	OP
Marshall, K.; Collings, S.; Hodson, M.; and O'Dowd, C., "A Framework for Assessing Risk Margins," Institute of Actuaries of Australia 16th General Insurance Seminar, 9-12 November 2008, Coolumb, Australia.	Marshall et al.	A5-A10	OP
Meyers, G., "Stochastic Loss Reserving Using Bayesian MCMC Models," CAS Monograph #1.	Meyers (2015)	A5-A10	OP
Patrik, G.S., "Reinsurance," <i>Foundations of Casualty Actuarial Science</i> , Fourth Edition, Casualty Actuarial Society, 2001, Chapter 7, pp. 434-464 (section on Reinsurance Loss Reserving).	Patrik	A11-A13	OP



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Citation	Abbreviation	Learning Objective	Source
Sahasrabudde, R., "Claims Development by Layer: The Relationship between Claims Development Patterns, Trend and Claim Size Models," <i>Casualty Actuarial Society E-Forum</i> , Fall 2010, Volume 1 (revised January 2, 2013). Including errata.	Sahasrabudde	A4	OP
Shapland, M., "Using the ODP Bootstrap Model: A Practitioner's Guide," CAS Monograph #4. Supplementary modeling files linked on pages 61-62 will aid in understanding of the method's application	Shapland	A5-A10	OP
Siewert, J.J., "A Model for Reserving Workers Compensation High Deductibles," <i>Casualty Actuarial Society Forum</i> , Summer 1996, pp. 217-244.	Siewert	A4	OP
Teng, M.T.S. and Perkins, M.E., "Estimating the Premium Asset on Retrospectively Rated Policies," <i>PCAS LXXXIII</i> , 1996, pp. 611-647, excluding Section 5. Including discussion of paper: Feldblum, S., <i>PCAS LXXXV</i> , 1998, pp. 274-315, Sections 1 and 2 only. Candidates will not be held responsible for specific Annual Statement notation but will be responsible for concepts presented.	Teng and Perkins	A14	OP
Venter, G.G., "Testing the Assumptions of Age-to-Age Factors," <i>PCAS LXXXV</i> , 1998, pp. 807-847.	Venter Factors	A2-A3	OP
Verrall, R.J., "Obtaining Predictive Distributions for Reserves Which Incorporate Expert Opinion," <i>Variance</i> , Vol. 1, Issue 1, 2007, <i>Casualty Actuarial Society</i> . Including errata.	Verrall	A5-A10	OP

Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the 2018 Study Kit.
SKU	Material included in both the 2018 CAS Study Kit and the 2018 Update to the 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.



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Publishers and Distributors

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Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
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Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .

Institute of Actuaries of Australia, Level 7 Challis House 4 Martin Place, Sydney NSW 2000, Australia; telephone: +61 (2) 9233 3466; website: http://www.actuaries.asn.au .



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SYLLABUS OF BASIC EDUCATION
2018
Advanced Ratemaking – Exam 8

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the 2018 Exam 8 Study Kit that may be purchased from the CAS Online Store. The 2018 Update to the 2017 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.



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SYLLABUS OF BASIC EDUCATION
2018
Advanced Ratemaking – Exam 8

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.

Candidates for Exam 8 are expected to have already acquired considerable technical knowledge and practical experience in insurance ratemaking. Therefore, this examination will assume a working knowledge of basic ratemaking and will deal with advanced topics. To some degree, the examination will deal with the types of practical problems that a fully qualified actuary, working in ratemaking, should be able to solve. The ability to apply ratemaking knowledge and experience may be tested through questions dealing with problems for which there are no generally recognized solutions. The readings for Exam 8 should be studied for illustration of basic principles and theories, as well as for insight into advanced ratemaking problems and their solutions.



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A. Classification Ratemaking

Range of weight for Section A: 25-35 percent

In this exam, classification ratemaking and rate filings, which were introduced earlier in the syllabus, are treated in greater depth. The material in this section provides tools that enable the practitioner to go beyond mechanical construction to the comparison and evaluation of alternative classification schemes.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Identify and evaluate possible rate classes. Range of weight: 5-10 percent	a. Characteristics of appropriate classifications b. Sampling techniques c. Credibility considerations d. Statistical significance e. Cluster analysis
READINGS	
<ul style="list-style-type: none">• ASOP 12• Bailey & Simon• Mahler• Robertson	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Measure statistical significance of possible classes and estimate the loss costs of rating classes. Range of weight: 5-10 percent	a. Multidimensional relativities b. Credibility techniques c. Quintiles Test d. Holdout sample
READINGS	
<ul style="list-style-type: none">• Bailey & Simon• Couret & Venter	



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SYLLABUS OF BASIC EDUCATION
2018
Advanced Ratemaking – Exam 8

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Design and build generalized linear models (GLMs) for classification ratemaking.	a. Components of a GLM formula b. Data considerations c. Distribution selection d. Transformation of variables e. Variable interactions
4. Assess model fit and interpret model results	a. Measures of fit: Log-likelihood, Deviance, etc. b. Comparing competing models c. Assessing fit with plots d. Measuring Lift
Range of weight for Learning Objectives A.3 through A.4 collectively: 10-15 percent	
READINGS	
• GLM	



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B. Excess, Deductible, and Individual Risk Rating

Range of weight for Section B: 45-65 percent

One of the important functions performed by an actuary is rating individual risks. Prior to Exam 8, most of the readings addressed group or classification risk rating. This section is intended to prepare candidates to design and manage excess, deductible, and individual risk rating systems.

The readings range from those that discuss the theoretical foundation of excess, deductible, and individual risk rating, to those that discuss the application of specific rating plans. Candidates are expected to apply these concepts in a creative and problem-solving manner.

The first subsection covers pricing for layers of loss including excess and deductible business while the following subsections cover individual risk rating consisting of:

- Experience rating, in which prior individual risk experience is used to adjust rates prospectively.
- Retrospective and loss sensitive rating, in which the insured will pay an amount (in premium or retained loss) that depends on the experience after the policy has been written.

Candidates are also expected to be knowledgeable in the application of individual risk rating plans currently in use. Excerpts from the NCCI *Experience Rating Plan Manual for Workers Compensation and Employers Liability Insurance*, NCCI *Retrospective Rating Plan Manual for Workers Compensation and Employers Liability Insurance*, and ISO *Commercial General Liability Experience and Schedule Rating Plan* will be provided with the examination. Candidates are not required to memorize the details, but will be expected to be able to use the details of these plans during the examination. Since the necessary excerpts will be included with the examination, candidates will not be allowed to bring copies of the documents into the examination room.



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Excess and Deductible Rating

Excess and deductible rating allows the insured to retain the risk of loss and loss expenses up to limits selected in advance.

This section builds on the material covered in the basic ratemaking section of Exam 5. Candidates should have a general knowledge and understanding of excess coverages and the problems inherent in pricing these coverages for different lines of business.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Apply frequency and severity distributions to determine expected losses by layer of insurance.</p> <p>Range of weight: 6-9 percent</p>	<p>a. Severity distributions and their uses, including increased limits factors (ILFs) and loss elimination ratios (LERs)</p> <p>b. Properties of ILFs and LERs</p> <p>c. Interaction among inflation, changes in layer, and losses</p> <p>d. Methods of estimating frequency and severity distributions from losses</p>
READINGS	
<ul style="list-style-type: none">• Bahnemann• Fisher et al. & Case Study	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Estimate aggregate loss distributions.</p> <p>Range of weight: 7-10 percent</p>	<p>a. Techniques to estimate aggregate loss distributions directly from aggregate data (e.g., Table M, Table L)</p> <p>b. Construction of an aggregate loss distribution from frequency and severity distributions</p>
READINGS	
<ul style="list-style-type: none">• Bahnemann• Fisher et al. & Case Study	



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SYLLABUS OF BASIC EDUCATION
2018
Advanced Ratemaking – Exam 8

Experience Rating

The primary goal of experience rating is the adjustment of an individual risk's rate to reflect the extent to which that risk's own experience identifies it as being different from other risks in the same class. The readings begin with principles and concepts, and then move to a discussion of plans in current use.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Adjust class rates based on individual risk experience and exposure.</p> <p>Range of weight: 8-11 percent</p>	<p>a. Actuarial principles and concepts underlying the development of experience rating plans</p> <p>b. Methods to apply credibility concepts to an insured's experience (e.g., maximum single loss)</p> <p>c. Current NCCI and ISO experience rating plans</p> <p>d. Schedule rating and its interaction with experience rating</p>
READINGS	
<ul style="list-style-type: none">Fisher et al. & Case StudyISONCCI 1	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Assess effectiveness of experience rating plans.</p> <p>Range of weight: 6-9 percent</p>	<p>a. Relationship between Modifications and Loss Ratios</p> <p>b. Evaluation techniques, e.g., quintile test</p> <p>c. Over-/Under- corrections</p>
READINGS	
<ul style="list-style-type: none">Fisher et al. & Case Study	



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Retrospective and Loss Sensitive Rating

Retrospective rating allows adjustment of individual risk premium after policy expiration in response to actual loss and expenses associated with the policy. The retrospective rating plans currently in use adjust the premium up or down within limits selected in advance.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
5. Construct a loss sensitive rating plan (LSRP). Range of weight: 8-11 percent	a. Actuarial principles and concepts underlying the construction of a retrospective rating plan (e.g., construction of table of insurance charges) b. NCCI retrospective rating plans
READINGS	
<ul style="list-style-type: none">Fisher et al. & Case StudyNCCI 2	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
6. Analyze the elements of a LSRP. Range of weight: 7-10 percent	a. Influence of the parameters and other elements of the plan on the final price and potential cost of product b. Influence of the parameters and other elements of the plan on cost and cash flow to insured c. Criteria for selecting among various LSRPs
READINGS	
<ul style="list-style-type: none">Fisher et al. & Case Study	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
7. Calculate the cost of the layer of risk given the loss cost. Range of weight: 3-5 percent	a. Impact of policy provisions on expected losses b. Variability of expenses by layer and policy provisions
READINGS	
<ul style="list-style-type: none">BahnemannFisher et al. & Case Study	



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C. Catastrophic and Reinsurance Pricing

Range of weight for Section C: 15-20 percent

Catastrophe Ratemaking

This subsection introduces candidates to the methods used to model losses due to catastrophic events for the purpose of generating a catastrophe risk load and to manage the total exposure from catastrophic events within an insurance portfolio.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Describe the components and structure of catastrophe models.	a. Hazard, exposure, vulnerability and loss modules b. Exceedance Probability Curve c. Simulation and modeling techniques
2. Explain the use of catastrophe models in insurance ratemaking and portfolio management.	a. Insurability of catastrophe risks b. Sources and nature of uncertainty in catastrophe modeling c. Use of catastrophe models in insurance ratemaking d. Use of catastrophe models in portfolio management
Range of weight for Learning Objectives C.1 and C.2 collectively: 4-6 percent	
READINGS	
• Grossi & Kunreuther and including errata for Section 2.4	



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Reinsurance Ratemaking

This subsection introduces candidates to current and historical methods used to price reinsurance. The candidates will be familiar with many of these methods from the materials on primary insurance ratemaking; the emphasis here is on the application of these methods in pricing reinsurance contracts.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Determine the price of various types of reinsurance contracts.	<ol style="list-style-type: none">Types of contracts, including excess of loss, quota share, surplus share, treaty, aggregate excess of loss, and facultativeCommon methods for pricing reinsurance, including burning cost, exposure rating and experience ratingReinsurance loss development and trendUse of increased limit factors in reinsurance pricingEvaluation of aggregate distribution modelsProspective and retrospective pricing in reinsurance
4. Determine the effect of common contract provision on the price of reinsurance contracts.	<ol style="list-style-type: none">Pricing for reinstatements, loss corridors, clash, profit and sliding scale commissions, and other common provisions in reinsurance contracts
5. Specify, fit, and use loss distribution based exposure curves.	<ol style="list-style-type: none">Define an exposure curveLimited and unlimited distributionsExpected value and total loss probabilityUse of MBBEFD class distributions as exposure curves
Range of weight for Learning Objectives C.3 through C.5 collectively: 11-14 percent	
READINGS	
<ul style="list-style-type: none">ClarkBernegger	



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Complete Text References for Exam 8

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 12, Risk Classification (for all Practice Areas)," December 2005, updated for deviation language in May 2011.	ASOP 12	A1	OP
Bahnemann, D., "Distributions for Actuaries," CAS Monograph # 2, Chapters 5 and 6. It is highly recommended that candidates should read the entire monograph, as the material in Chapters 1-4 will be assumed to be familiar to candidates.	Bahnemann	B1-B2, B7	OP
Bailey, R. A. and Simon, L. J., "An Actuarial Note on the Credibility of Experience of a Single Private Passenger Car," <i>PCAS</i> XLVI, 1959, pp. 159-164. Including discussion of paper: Hazam, W. J., <i>PCAS</i> XLVII, 1960, pp. 150-152.	Bailey & Simon	A1-A2	OP
Bernegger, S., "Swiss Re Exposure Curves and the MBBEFD Distribution Class," <i>ASTIN Bulletin</i> , Vol. 27, No. 1, May 1997, pp. 99-111.	Bernegger	C3, C5	OP
Clark, D. R., "Basics of Reinsurance Pricing," CAS Study Note, Revised 2014. Candidates are not responsible for Section 6 of the paper.	Clark	C3-C4	OP
Couret, J. and Venter, G., "Using Multi-Dimensional Credibility to Estimate Class Frequency Vectors in Workers Compensation," <i>ASTIN Bulletin</i> , Vol. 38, No. 1, May 2008, pp. 72-85.	Couret & Venter	A2	OP
Fisher, G. et al., "Individual Risk Rating Study Note," CAS Study Note, Version 2, April 2018. Candidates are also responsible for the case study presented in an Excel file, which can be downloaded here .	Fisher et al. & Case Study	B1-B7	OP NEW
Goldburd, M.; Khare, A.; and Tevet, D., "Generalized Linear Models for Insurance Rating," CAS Monograph #5, Chapters 1-8.	GLM	A3-A4	OP
Grossi, P. and Kunreuther, H., Editors, <i>Catastrophe Modeling: A New Approach to Managing Risk</i> , 2005, Springer, Chapters 2-6 (excluding references at the end of each chapter) and including errata for Section 2.4, updated May 2016.	Grossi & Kunreuther	C1-C2	B Errata is OP



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Citation	Abbreviation	Learning Objective	Source
<p>Insurance Services Office, Inc., <i>Commercial General Liability Experience and Schedule Rating Plan</i>, 2006. Excerpts from the ISO Commercial General Liability Experience and Schedule Rating Plan will be provided with the exam. Candidates are not required to memorize the details, but will be expected to be able to use them on the exam. Portions of this manual will be provided with the examination booklet to the extent needed to answer questions on the exam. Candidates should not rely on having the complete manual available during the exam administration.</p>	ISO	B3	SK
<p>Mahler, H. C., "An Example of Credibility and Shifting Risk Parameters," <i>PCAS LXXVII</i>, 1990, pp. 225-282. Candidates will not be tested on the Appendices.</p>	Mahler	A1	OP
<p>National Council on Compensation Insurance, <i>Experience Rating Plan Manual for Workers Compensation and Employers Liability Insurance</i>. Candidates are responsible for only the excerpted material included in the Study Kit. Candidates are not required to memorize the details, but will be expected to be able to use them on the examination. Portions of this manual will be provided with the examination booklet to the extent needed to answer questions on the exam. Candidates should not rely on having the complete manual available during the exam administration.</p>	NCCI 1	B3	SK
<p>National Council on Compensation Insurance, <i>Retrospective Rating Plan Manual for Workers Compensation and Employers Liability Insurance</i>. Candidates are responsible for only the excerpted material included in the Study Kit, excluding Part 2, Section III, on cancellation provisions. Candidates are not required to memorize the details, but will be expected to be able to use them on the examination. Portions of this manual will be provided with the examination booklet to the extent needed to answer questions on the exam. Candidates should not rely on having the complete manual available during the exam administration.</p>	NCCI 2	B5	SK
<p>Robertson, J.P., "NCCI's 2007 Hazard Group Mapping," <i>Variance</i>, Vol. 3, Issue 2, 2009, Casualty Actuarial Society, pp. 194-213.</p>	Robertson	A1	OP



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Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the 2018 Study Kit.
SKU	Material included in both the 2018 CAS Study Kit and the 2018 Update to the 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexamdriver.com ; website: www.actexamdriver.com .
Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
American Academy of Actuaries, 1100 Seventeenth Street NW, Seventh Floor, Washington, DC 20036; telephone: (202) 223-8196; website: www.actuary.org .
Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .
Insurance Services Office, Inc., 545 Washington Boulevard, Jersey City, NJ 07310-1686; telephone: (800) 888-4476.
National Council on Compensation Insurance, 901 Peninsula Corporate Circle, Boca Raton, FL 33487; telephone: (800) NCCI-123.



The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the 2018 Exam 9 Study Kit that may be purchased from the CAS Online Store. The 2018 Update to the 2017 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the “*Syllabus Updates*” section of the CAS Web Site for any changes to the *Syllabus*.



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Exam 9 focuses on a broad array of finance, investment, and financial risk management topics. This examination assumes a working knowledge of basic ratemaking, finance, probability and statistical modeling, liability and reserve risk, and insurance underwriting. The ability to apply this knowledge and experience may be tested through questions dealing with problems for which there are no generally recognized solutions.

Texts for this Exam

There is one main text for this exam: *Investments* (10th Edition) by Bodie, Kane, and Marcus. The *Investments* text contains references to various websites. Candidates are not responsible for the identity of the websites or the actual content of the websites except to the extent that the content is reproduced in the text. Candidates are also not responsible for any aspect of the Excel applications or the boxes entitled “E-Investments” that are usually placed at or towards the end of a chapter.

While, in general, it is suggested that the candidate cover the learning objectives in the order listed, some references to later chapters in texts may occur before references to earlier chapters. In these cases, the candidate may need to review the earlier chapters first and then return to the learning objectives that reference the later chapters.

For the Financial Risk and Rate of Return exam, the appendices are part of the material covered unless specifically excluded.

There are various numeric tables scattered throughout the readings, illustrating actual observations or hypothetical examples. Candidates are not responsible for the actual numeric values.

Background in Financial Markets and Instruments

Candidates may find it helpful to review Chapters 1-5 of the *Investments* text for background in financial markets and instruments.



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A. Portfolio Theory and Equilibrium in Capital Markets

Range of weight for Section A: 20-30 percent

The portfolio theory portion of this section discusses the relationship between the risk and return for different combinations of risky and risk-free investments and discusses the effect of diversification on this relationship. Candidates are introduced to the manner in which investors might select a particular portfolio, from those available, that best suits their individual preferences for risk and return. In the portion of this section on equilibrium in capital markets, various equilibrium models are presented, including the Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT). The concept of market efficiency is presented to help candidates understand the factors that move market prices towards and away from the theoretical prices presented in these models.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Explain key concepts of risk:</p> <ul style="list-style-type: none">• Appetite• Tolerance• Aversion• Measurement• Portfolio construction• Strategies for monitoring <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none">a. Utility functions, utility scores, and utility maximizationb. Risk aversionc. Mean-variance criteriond. Capital allocation linee. Complete portfoliof. Reward to volatility ratio (Sharpe ratio)g. Passive versus active strategies: costs of active strategy and free-rider benefit
READINGS	
<ul style="list-style-type: none">• BKM, Chapter 6	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Calculate the expected value, variance, and covariance of returns of asset portfolios in a multi-dimensional setting. Range of weight: 0-5 percent	a. Expected return and standard deviation for portfolios of risky and risk-free assets b. Optimal risky portfolio c. Optimal complete portfolio
3. Describe the Markowitz Portfolio Selection Model. Range of weight: 0-5 percent	a. Minimum variance frontier b. Efficient frontier of risky assets c. Optimal capital allocation line d. Separation property e. Asset allocation versus security selection
4. Explain and demonstrate effects of various diversification strategies. Range of weight: 0-5 percent	a. Systematic risk b. Risk pooling c. Risk sharing d. Insurance principle
READINGS	
• BKM, Chapter 7	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>5. Explain and use the single factor models and compare/contrast the process of portfolio construction with the full covariance (Markowitz) model.</p> <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none"> a. Markowitz model b. Single factor model c. Single index model d. Systematic risk e. Alpha, Beta estimating and forecasting f. Covariance and correlation estimates for single index model g. Risk premiums due to market and non-market factors h. Parameter estimation risk i. Macroeconomic factors
<p>READINGS</p>	
<ul style="list-style-type: none"> • BKM, Chapter 8 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>6. Explain the assumptions and construction of CAPM and use CAPM to calculate expected returns for risky securities.</p> <p>Range of weight: 3-7 percent</p>	<ul style="list-style-type: none"> a. CAPM assumptions b. Market price of risk c. Capital market line d. Security market line
<p>7. Compare/contrast CAPM and single index model and explain the assumptions that are modified under various extensions of CAPM.</p> <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none"> a. CAPM b. Single index model c. Expected versus actual returns d. Market portfolio versus market index e. Extensions of CAPM <ul style="list-style-type: none"> • Zero Beta CAPM • CAPM with non-traded assets and labor income • ICAPM • CAPM with liquidity adjustments
<p>READINGS</p>	
<ul style="list-style-type: none"> • BKM, Chapter 9 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>8. Use APT to determine the expected return for a security and compare/contrast with CAPM and factor models.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Arbitrage and the Law of One Price</p> <p>b. APT and its comparison to CAPM</p> <p>c. Factor betas</p> <p>d. Factor portfolios and factor risk premiums</p> <p>e. Fama and French's 3 Factor Model</p> <p>f. Alternative factors in multifactor models</p>
READINGS	
<ul style="list-style-type: none"> BKM, Chapter 10 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>9. Explain market efficiency and its implications for portfolio management, and describe the various tests and studies of market efficiency.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Efficient market hypothesis</p> <p>b. Random walk</p> <p>c. Technical analysis</p> <p>d. Fundamental analysis</p> <p>e. Passive investment strategy</p> <p>f. Portfolio management</p>
READINGS	
<ul style="list-style-type: none"> BKM, Chapter 11 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>10. Explain the influence of behavioral finance in understanding certain aspects of market efficiency.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Information processing errors</p> <p>b. Behavioral biases</p> <p>c. Limits to arbitrage</p> <p>d. Violations of Law of One Price</p> <p>e. Behavioral critique</p> <p>f. Technical analysis</p>
READINGS	
<ul style="list-style-type: none"> BKM, Chapter 12 	



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B. Asset-Liability Management

Range of weight for Section B: 10-20 percent

This section exposes the candidate to factors that influence the price sensitivity of fixed income securities and presents various ways in which a portfolio manager might manage the interest rate and cash flow risk in a portfolio of these instruments. The same concepts are also applied to the interest rate risk associated with a firm's liabilities and the interest rate risk associated with a firm's total market value, inclusive of their franchise value.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Explain the different Term Structure Theories Range of weight: 0-5 percent	a. Expectations hypothesis b. Liquidity preference theory c. Forward rates versus expected short rates and spot rates
2. Determine U.S. Treasury zero rates at different maturities. Range of weight: 3-7 percent	a. Determining zero rates from coupon bonds using both annual and semi-annual compounding b. Determining forward rates from spot rates (zero rates) c. Spot rates d. Short rates e. Forward Contracts f. Treasury Inflation Protected Securities (TIPS)
READINGS	
• BKM, Chapters 14, 15 and 16	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Utilize various strategies to manage interest rate risk and cash flow risk in a bond portfolio.</p> <p>Range of weight: 3-7 percent</p>	<p>a. Duration (Macaulay, modified, and effective)</p> <p>b. Convexity</p> <p>c. The effect of interest changes on bond prices</p> <p>d. Immunization</p> <p>e. Cash flow matching and dedication</p> <p>f. Rebalancing</p> <p>g. Use of interest rate swaps, mortgage-backed securities, and other derivative securities to alter the interest rate risk for a bond portfolio</p> <p>h. Currency swaps</p>
READINGS	
<ul style="list-style-type: none">BKM, Chapters 16 and 23 (Sections 23.3 and 23.4)	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Quantify franchise value, evaluate the impact of interest rate sensitivity, and demonstrate how interest rate sensitivity of the franchise value can be managed.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Total economic value</p> <p>b. Franchise value—magnitude and exposure to interest rate risk (duration)</p> <p>c. Pricing strategy</p> <p>d. Advantages of managing the interest rate sensitivity of the firm's total economic value through pricing strategy</p>
READINGS	
<ul style="list-style-type: none">Panning	



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C. Financial Risk Management

Range of weight for Section C: 25-35 percent

This section addresses financial risks as well as risks related to the insurance industry from the financial economics perspective. The concepts and techniques presented in this section are important components in the field of enterprise risk management.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Estimate the credit risk due to default and default correlation associated with fixed income securities. Range of weight: 0-5 percent	a. Default risk b. Bond safety determinants c. Expected loss from default d. Yield spread
2. Describe the credit risk in derivatives transactions and various mechanisms to manage the risk. Range of weight: 0-5 percent	a. Counterparty default risk b. Collateralization
READINGS	
<ul style="list-style-type: none"> BKM, Chapter 14 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Describe the reasons for the development of credit derivatives market, the valuation of credit derivative contracts, and the complexity of trading credit risks. Range of weight: 0-5 percent	a. Credit default swaps (CDS) b. Types of Active Bond Portfolio management swaps c. Collateralized debt obligations (CDOs) and related structured financial instruments d. The role credit derivative contracts played in the 2008 financial crisis
READINGS	
<ul style="list-style-type: none"> BKM, Chapters 14 and 16 Coval, Jurek, and Stafford 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Discuss the development and the complexity of financial engineering products such as mortgage-backed securities and other forms of securitization.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Effect of securitization on sources of funds for mortgage holders and on interest rate risk retained by the mortgage originators</p> <p>b. Mortgage pass-throughs and the effect of mortgage prepayment on cash flows to investors</p> <p>c. Collateralized mortgage obligations (CMOs) and the effect of prepayments on cash flows to investors in particular tranches</p> <p>d. Market liquidity and premium spreads</p> <p>e. Lessons from the recent subprime crisis</p>
<p>5. Describe the market for securitizing catastrophe risk in the insurance industry and explain the reasons for its growth.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Products on the market:</p> <ul style="list-style-type: none"> • Risk-linked securities • CAT bonds • Sidecars • Cat-E-puts • Catastrophe risk swaps • Industry loss warranties <p>b. Factors influencing interest in insurance securitization in relation to traditional reinsurance</p> <p>c. Factors impeding the growth of the market:</p> <ul style="list-style-type: none"> • Regulatory • Accounting • Tax • Rating issues
<p>READINGS</p>	
<ul style="list-style-type: none"> • BKM, Chapter 16 (Section 16.2) • Coval, Jurek, and Stafford • Cummins CAT Bond 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>6. Describe various risk measures and the need for practicing sound financial risk management.</p> <p>Range of weight: 3-7 percent</p>	<ul style="list-style-type: none">a. Capital structure and risk taking incentivesb. Regulation and rating agencyc. Value at risk (VaR)d. Risk-based capitale. Expected policyholder deficit (EPD)f. Capital associated with a constant EPD ratiog. Risk-adjusted return on capital (RAROC), including alternative measures of income and alternative measures of risk-adjusted capitalh. Economic value added (EVA)i. Percentile layer of capitalj. Lessons from past failures due to poor financial risk management
READINGS	
<ul style="list-style-type: none">• Bodoff• Butsic• Cummins Capital• Goldfarb	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>7. Describe the concept of economic capital (or risk capital) in the insurance industry and various methods of allocating the risk capital to business units or lines of business.</p> <p>Range of weight: 3-7 percent</p>	<p>a. Financial and insurance risks</p> <p>b. Economic capital or risk capital</p> <p>c. Risk aggregation</p> <p>d. Strengths and weaknesses of the various allocation methods using risk measures such as:</p> <ul style="list-style-type: none"> • Percentile (VaR) • Conditional tail expectation (CTE) • EPD Ratio • Merton-Perold method • Insolvency Put/EPD ratio risk measure • Myers-Read method • Co-Measures • Co-CTE • Percentile Layer of Capital
<p>8. Apply the RAROC framework to risk management in the insurance industry.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Economic profit as income measure</p> <p>b. Cost of capital</p> <p>c. RAROC</p> <p>d. Additional risk margin in price</p> <p>e. Multi-period capital commitment</p>
<p>9. Assess the performance of business units and set prices for insurance policies on a risk-adjusted basis.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Economic profit as income measure</p> <p>b. Cost of capital</p> <p>c. RAROC</p> <p>d. Additional risk margin in price</p> <p>e. Multi-period capital commitment</p>
READINGS	
<ul style="list-style-type: none"> • Bodoff • Cummins Capital • Goldfarb 	



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D. Rate of Return, Risk Loads, and Contingency Provision

Range of weight for Section D: 25-35 percent

This section explores the relationship between insurance concepts (such as underwriting profits, premium-to-surplus ratios, and investment income) and financial concepts (such as interest rates, inflation rates, cost of capital, and risk premiums). The readings build on a background of finance as related to the insurance business, and deal with specific techniques used by actuaries to develop an appropriate profit loading in insurance prices.

Because insurance claims are fortuitous, the expected profit loaded in rates may not be realized. Some models discuss insured events that are predictable in time and amount while other models consider when insured events are uncertain, particularly where capacity is limited and/or sufficient diversification of exposure is impossible.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Evaluate the internal rate of return framework.</p> <p>Range of weight: 3-7 percent</p>	<p>a. Inter-relationship between the product market and financial market</p> <p>b. IRR Model calculations</p> <p>c. Decision rule of the IRR model</p> <p>d. Distinction between equity flows and all other cash flows</p> <p>e. Impact of surplus allocation and timing on equity flows</p> <p>f. Methods of allocating surplus and impact on IRR</p> <p>g. Potential pitfalls in IRR analysis</p>
READINGS	
<ul style="list-style-type: none">Feldblum Financial	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Evaluate the components of total return to stockholders and how leverage can be used to maximize shareholder value.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Relationship between profitability measures from investors' perspective, society's perspective, and regulators' perspective</p> <p>b. Insurance leverage and reserve capital</p> <p>c. Influence of leverage on stockholders' equity</p> <p>d. Optimal capital structure</p> <p>e. Dynamic relationship among formula variables</p>
READINGS	
<ul style="list-style-type: none">Ferrari	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Assess insurance profitability.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Policyholder versus investor perspectives</p> <p>b. Return on equity versus return on sales</p> <p>c. Methods to determine benchmark rate of return</p>
READINGS	
<ul style="list-style-type: none">McClenahan	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Describe the underwriting profit provision.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Evolution of the profit provision</p> <p>b. Policyholder versus stockholder return</p> <p>c. Types of underwriting profit</p>
<p>5. Calculate and compare the provision for underwriting profit in property and casualty insurance rates</p> <p>Range of weight: 3-7 percent</p>	<p>a. Calendar Year Investment Offset procedure</p> <p>b. Present Value Offset procedure</p> <p>c. Calendar Year Return on Equity and Growth Model</p> <p>d. Present Value of Income over Present Value of Equity method</p> <p>e. Present Value Return on Cash Flow method</p> <p>f. Risk-Adjusted Discounted Cash Flow method</p> <p>g. Internal Rate of Return on Equity Flows method</p>
READINGS	
<ul style="list-style-type: none"> • Robbin IRR • Robbin UW 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>6. Use Riskiness Leverage models to determine risk loads.</p> <p>Range of weight: 3-7 percent</p>	<p>a. Relationship of capital needs and risk loads</p> <p>b. Forms of riskiness leverage models</p> <p>c. Representation of various risk attitudes with riskiness leverage models</p> <p>d. Properties of riskiness leverage models</p> <p>e. Evaluation of reinsurance purchases with riskiness leverage models from the cedant perspective</p>
READINGS	
<ul style="list-style-type: none"> • Kreps Ratios 	



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SYLLABUS OF BASIC EDUCATION

2018

Financial Risk and Rate of Return - Exam 9

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
7. Calculate and compare the risk loads for property catastrophe insurance. Range of weight: 3-7 percent	a. Order dependency b. Marginal Surplus method c. Marginal Variance method d. Sub-additive and super-additive properties e. Renewal additivity f. Shapley Value method g. Covariance Share method
READINGS	
• Mango	



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Complete Text References for Exam 9

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Bodie, Z.; Kane, A.; and Marcus, A.J., <i>Investments</i> , 10 th Edition, McGraw-Hill/Irwin, 2014. Chapter or section citations are listed under the appropriate learning objective.	BKM	A1-A10, B1-B3, C1-C5	B
Bodoff, N.M., "Capital Allocation by Percentile Layer," <i>Casualty Actuarial Society Forum</i> , Winter 2008.	Bodoff	C6-C9	OP
Butsic, R.P., "Solvency Measurement for Property-Liability Risk-Based Capital Applications," <i>The Journal of Risk and Insurance</i> , American Risk and Insurance Association, Inc., December 1994, Vol. 61, No. 4, pp. 656-690.	Butsic	C6	SK
Coval, J.; Jurek, J.; and Stafford, E., "The Economics of Structured Finance," <i>The Journal of Economic Perspectives</i> , American Economic Association, Winter 2009, Vol. 23, No. 1.	Coval, Jurek, and Stafford	C3-C5	SK
Cummins, J. D., "Allocation of Capital in the Insurance Industry," <i>Risk Management and Insurance Review</i> , American Risk and Insurance Association, Inc., Spring 2000, Vol. 3, No. 1, pp. 7-27.	Cummins Capital	C6-C9	SK
Cummins, J. D., "CAT Bond and Other Risk-Linked Securities: State of the Market and Recent Developments," <i>Risk Management and Insurance Review</i> , American Risk and Insurance Association, Inc., 2008, Vol. 11, No. 1, pp. 23-47.	Cummins CAT Bond	C4-C5	SK
Feldblum, S., "Pricing Insurance Policies: The Internal Rate of Return Model," CAS Study Note, May 1992. Only Sections 1, 3, and 6 will be directly tested, but the other sections may provide useful background.	Feldblum Financial	D1	OP
Ferrari, J.R., "The Relationship of Underwriting, Investment, Leverage, and Exposure to Total Return on Owners' Equity," <i>PCAS LV</i> , 1968, pp. 295-302. Includes discussion: Balcarek, R.J., <i>PCAS LVI</i> , 1969, pp. 58-60.	Ferrari	D2	OP
Goldfarb, R. "Risk-Adjusted Performance Measurement for P&C Insurers," CAS Study Note, October 2010.	Goldfarb	C6-C9	OP
Kreps, R.E., "Riskiness Leverage Models," <i>PCAS XCII</i> , 2005, pp. 31-60. For candidates attempting to replicate the exhibits in this paper, a spreadsheet developed by the author can be downloaded here.	Kreps Ratios	D6	OP
Mango, D.F., "An Application of Game Theory: Property Catastrophe Risk Load," <i>PCAS LXXXV</i> , 1998, pp. 157-186.	Mango	D7	OP



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Citation	Abbreviation	Learning Objective	Source
McClenahan, C.L., "Insurance Profitability," <i>Actuarial Considerations Regarding Risk and Return in Property-Casualty Insurance Pricing</i> , Casualty Actuarial Society, 1999, Chapter 8.	McClenahan	D3	OP
Panning, W.H., "Managing Interest Rate Risk: ALM, Franchise Value, and Strategy," Willis Re Working Paper, July 2006.	Panning	B4	OP
Robbin, Ira, "IRR, ROE, and PVI/PVE," <i>Casualty Actuarial Society Forum</i> , Winter 2007. Excluding Sections 6 and 7.	Robbin IRR	D4-D5	OP
Robbin, Ira, "The Underwriting Profit Provision," CAS Study Note, as updated in 1992. Excluding Sections V, VI, and IX and related exhibits.	Robbin UW	D4-D5	OP

Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the 2016 Study Kit.
SKU	Material included in both the 2016 CAS Study Kit and the 2016 Update to the 2015 Study Kit.

Items printed in **red** indicate an update, clarification, or change.



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Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexamdriver.com ; website: www.actexamdriver.com .

Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
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American Risk and Insurance Association, 716 Providence Road, P.O. Box 3028, Malvern, PA 19355; telephone: (610) 640-1997; fax: (610) 725-1007; website: aria@cpcuiia.org .

Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .

American Economic Association, 2014 Broadway, Suite 305, Nashville, TN 37203, telephone: (615) 322-2595; fax: (615) 343-7590; website: http://www.aeaweb.org/jep/index.php .
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McGraw-Hill/Irwin, 860 Taylor Station Road, Blacklick, OH 43004; telephone: (800) 262-4729.



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SYLLABUS OF BASIC EDUCATION

2018

Modern Actuarial Statistics-I - Exam MAS-I

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as calculating the Hat Matrix for a complex Generalized Linear Model, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the “*Syllabus Update*” for this exam for any changes to this *Syllabus*.

A thorough knowledge of calculus and probability is assumed, as is familiarity with discounting cash flows. Given the material covered on Section C, we assume that the candidate has knowledge of Linear Algebra concepts at the

Materials for Study, 2018 Exam MAS-I (revised 11/30/2017)

Exam MAS-I-1



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level commonly assumed as a prerequisite to taking an undergraduate level course in regression analysis. While some problems may have an insurance or risk management theme, no prior knowledge of insurance terminology is expected.

The Probability Models section (Section A) covers Stochastic Processes, Markov Chains and Survival Models along with a simplified version of Life Contingencies. Survival models are covered in depth as part of probability modeling in generic terms. Markov Chains provide the means to model how an entity can move through different states. Life Contingencies problems can be viewed as discounted cash flow problems that include the effect of probability of payment, and are covered through a Study Note linking the generic survival model concepts to a subset of life actuarial concepts to illustrate how to calculate annuities or single premium insurance amounts.

In general, the material covered under the Statistics section (Section B) covers topics that would be commonly found in a second semester course of a two semester Probability & Statistics sequence at the undergraduate level. Coverage of the topics listed under the Statistics section will vary by college and the candidate may need to supplement that course work with additional reading and problem solving work from the suggested textbooks listed at the end of Section B.

Extended Linear Models including Generalized Linear Models, a predictive modeling technique commonly used to construct classification plans, are covered in Section C. The ordinary least squares model is covered as one member of the exponential family under the Extended Linear Models section. Many textbooks covering this topic, including the textbook on the syllabus, use statistical software to illustrate the concepts covered in examples, since using a calculator to solve a realistic problem is impractical. While we are not testing a candidate's ability to write R code, some of the examples in the textbooks cited in the Readings require using R code to work the examples. Those candidates that work through the examples or exercises will understand the material better than those who do not.

The Time Series section (Section D) covers an introduction to modeling activity over time like financial results or stock prices using the Auto Regressive Integrated Moving Average (ARIMA) where activity in a given time period may be linked to activity in subsequent time periods. That connection between adjacent time periods violates one of the assumptions behind the Extended Linear Model techniques, but the ARIMA approach incorporates that linkage as an aid in predicting future results. The Time Series section also covers the application of regression models to time series analysis.

A variety of tables will be provided to the candidate with the exam. The tables include values for the illustrative life tables, standard normal distribution, abridged inventories of discrete and continuous probability distributions, Chi-square Distribution, t-Distribution, and F-Distribution. Since they will be included with the examination, candidates will not be allowed to bring copies of the tables into the examination room.

A guessing adjustment will be used in grading this exam. Details are provided under "Guessing Adjustment" in the "Examination Rules-The Examination" section of the *Syllabus of Basic Education*.



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A. Probability Models (Stochastic Processes and Survival Models)

Range of weight for Section A: 20-35 percent

Candidates should be able to solve problems using stochastic processes. They should be able to determine the probabilities and distributions associated with these processes. Specifically, candidates should be able to use a Poisson process in these applications. Survival models are simply an extension of the stochastic process probability models where one is estimating the future lifetime of an entity given assumptions on the distribution function used to describe the likelihood of survival. Markov Chains are a useful tool to model movement between states in a given process and underlie modern Bayesian MCMC models. A short section on computer simulation is included, since in some cases a closed form solution to a problem involving random variables is not possible and simulation provides a means to arrive at a solution. The Study Note will re-cast the generic survival model learning objectives to link those concepts to life actuarial symbols to help ensure P&C actuaries can communicate with life actuaries on basic concepts, but we should recognize that many disciplines like engineering or computer science incorporate survival models in their work. Life Contingencies problems can be viewed as discounted cash flow problems that can be set up and solved using Markov Chain concepts or simply viewed as three matrices in a spreadsheet indicating payment amount, likelihood of payment, and discount effect by time period as illustrated by Learning Objective A.7.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Understand and apply the properties of Poisson processes:</p> <ul style="list-style-type: none"> • For increments in the homogeneous case • For interval times in the homogeneous case • For increments in the non-homogeneous case • Resulting from special types of events in the Poisson process • Resulting from sums of independent Poisson processes <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none"> a. Poisson process b. Non-homogeneous Poisson process c. Memoryless property of Exponential and Poisson d. Relationship between Exponential and Gamma e. Relationship between Exponential and Poisson
<p>2. For any Poisson process and the inter-arrival and waiting distributions associated with the Poisson process, calculate:</p> <ul style="list-style-type: none"> • Expected values • Variances • Probabilities <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none"> a. Probability calculations for Poisson process b. Conditional distribution of arrival times c. Splitting grouped Poisson rate to subsets of population using probability distribution d. Conditional distribution of events by category within a group within a certain time period
READINGS	
<ul style="list-style-type: none"> • Daniel • Ross, Sections 5.3, 5.4.1 	



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Modern Actuarial Statistics-I - Exam MAS-I

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. For a compound Poisson process, calculate moments associated with the value of the process at a given time.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Compound Poisson process mean and variance</p> <p>b. Normal approximation and hypothesis testing</p>
READINGS	
<ul style="list-style-type: none">• Daniel• Ross, Sections 5.4.2	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Apply the Poisson process concepts to calculate the hazard function and related survival model concepts.</p> <ul style="list-style-type: none">• Relationship between hazard rate, probability density function and cumulative distribution function• Effect of memoryless nature of Poisson distribution on survival time estimation <p>Range of weight: 2-8 percent</p>	<p>a. Failure time random variables</p> <p>b. Cumulative distribution functions</p> <p>c. Survival functions</p> <p>d. Probability density functions</p> <p>e. Hazard functions and relationship to Exponential distribution</p> <p>f. Relationships between failure time random variables in the functions above</p> <p>g. Greedy algorithms</p>
READINGS	
<ul style="list-style-type: none">• Ross, Section 5.2	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>5. Given the joint distribution of more than one source of failure in a system (or life) and using Poisson Process assumptions:</p> <ul style="list-style-type: none"> • Calculate probabilities and moments associated with functions of these random variables' variances. • Understand difference between a series system (joint life) and parallel system (last survivor) when calculating expected time to failure or probability of failure by a certain time. • Understand the effect of multiple sources of failure (multiple decrement) on expected system time to failure (expected lifetime). <p>Range of weight: 2-8 percent</p>	<ul style="list-style-type: none"> a. Joint distribution of failure times b. Probabilities and moments c. Time until failure of the system (life) d. Time until failure of the system (life) from a specific cause e. Time until failure of the system (life) for parallel or series systems with multiple components f. Paths that lead to parallel or series system failure for systems with multiple components g. Relationship between failure time and minimal path and minimal cut sets h. Bridge system and defining path to failure i. Random graphs and defining path to failure j. Effect of multiple sources of failure (multiple decrements) on failure time calculations (competing risk) k. Non-uniform probability of component failure (multiple decrement) l. Method of inclusion and exclusion as applied to failure time estimates m. Expected system lifetime as function of component lifetime and properties of expected lifetime estimates n. Linkage between reliability function for a system and future expected lifetime
READINGS	
<ul style="list-style-type: none"> • Ross, Sections 9.1-9.6 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>6. For discrete Markov Chains under both homogeneous and non-homogenous states:</p> <ul style="list-style-type: none"> • Definition of a Markov Chain • Chapman-Kolmogorov Equations for n-step transition calculations • Accessible states • Ergodic Markov Chains and limiting probabilities <p>Range of weight: 2-8 percent</p>	<ul style="list-style-type: none"> a. Random Walk b. Classification of states and classes of states (absorbing, accessible, transition, irreducible, and recurrent) c. Transition step probabilities d. Stationary probabilities e. Recurrent vs. transient states f. Gamblers ruin problem g. Branching processes h. Homogeneous transition probabilities i. Memoryless property of Markov Chains j. Limiting probabilities
READINGS	
<ul style="list-style-type: none"> • Ross, Sections 4.1-4.8 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>7. Solve Life Contingency problems using a life table in a spreadsheet as the combined result of discount, probability of payment and amount of payment vectors. Understand the linkage between the life table and the corresponding probability models.</p> <ul style="list-style-type: none"> • Calculate annuities for discrete time. • Calculate life insurance single net premiums (or property/casualty pure premiums) for discrete time. • Solve for net level premiums (not including fractional lives). <p>Range of weight: 2-5 percent</p>	<ul style="list-style-type: none"> a. Discounted cash flow b. Relationship between annuity values and insurance premiums c. Life table linkage to probability models d. Equivalence property
READINGS	
<ul style="list-style-type: none"> • Struppeck 	



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Modern Actuarial Statistics-I - Exam MAS-I

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>8. The candidate should be familiar with basic computer simulation methods.</p> <ul style="list-style-type: none">• Understand the basic framework of Monte Carlo Simulation.• Understand the mechanics of generating uniform random numbers.• Generate random numbers from a variety of distributions using the inversion method.• Be able to explain when and how to use the Acceptance-Rejection method. <p>Range of weight: 2-5 percent</p>	<ul style="list-style-type: none">a. Random Number Generationb. Uniform Random Numbersc. Inversion Methodd. Acceptance-Rejection Method
READINGS	
<ul style="list-style-type: none">• Ross, Sections 11.1, 11.2.1, and 11.2.2	



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B. Statistics

Range of weight for Section B: 15-30 percent

Candidates should have a thorough understanding of the concepts typically covered in the 2nd semester of a two semester undergraduate sequence in Probability and Statistics. The specific topics to be tested are described below. Mastering the concepts listed under Section B is necessary to understand the concepts behind the Generalized Linear Models presented under Section C.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Perform point estimation of statistical parameters using Maximum likelihood estimation (“MLE”). Apply criteria to the estimates such as:</p> <ul style="list-style-type: none">• Consistency• Unbiasedness• Sufficiency• Efficiency• Minimum variance• Mean square error <p>Calculate parameter estimates using methods other than maximum likelihood.</p>	<ul style="list-style-type: none">a. Equations for MLE of mean, variance from a sampleb. Estimation of mean and variance based on samplec. General equations for MLE of parametersd. Recognition of consistency property of estimators and alternative measures of consistencye. Application of criteria for measurement when estimating parameters through minimization of variance, mean square errorf. Definition of statistical bias and recognition of estimators that are unbiased or biasedg. Application of Rao-Cramer Lower Bound and Efficiencyh. Relationship between Sufficiency and Minimum Variancei. Develop and estimate a sufficient statistic for a distributionj. Factorization Criterion for sufficiencyk. Application of Rao-Cramer Lower Bound and Fisher Informationl. Application of MVUE for the exponential class of distributionsm. Linkage between Score Function, Fisher Information and maximum likelihoodn. Method of Momentso. Percentile Matchingp. Kernel Density Estimationq. Maximum Likelihood with Censoring & Truncation



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
Range of weight: 5-15 percent	
<p>2. Test statistical hypotheses including Type I and Type II errors using:</p> <ul style="list-style-type: none"> • Neyman-Pearson theorem • Likelihood ratio tests • First principles <p>Apply Neyman-Pearson theorem to construct likelihood ratio equation.</p> <p>Use critical values from a sampling distribution to test means and variances.</p>	<ul style="list-style-type: none"> a. Presentation of fundamental inequalities based on general assumptions and normal assumptions b. Definition of Type I and Type II errors c. Significance levels d. One-sided versus two-sided tests e. Estimation of sample sizes under normality to control for Type I and Type II errors f. Determination of critical regions g. Definition and measurement of likelihood ratio tests h. Determining parameters and testing using tabular values i. Recognizing when to apply likelihood ratio tests versus chi-square or other goodness of fit tests j. Apply paired t-test to two samples k. Test for difference in variance under Normal distribution between two samples through application of F-test l. Test of significance of means from two samples under Normal distribution assumption in both large and small sample cases m. Test for significance of difference in proportions between two samples under Binomial distribution assumption in both large and small sample case n. Application of contingency tables to test independence between effects o. Asymptotic relationship between likelihood ratio tests and the Chi-Square distribution p. Application of Neyman-Pearson theorem to Uniformly Most Powerful hypothesis tests q. Equivalence between critical regions and confidence intervals r. Kolmogorov -Smirnov test
Range of weight: 5-15 percent	



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Modern Actuarial Statistics-I - Exam MAS-I

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. For the Exponential, Gamma, Weibull, Pareto, Lognormal, Beta, and mixtures thereof:</p> <ul style="list-style-type: none">• Identify the applications in which each distribution is used and reasons why.• Transformation of distributions <p>Range of weight: 0-5 percent</p>	<p>a. Common continuous distributions for modeling claim severity</p> <p>b. Mixing distributions</p>
<p>4. Calculate Order Statistics of a sample for a given distribution</p> <p>Range of weight: 0-5 percent</p>	<p>a. General Form for distribution of nth largest element of a set</p> <p>b. Application to a given distributional form</p>
READINGS	
<p>There are many good introductory statistics textbooks that do an excellent job of covering the material on Section B. In the interest of clarity for the candidates though we have selected two. One should note that the Tse textbook is also used as a reference on Exam MAS-II.</p> <ul style="list-style-type: none">• Hogg, McKean, and Craig• Tse <p>For a mapping of the sections of these texts to the learning objectives, candidates should refer to the “Knowledge Statement Mapping for Exam MAS-I” document posted on the CAS website under the Syllabus Material section for this exam.</p> <p>For those candidates who would like to work additional problems or see additional examples to illustrate the concepts in Section B, a couple of sources are listed below that are from the Schaum’s Outline series. We are not expanding the range of material covered and only mention these additional sources as a study aid.</p> <ul style="list-style-type: none">• Schiller, Spiegel, and Srinivasan: Chapters 4-9• Spiegel and Stephens: Chapters 8-12	



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C. Extended Linear Models

Range of weight for Section C: 30-50 percent

This section covers the Extended Linear Model Family and treats Ordinary Least Squares as one type of a Linear Model that may be used when the dependent variable follows the Normal distribution and the observations are independent and identically distributed with constant variance. There is a range of models shown in this section with varying degrees of depth of coverage in the readings. The most commonly used form of the Linear Model for insurance modeling work today is the Generalized Linear Model. Generalized Additive Models are an extension of Generalized Linear Models in which the explanatory variables in the linear equation contain functions, which are in turn modeled when running the software. The models presented in this section all assume that the underlying data consists of independent and identically distributed observations from a member of the exponential distribution family. Also, we assume there is a formula describing the behavior of the dependent variable can be described as a linear process of the dependent variables after applying a link function and that the variance is a function of the mean. There are linear models in which those assumptions are violated, but that is a topic for Exam MAS-II. The specific topics to be tested are described below

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Understand the assumptions behind different forms of the Extended Linear Model and be able to select the appropriate model from list below:</p> <ul style="list-style-type: none"> • Ordinary Least Squares • Generalized Linear Model • ANOVA • Generalized Additive Models • Local Regression • Lasso • Ridge Regression • Partial Least Squares • Principle Component Analysis (PCA) Regression <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none"> a. Understand the relationship between mean and variance by model family member for the exponential distribution b. Understand how to select the appropriate distribution function for the dependent variable and the implication for the appropriate model form c. Link Functions (Identity, Log, Logit, Power, Inverse) d. Characteristics of Exponential Family (Binomial, Normal, Exponential, Gamma, Poisson, Inverse Gaussian, Negative Binomial, and Tweedie) e. Canonical Forms of link function and effect of non-canonical link function on bias f. Penalized Regression as implemented using the Lasso or Ridge Regression g. Understand concept of models within models for Generalized Additive Models h. Understand dimension reduction using Partial Least Squares or PCA Regression



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Modern Actuarial Statistics-I - Exam MAS-I

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Evaluate models developed using Extended Linear Model approach.</p> <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none">a. Raw and studentized Residualsb. R-Squared statisticc. Cook's Distance and outliersd. Influential pointse. Leveragef. Akaike Information Criterion (AIC) and BIC penalized log likelihood measuresg. Standardized/Studentized Residualsh. Deviance Residuals and relationship to likelihoodi. Pearson Residuals vs. Deviance Residualsj. Scatter, QQ and Box Plotsk. Type III Sequential Chi-Square testl. T-test and Wald test for significance of regression coefficientsm. Prediction intervals for response variablen. Mean square error and standard erroro. Calculation and validity of F test to compare two models (under OLS)p. Cross Validationq. Test vs. Train Errorr. Bootstrapping to test model validitys. Prediction vs. Forecast Errort. Overfittingu. Bias-Variance Tradeoffv. Evaluate collinearity using variance inflation factorw. Evaluate appropriateness of underlying assumptions including:<ul style="list-style-type: none">• Homoscedasticity• Autocorrelation of residuals



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Understand the algorithms behind the numerical solutions for the different forms of the Extended Linear Model family to enable interpretation of output from the statistical software employed in modeling and to make appropriate modeling choices when selecting modeling options.</p> <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none">a. Maximum Likelihood and Ordinary Least Squaresb. Fisher Scoring (iterative weighted least squares as implemented using the Information and Score functions covered in Section B.1)c. Quasi-Likelihood and relationship to maximum likelihoodd. Collinearity (Aliasing) and model stabilitye. Hat matrixf. Design matrixg. Fitting adjoining, overlapping observations in groups for Local Regressionh. Supervised vs. Unsupervised learning methodsi. Modeling functions within functions for Generalized Additive Modelsj. Penalty function in Penalized regression models (Lasso and Ridge Regression)k. Partial Least Squares Supervised learning vs. PCA Regression Unsupervised learning



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Understand and be able to select the appropriate model structure for an Extended Linear Model given the behavior of the data set to be modeled.</p> <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none">a. Predictor variablesb. Response variablesc. Regression through the origind. Transformation of variablese. Categorical vs. continuous explanatory variablesf. Interaction termsg. Significance and model comparison statisticsh. Residuals and model parameter selectioni. Piecewise Linear and Smoothing Splinesj. Smoothing parameter for splinesk. Basis Functionsl. Knot Selection for Splinesm. Weighting function for local regressionn. Selection of functions within functions for Generalized Additive Modelso. Selection of appropriate tuning factor for Lasso or Ridge Regressionp. Select either Lasso or Ridge Regression depending on desired effect from penalized regressionq. Curse of High Dimensionality



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
READINGS	
<ul style="list-style-type: none">• Dobson and Barnett, Chapters 1-9• Hogg, McKean, and Craig, Sections 4.4 (only the sections related to QQ and Box Plots), 6.3 through 6.5, 7.5, and 9.1 through 9.6• James et al., Chapters 1, 2 (excluding Section 2.2.3), 3 (Sections 3.1 through 3.3), 4 (Sections 4.1 through 4.3), 5, 6, and 7• Larsen <p>For a mapping of the sections of these texts to the learning objectives, candidates should refer to the “Knowledge Statement Mapping for Exam MAS-I” document posted on the CAS website under the Syllabus Material section for this exam.</p> <p>Exam questions from this section may contain parameter tables and diagnostic tables or plots of the type shown in the texts. Candidates should understand how to interpret these tables. Candidates who become familiar with a statistical language capable of generating this type of output, such as R, will have an easier time understanding and applying the concepts covered in the syllabus material. In particular, candidates that work the lab exercises at the end of the chapters in the James, Gareth, et al. textbook will have a better grasp of the material than that obtained by simply reading the textbook. However, for exam questions from this section, candidates will not be asked to write or interpret R code.</p> <p>Candidates are encouraged to seek out examples of GLM problems to enhance their understanding of GLM concepts. Sources for such examples will be posted on the CAS website under the Study Tips, Tools, and Past Pass Marks section for this exam. Candidates will not be tested on concepts that are outside of the scope of the required reading that may appear in those examples. The examples are furnished so that candidates might reinforce concepts covered in the Dobson and Barnett textbook.</p> <p>For those candidates who would like to work additional problems or see additional examples to illustrate the concepts in Section C, a couple of sources are listed below that are from the Schaum’s Outline series. We are not expanding the range of material covered and only mention these additional sources as a study aid.</p> <ul style="list-style-type: none">• Salvatore and Reagle: Chapters 6-9• Schiller, Spiegel, and Srinivasan: Chapters 8 and 9• Spiegel and Stephens: Chapters 13 and 16	



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D. Time Series with Constant Variance

Range of weight for Section D: 10-20 percent

This section will cover basic applications of the Auto Regressive Integrated Moving Average time series model. The specific topics to be tested are described below.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Use time series to model trends. <ul style="list-style-type: none"> • Estimation, data analysis, and forecasting • Forecast errors and confidence intervals Range of weight: 2-8 percent	a. Mean-reverting time series b. Elimination of trends using differencing c. Relationship between seasonality and autocorrelation
2. Model relationships of current and past values of a statistic / metric. <ul style="list-style-type: none"> • Estimation, data analysis, and forecasting • Forecast errors and confidence intervals Range of weight: 2-8 percent	a. Calculation and use of lag k autocorrelation statistic and cross correlation statistics in determining model structure b. Stationary series c. Autoregressive models of order 1, AR(1) d. Autoregressive integrated moving average models (ARIMA) <ul style="list-style-type: none"> • AR(p) models • Moving average models (MA) • Autoregressive moving average models (ARMA) • ARIMA model vs. ARMA model e. Invertible time series and relationship between AR and MA models f. Converting between AR and MA models g. Interpretation of auto-correlation function as aid to model selection (AR vs. MA and number of lags to include in model) h. Relationship between time series input and item modeled for AR vs. MA
3. Understand forecasts produced by ARIMA. Range of weight: 2-5 percent	a. Forecast using ARIMA models b. One step ahead prediction vs. many step ahead projection c. Change in variance in prediction by AR vs. MA model



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Time Series with Regression Range of weight: 2-5 percent	a. Deterministic vs. Stochastic Trend b. Serial correlation in regression error results c. Correction in regression via Generalized Least Squares d. Transformation of data using natural logarithms for regression modeling e. Forecast error correction under natural logarithm transformation
READINGS	
<ul style="list-style-type: none">Cowpertwait, Chapters 1-5 (excluding Sections 3.3 and 3.4), 6, 7 (Sections 7.1, 7.2 and 7.3) <p>Exam questions from this section may contain snippets of simple R code and illustrative output of the type shown in the text. Candidates should understand the general functionality of the R commands listed in the “Summary of commands used in examples” sections at the end of Chapters 1-5 and 6. Candidates will not be asked to write R code, nor will they be required to interpret complex applications or complete R programs.</p>	



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Complete Text References for Exam MAS-I

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Cowpertwait, P. and Metcalfe, A., <i>Introductory Time Series with R</i> , Springer, 2009.	Cowpertwait	D1-D4	B
Daniel, J.W., "Poisson processes (and mixture distributions)," CAS Study Note, June 2008.	Daniel	A1-A3	OP
Dobson, A and Barnett, A, <i>An Introduction to Generalized Linear Models</i> , 3 rd Edition, Chapman and Hall/CRC Press, 2008.	Dobson & Barnett	C1-C4	B
Hogg, R.V.; McKean, J.W.; and Craig, A.T., <i>Introduction to Mathematical Statistics</i> , 7 th Edition, Prentice Hall, 2013.	Hogg, McKean, and Craig	B1-B3, C1-C4	B
James, G., et al., <i>An Introduction to Statistical Learning, with Application in R</i> , 1 st ed. 2013, Corr. 7 th printing, Springer, 2017.	James et al.	C1-C4	OP
Larsen, M., "Generalized Linear Models," CAS Study Note, December 2015, revised June 2016.	Larsen	C1-C4	OP
Ross, S. M., <i>Introduction to Probability Models</i> , 11 th Edition, Academic Press (an imprint of Elsevier, Inc.), 2014.	Ross	A1-A6, A8	B
Struppeck, T., "Life Contingencies," CAS Study Note, October 2014, revised September 2015.	Struppeck	A7	OP
Tse, Y., <i>Nonlife Actuarial Models, Theory Methods and Evaluation</i> , Cambridge University Press, 2009.	Tse	B1-B3	B

Additional Study Aids

Citation	Abbreviation	Learning Objective	Source
Salvatore, D. and Reagle, D., <i>Schaum's Outline of Statistics and Econometrics</i> , McGraw-Hill, 2 nd Edition, paperback, January 27, 2011, Chapters 6-9.	Salvatore	C1-C4	BO
Schiller, J.; Spiegel, M.; and Srinivasan, R., <i>Schaum's Outlines of Probability and Statistics: 897 Solved Problems + 20 Videos</i> , McGraw-Hill, 4th Edition, Chapters 4-9.	Schiller	B1-B3, C1-C4	BO
Spiegel, M. and Stephens, L., <i>Schaum's Outline of Statistics</i> , McGraw-Hill, 5 th Edition, Chapters 8-13 and 16.	Spiegel	B1-B3, C1-C4	BO



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Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
BO	Book (Optional)—may be purchased from the publisher or bookstore.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the 2018 Study Kit.
SKU	Material included in both the 2018 CAS Study Kit and the 2018 Update to the 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

Academic Press, 200 Wheeler Road, Burlington, MA, 01803; website: http://www.academicpressbooks.com
ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexamdriver.com ; website: www.actexamdriver.com .
Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .
Cambridge University Press, 1 Liberty Plaza, Floor 20, New York, NY 10006 (U.S. address); telephone: (212) 337-5000; e-mail: customer_service@cambridge.org ; website: http://www.cambridge.org .
CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742; website: http://www.crcpress.com .
McGraw-Hill/Irwin, 860 Taylor Station Road, Blacklick, OH 43004; telephone: (800) 262-4729.
Prentice Hall, Inc., 200 Old Tappan Road, Old Tappan, NJ 07675; telephone: (800) 282-0693; website: www.pearsonhighered.com
Springer Science+Business Media LLC, 233 Spring Street, New York, New York, 10013, website: http://www.springer.com



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The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as calculating the Hat Matrix for a complex Generalized Linear Model, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the “*Syllabus Update*” for this exam for any changes to this *Syllabus*.

A thorough knowledge of calculus and probability is assumed, as is familiarity with discounting cash flows.

Materials for Study, 2018 Exam MAS-I (revised 05/28/2018)

Exam MAS-I-1

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Given the material covered on Section C, we assume that the candidate has knowledge of Linear Algebra concepts at the level commonly assumed as a prerequisite to taking an undergraduate level course in regression analysis. While some problems may have an insurance or risk management theme, no prior knowledge of insurance terminology is expected.

The Probability Models section (Section A) covers Stochastic Processes, Markov Chains and Survival Models along with a simplified version of Life Contingencies. Survival models are covered in depth as part of probability modeling in generic terms. Markov Chains provide the means to model how an entity can move through different states. Life Contingencies problems can be viewed as discounted cash flow problems that include the effect of probability of payment, and are covered through a Study Note linking the generic survival model concepts to a subset of life actuarial concepts to illustrate how to calculate annuities or single premium insurance amounts.

In general, the material covered under the Statistics section (Section B) covers topics that would be commonly found in a second semester course of a two semester Probability & Statistics sequence at the undergraduate level. Coverage of the topics listed under the Statistics section will vary by college and the candidate may need to supplement that course work with additional reading and problem solving work from the suggested textbooks listed at the end of Section B.

Extended Linear Models including Generalized Linear Models, a predictive modeling technique commonly used to construct classification plans, are covered in Section C. The ordinary least squares model is covered as one member of the exponential family under the Extended Linear Models section. Many textbooks covering this topic, including the textbook on the syllabus, use statistical software to illustrate the concepts covered in examples, since using a calculator to solve a realistic problem is impractical. While we are not testing a candidate's ability to write R code, some of the examples in the textbooks cited in the Readings require using R code to work the examples. Those candidates that work through the examples or exercises will understand the material better than those who do not.

The Time Series section (Section D) covers an introduction to modeling activity over time like financial results or stock prices using the Auto Regressive Integrated Moving Average (ARIMA) where activity in a given time period may be linked to activity in subsequent time periods. That connection between adjacent time periods violates one of the assumptions behind the Extended Linear Model techniques, but the ARIMA approach incorporates that linkage as an aid in predicting future results. The Time Series section also covers the application of regression models to time series analysis.

A variety of tables will be provided to the candidate with the exam. The tables include values for the illustrative life tables, standard normal distribution, abridged inventories of discrete and continuous probability distributions, Chi-square Distribution, t-Distribution, and F-Distribution. Since they will be included with the examination, candidates will not be allowed to bring copies of the tables into the examination room.

A guessing adjustment will be used in grading this exam. Details are provided under "Guessing Adjustment" in the "Examination Rules-The Examination" section of the *Syllabus of Basic Education*.



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A. Probability Models (Stochastic Processes and Survival Models)

Range of weight for Section A: 20-35 percent

Candidates should be able to solve problems using stochastic processes. They should be able to determine the probabilities and distributions associated with these processes. Specifically, candidates should be able to use a Poisson process in these applications. Survival models are simply an extension of the stochastic process probability models where one is estimating the future lifetime of an entity given assumptions on the distribution function used to describe the likelihood of survival. Markov Chains are a useful tool to model movement between states in a given process and underlie modern Bayesian MCMC models. A short section on computer simulation is included, since in some cases a closed form solution to a problem involving random variables is not possible and simulation provides a means to arrive at a solution. The Study Note will re-cast the generic survival model learning objectives to link those concepts to life actuarial symbols to help ensure P&C actuaries can communicate with life actuaries on basic concepts, but we should recognize that many disciplines like engineering or computer science incorporate survival models in their work. Life Contingencies problems can be viewed as discounted cash flow problems that can be set up and solved using Markov Chain concepts or simply viewed as three matrices in a spreadsheet indicating payment amount, likelihood of payment, and discount effect by time period as illustrated by Learning Objective A.7.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Understand and apply the properties of Poisson processes:</p> <ul style="list-style-type: none">• For increments in the homogeneous case• For interval times in the homogeneous case• For increments in the non-homogeneous case• Resulting from special types of events in the Poisson process• Resulting from sums of independent Poisson processes <p>Range of weight: 0-5 percent</p>	<ul style="list-style-type: none">a. Poisson processb. Non-homogeneous Poisson processc. Memoryless property of Exponential and Poissond. Relationship between Exponential and Gammae. Relationship between Exponential and Poisson



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. For any Poisson process and the inter-arrival and waiting distributions associated with the Poisson process, calculate:</p> <ul style="list-style-type: none"> Expected values Variances Probabilities <p>Range of weight: 0-5 percent</p>	<p>a. Probability calculations for Poisson process</p> <p>b. Conditional distribution of arrival times</p> <p>c. Splitting grouped Poisson rate to subsets of population using probability distribution</p> <p>d. Conditional distribution of events by category within a group within a certain time period</p>
READINGS	
<ul style="list-style-type: none"> Daniel Ross, Sections 5.3, 5.4.1 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. For a compound Poisson process, calculate moments associated with the value of the process at a given time.</p> <p>Range of weight: 0-5 percent</p>	<p>a. Compound Poisson process mean and variance</p> <p>b. Normal approximation and hypothesis testing</p>
READINGS	
<ul style="list-style-type: none"> Daniel Ross, Sections 5.4.2 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Apply the Poisson process concepts to calculate the hazard function and related survival model concepts.</p> <ul style="list-style-type: none"> Relationship between hazard rate, probability density function and cumulative distribution function Effect of memoryless nature of Poisson distribution on survival time estimation <p>Range of weight: 2-8 percent</p>	<p>a. Failure time random variables</p> <p>b. Cumulative distribution functions</p> <p>c. Survival functions</p> <p>d. Probability density functions</p> <p>e. Hazard functions and relationship to Exponential distribution</p> <p>f. Relationships between failure time random variables in the functions above</p> <p>g. Greedy algorithms</p>
READINGS	
<ul style="list-style-type: none"> Ross, Section 5.2 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>5. Given the joint distribution of more than one source of failure in a system (or life) and using Poisson Process assumptions:</p> <ul style="list-style-type: none"> • Calculate probabilities and moments associated with functions of these random variables' variances. • Understand difference between a series system (joint life) and parallel system (last survivor) when calculating expected time to failure or probability of failure by a certain time. • Understand the effect of multiple sources of failure (multiple decrement) on expected system time to failure (expected lifetime). <p>Range of weight: 2-8 percent</p>	<ul style="list-style-type: none"> a. Joint distribution of failure times b. Probabilities and moments c. Time until failure of the system (life) d. Time until failure of the system (life) from a specific cause e. Time until failure of the system (life) for parallel or series systems with multiple components f. Paths that lead to parallel or series system failure for systems with multiple components g. Relationship between failure time and minimal path and minimal cut sets h. Bridge system and defining path to failure i. Random graphs and defining path to failure j. Effect of multiple sources of failure (multiple decrements) on failure time calculations (competing risk) k. Non-uniform probability of component failure (multiple decrement) l. Method of inclusion and exclusion as applied to failure time estimates m. Expected system lifetime as function of component lifetime and properties of expected lifetime estimates n. Linkage between reliability function for a system and future expected lifetime
<p>READINGS</p> <ul style="list-style-type: none"> • Ross, Sections 9.1-9.6 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>6. For discrete Markov Chains under both homogeneous and non-homogenous states:</p> <ul style="list-style-type: none"> • Definition of a Markov Chain • Chapman-Kolmogorov Equations for n-step transition calculations • Accessible states • Ergodic Markov Chains and limiting probabilities <p>Range of weight: 2-8 percent</p>	<ul style="list-style-type: none"> a. Random Walk b. Classification of states and classes of states (absorbing, accessible, transition, irreducible, and recurrent) c. Transition step probabilities d. Stationary probabilities e. Recurrent vs. transient states f. Gamblers ruin problem g. Branching processes h. Homogeneous transition probabilities i. Memoryless property of Markov Chains j. Limiting probabilities
<p>READINGS</p>	
<ul style="list-style-type: none"> • Ross, Sections 4.1-4.8 	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>7. Solve Life Contingency problems using a life table in a spreadsheet as the combined result of discount, probability of payment and amount of payment vectors. Understand the linkage between the life table and the corresponding probability models.</p> <ul style="list-style-type: none"> • Calculate annuities for discrete time. • Calculate life insurance single net premiums (or property/casualty pure premiums) for discrete time. • Solve for net level premiums (not including fractional lives). <p>Range of weight: 2-5 percent</p>	<ul style="list-style-type: none"> a. Discounted cash flow b. Relationship between annuity values and insurance premiums c. Life table linkage to probability models d. Equivalence property
<p>READINGS</p>	
<ul style="list-style-type: none"> • Struppeck 	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>8. The candidate should be familiar with basic computer simulation methods.</p> <ul style="list-style-type: none">• Understand the basic framework of Monte Carlo Simulation.• Understand the mechanics of generating uniform random numbers.• Generate random numbers from a variety of distributions using the inversion method.• Be able to explain when and how to use the Acceptance-Rejection method. <p>Range of weight: 2-5 percent</p>	<ul style="list-style-type: none">a. Random Number Generationb. Uniform Random Numbersc. Inversion Methodd. Acceptance-Rejection Method
READINGS	
<ul style="list-style-type: none">• Ross, Sections 11.1, 11.2.1, and 11.2.2	



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B. Statistics

Range of weight for Section B: 15-30 percent

Candidates should have a thorough understanding of the concepts typically covered in the 2nd semester of a two semester undergraduate sequence in Probability and Statistics. The specific topics to be tested are described below. Mastering the concepts listed under Section B is necessary to understand the concepts behind the Generalized Linear Models presented under Section C.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Perform point estimation of statistical parameters using Maximum likelihood estimation (“MLE”).</p> <p>Apply criteria to the estimates such as:</p> <ul style="list-style-type: none">• Consistency• Unbiasedness• Sufficiency• Efficiency• Minimum variance• Mean square error <p>Calculate parameter estimates using methods other than maximum likelihood.</p>	<ul style="list-style-type: none">a. Equations for MLE of mean, variance from a sampleb. Estimation of mean and variance based on samplec. General equations for MLE of parametersd. Recognition of consistency property of estimators and alternative measures of consistencye. Application of criteria for measurement when estimating parameters through minimization of variance, mean square errorf. Definition of statistical bias and recognition of estimators that are unbiased or biasedg. Application of Rao-Cramer Lower Bound and Efficiencyh. Relationship between Sufficiency and Minimum Variancei. Develop and estimate a sufficient statistic for a distributionj. Factorization Criterion for sufficiencyk. Application of Rao-Cramer Lower Bound and Fisher Informationl. Application of MVUE for the exponential class of distributionsm. Linkage between Score Function, Fisher Information and maximum likelihoodn. Method of Momentso. Percentile Matchingp. Kernel Density Estimationq. Maximum Likelihood with Censoring & Truncation



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>Range of weight: 5-15 percent</p>	
<p>2. Test statistical hypotheses including Type I and Type II errors using:</p> <ul style="list-style-type: none"> • Neyman-Pearson theorem • Likelihood ratio tests • First principles <p>Apply Neyman-Pearson theorem to construct likelihood ratio equation.</p> <p>Use critical values from a sampling distribution to test means and variances.</p>	<ul style="list-style-type: none"> a. Presentation of fundamental inequalities based on general assumptions and normal assumptions b. Definition of Type I and Type II errors c. Significance levels d. One-sided versus two-sided tests e. Estimation of sample sizes under normality to control for Type I and Type II errors f. Determination of critical regions g. Definition and measurement of likelihood ratio tests h. Determining parameters and testing using tabular values i. Recognizing when to apply likelihood ratio tests versus chi-square or other goodness of fit tests j. Apply paired t-test to two samples k. Test for difference in variance under Normal distribution between two samples through application of F-test l. Test of significance of means from two samples under Normal distribution assumption in both large and small sample cases m. Test for significance of difference in proportions between two samples under Binomial distribution assumption in both large and small sample case n. Application of contingency tables to test independence between effects o. Asymptotic relationship between likelihood ratio tests and the Chi-Square distribution p. Application of Neyman-Pearson theorem to Uniformly Most Powerful hypothesis tests q. Equivalence between critical regions and confidence intervals r. Kolmogorov –Smirnov test
<p>Range of weight: 5-15 percent</p>	



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. For the Exponential, Gamma, Weibull, Pareto, Lognormal, Beta, and mixtures thereof:</p> <ul style="list-style-type: none">• Identify the applications in which each distribution is used and reasons why.• Transformation of distributions <p>Range of weight: 0-5 percent</p>	<p>a. Common continuous distributions for modeling claim severity</p> <p>b. Mixing distributions</p>
<p>4. Calculate Order Statistics of a sample for a given distribution</p> <p>Range of weight: 0-5 percent</p>	<p>a. General Form for distribution of nth largest element of a set</p> <p>b. Application to a given distributional form</p>
READINGS	
<p>There are many good introductory statistics textbooks that do an excellent job of covering the material on Section B. In the interest of clarity for the candidates though we have selected two. One should note that the Tse textbook is also used as a reference on Exam MAS-II.</p> <ul style="list-style-type: none">• Hogg, McKean, and Craig• Tse <p>For a mapping of the sections of these texts to the learning objectives, candidates should refer to the “Knowledge Statement Mapping for Exam MAS-I” document posted on the CAS website under the Syllabus Material section for this exam.</p> <p>For those candidates who would like to work additional problems or see additional examples to illustrate the concepts in Section B, a couple of sources are listed below that are from the Schaum’s Outline series. We are not expanding the range of material covered and only mention these additional sources as a study aid.</p> <ul style="list-style-type: none">• Schiller, Spiegel, and Srinivasan: Chapters 4-9• Spiegel and Stephens: Chapters 8-12	



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C. Extended Linear Models

Range of weight for Section C: 30-50 percent

This section covers the Extended Linear Model Family and treats Ordinary Least Squares as one type of a Linear Model that may be used when the dependent variable follows the Normal distribution and the observations are independent and identically distributed with constant variance. There is a range of models shown in this section with varying degrees of depth of coverage in the readings. The most commonly used form of the Linear Model for insurance modeling work today is the Generalized Linear Model. Generalized Additive Models are an extension of Generalized Linear Models in which the explanatory variables in the linear equation contain functions, which are in turn modeled when running the software. The models presented in this section all assume that the underlying data consists of independent and identically distributed observations from a member of the exponential distribution family. Also, we assume there is a formula describing the behavior of the dependent variable can be described as a linear process of the dependent variables after applying a link function and that the variance is a function of the mean. There are linear models in which those assumptions are violated, but that is a topic for Exam MAS-II. The specific topics to be tested are described below

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>1. Understand the assumptions behind different forms of the Extended Linear Model and be able to select the appropriate model from list below:</p> <ul style="list-style-type: none"> • Ordinary Least Squares • Generalized Linear Model • ANOVA • Generalized Additive Models • Local Regression • Lasso • Ridge Regression • Partial Least Squares • Principle Component Analysis (PCA) Regression <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none"> a. Understand the relationship between mean and variance by model family member for the exponential distribution b. Understand how to select the appropriate distribution function for the dependent variable and the implication for the appropriate model form c. Link Functions (Identity, Log, Logit, Power, Inverse) d. Characteristics of Exponential Family (Binomial, Normal, Exponential, Gamma, Poisson, Inverse Gaussian, Negative Binomial, and Tweedie) e. Canonical Forms of link function and effect of non-canonical link function on bias f. Penalized Regression as implemented using the Lasso or Ridge Regression g. Understand concept of models within models for Generalized Additive Models h. Understand dimension reduction using Partial Least Squares or PCA Regression



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Evaluate models developed using Extended Linear Model approach.</p> <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none">a. Raw and studentized Residualsb. R-Squared statisticc. Cook's Distance and outliersd. Influential pointse. Leveragef. Akaike Information Criterion (AIC) and BIC penalized log likelihood measuresg. Standardized/Studentized Residualsh. Deviance, Deviance Residuals and relationship to likelihoodi. Pearson Residuals vs. Deviance Residualsj. Scatter, QQ and Box Plotsk. Type III Sequential Chi-Square testl. T-test and Wald test for significance of regression coefficientsm. Prediction intervals for response variablen. Mean square error and standard erroro. Calculation and validity of F test to compare two models (under OLS)p. Cross Validationq. Test vs. Train Errorr. Bootstrapping to test model validitys. Prediction vs. Forecast Errort. Overfittingu. Bias-Variance Tradeoffv. Evaluate collinearity using variance inflation factorw. Evaluate appropriateness of underlying assumptions including:<ul style="list-style-type: none">• Homoscedasticity• Autocorrelation of residuals



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Understand the algorithms behind the numerical solutions for the different forms of the Extended Linear Model family to enable interpretation of output from the statistical software employed in modeling and to make appropriate modeling choices when selecting modeling options.</p> <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none">a. Maximum Likelihood and Ordinary Least Squaresb. Fisher Scoring (iterative weighted least squares as implemented using the Information and Score functions covered in Section B.1)c. Quasi-Likelihood and relationship to maximum likelihoodd. Collinearity (Aliasing) and model stabilitye. Hat matrixf. Design matrixg. Fitting adjoining, overlapping observations in groups for Local Regressionh. Supervised vs. Unsupervised learning methodsi. Modeling functions within functions for Generalized Additive Modelsj. Penalty function in Penalized regression models (Lasso and Ridge Regression)k. Partial Least Squares Supervised learning vs. PCA Regression Unsupervised learning



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>4. Understand and be able to select the appropriate model structure for an Extended Linear Model given the behavior of the data set to be modeled.</p> <p>Range of weight: 5-15 percent</p>	<ul style="list-style-type: none">a. Predictor variablesb. Response variablesc. Regression through the origind. Transformation of variablese. Categorical vs. continuous explanatory variablesf. Interaction termsg. Significance and model comparison statisticsh. Residuals and model parameter selectioni. Piecewise Linear and Smoothing Splinesj. Smoothing parameter for splinesk. Basis Functionsl. Knot Selection for Splinesm. Weighting function for local regressionn. Selection of functions within functions for Generalized Additive Modelso. Selection of appropriate tuning factor for Lasso or Ridge Regressionp. Select either Lasso or Ridge Regression depending on desired effect from penalized regressionq. Curse of High Dimensionalityr. Forward or backward or best subset selection



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
READINGS	
<ul style="list-style-type: none"> • Dobson and Barnett, Chapters 1-9 • Hogg, McKean, and Craig, Sections 4.4 (only the sections related to QQ and Box Plots), 6.3 through 6.5, 7.5, and 9.1 through 9.6 • James et al., Chapters 1, 2 (excluding Section 2.2.3), 3 (Sections 3.1 through 3.3, and 3.6 labs on Sections 3.1 through 3.3), 4 (Sections 4.1 through 4.4; the Linear Discrimination Analysis portion of Section 4.4 will not be tested), 5, 6, and 7 • Larsen <p>For a mapping of the sections of these texts to the learning objectives, candidates should refer to the “Knowledge Statement Mapping for Exam MAS-I” document posted on the CAS website under the Syllabus Material section for this exam.</p> <p>Exam questions from this section may contain parameter tables and diagnostic tables or plots of the type shown in the texts. Candidates should understand how to interpret these tables. Candidates who become familiar with a statistical language capable of generating this type of output, such as R, will have an easier time understanding and applying the concepts covered in the syllabus material. In particular, candidates that work the lab exercises at the end of the chapters in the James, Gareth, et al. textbook will have a better grasp of the material than that obtained by simply reading the textbook. However, for exam questions from this section, candidates will not be asked to write or interpret R code.</p> <p>Candidates are encouraged to seek out examples of GLM problems to enhance their understanding of GLM concepts. Sources for such examples will be posted on the CAS website under the Study Tips, Tools, and Past Pass Marks section for this exam. Candidates will not be tested on concepts that are outside of the scope of the required reading that may appear in those examples. The examples are furnished so that candidates might reinforce concepts covered in the Dobson and Barnett textbook.</p> <p>For those candidates who would like to work additional problems or see additional examples to illustrate the concepts in Section C, a couple of sources are listed below that are from the Schaum’s Outline series. We are not expanding the range of material covered and only mention these additional sources as a study aid.</p> <ul style="list-style-type: none"> • Salvatore and Reagle: Chapters 6-9 • Schiller, Spiegel, and Srinivasan: Chapters 8 and 9 • Spiegel and Stephens: Chapters 13 and 16 	



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D. Time Series with Constant Variance

Range of weight for Section D: 10-20 percent

This section will cover basic applications of the Auto Regressive Integrated Moving Average time series model. The specific topics to be tested are described below.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Use time series to model trends. <ul style="list-style-type: none"> • Estimation, data analysis, and forecasting • Forecast errors and confidence intervals Range of weight: 2-8 percent	a. Mean-reverting time series b. Elimination of trends using differencing c. Relationship between seasonality and autocorrelation
2. Model relationships of current and past values of a statistic / metric. <ul style="list-style-type: none"> • Estimation, data analysis, and forecasting • Forecast errors and confidence intervals Range of weight: 2-8 percent	a. Calculation and use of lag k autocorrelation statistic and cross correlation statistics in determining model structure b. Stationary series c. Autoregressive models of order 1, AR(1) d. Autoregressive integrated moving average models (ARIMA) <ul style="list-style-type: none"> • AR(p) models • Moving average models (MA) • Autoregressive moving average models (ARMA) • ARIMA model vs. ARMA model e. Invertible time series and relationship between AR and MA models f. Converting between AR and MA models g. Interpretation of auto-correlation function as aid to model selection (AR vs. MA and number of lags to include in model) h. Relationship between time series input and item modeled for AR vs. MA
3. Understand forecasts produced by ARIMA. Range of weight: 2-5 percent	a. Forecast using ARIMA models b. One step ahead prediction vs. many step ahead projection c. Change in variance in prediction by AR vs. MA model



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Time Series with Regression Range of weight: 2-5 percent	a. Deterministic vs. Stochastic Trend b. Serial correlation in regression error results c. Correction in regression via Generalized Least Squares d. Transformation of data using natural logarithms for regression modeling e. Forecast error correction under natural logarithm transformation
READINGS	
<ul style="list-style-type: none">Cowpertwait, Chapters 1-5 (excluding Sections 3.3 and 3.4), 6, 7 (Sections 7.1, 7.2 and 7.3) <p>Exam questions from this section may contain snippets of simple R code and illustrative output of the type shown in the text. Candidates should understand the general functionality of the R commands listed in the “Summary of commands used in examples” sections at the end of Chapters 1-5 and 6. Candidates will not be asked to write R code, nor will they be required to interpret complex applications or complete R programs.</p>	



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Complete Text References for Exam MAS-I

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Cowpertwait, P. and Metcalfe, A., <i>Introductory Time Series with R</i> , Springer, 2009.	Cowpertwait	D1-D4	B
Daniel, J.W., "Poisson processes (and mixture distributions)," CAS Study Note, June 2008.	Daniel	A1-A3	OP
Dobson, A and Barnett, A, <i>An Introduction to Generalized Linear Models</i> , 3 rd Edition, Chapman and Hall/CRC Press, 2008.	Dobson & Barnett	C1-C4	B
Hogg, R.V.; McKean, J.W.; and Craig, A.T., <i>Introduction to Mathematical Statistics</i> , 7 th Edition, Prentice Hall, 2013.	Hogg, McKean, and Craig	B1-B3, C1-C4	B
James, G., et al., <i>An Introduction to Statistical Learning, with Application in R</i> , 1st ed. 2013, Corr. 8th printing, Springer, 2017. Note: Although page iv of the text identifies it as the corrected 8th printing, the publisher refers to it as the corrected 7th printing. Candidates should use the version found in the Complete Online Text References web page for this exam.	James et al.	C1-C4	OP
Larsen, M., "Generalized Linear Models," CAS Study Note, December 2015, revised June 2016.	Larsen	C1-C4	OP
Ross, S. M., <i>Introduction to Probability Models</i> , 11 th Edition, Academic Press (an imprint of Elsevier, Inc.), 2014.	Ross	A1-A6, A8	B
Struppeck, T., "Life Contingencies," CAS Study Note, October 2014, revised September 2015.	Struppeck	A7	OP
Tse, Y., <i>Nonlife Actuarial Models, Theory Methods and Evaluation</i> , Cambridge University Press, 2009.	Tse	B1-B3	B



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Additional Study Aids

Citation	Abbreviation	Learning Objective	Source
Salvatore, D. and Reagle, D., <i>Schaum's Outline of Statistics and Econometrics</i> , McGraw-Hill, 2 nd Edition, paperback, January 27, 2011, Chapters 6-9.	Salvatore	C1-C4	BO
Schiller, J.; Spiegel, M.; and Srinivasan, R., <i>Schaum's Outlines of Probability and Statistics: 897 Solved Problems + 20 Videos</i> , McGraw-Hill, 4th Edition, Chapters 4-9.	Schiller	B1-B3, C1-C4	BO
Spiegel, M. and Stephens, L., <i>Schaum's Outline of Statistics</i> , McGraw-Hill, 5 th Edition, Chapters 8-13 and 16.	Spiegel	B1-B3, C1-C4	BO

Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
BO	Book (Optional)—may be purchased from the publisher or bookstore.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the 2018 Study Kit.
SKU	Material included in both the 2018 CAS Study Kit and the 2018 Update to the 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

Academic Press, 200 Wheeler Road, Burlington, MA, 01803; website: http://www.academicpressbooks.com
ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexmadriver.com ; website: www.actexmadriver.com .
Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: www.actuarialbookstore.com .



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SYLLABUS OF BASIC EDUCATION
2018

Modern Actuarial Statistics-I – Exam MAS-I

Cambridge University Press, 1 Liberty Plaza, Floor 20, New York, NY 10006 (U.S. address); telephone: (212) 337-5000; e-mail: customer_service@cambridge.org; website: <http://www.cambridge.org>.

CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742; website: <http://www.crcpress.com>.

McGraw-Hill/Irwin, 860 Taylor Station Road, Blacklick, OH 43004; telephone: (800) 262-4729.

Prentice Hall, Inc., 200 Old Tappan Road, Old Tappan, NJ 07675; telephone: (800) 282-0693; website: www.pearsonhighered.com

Springer Science+Business Media LLC, 233 Spring Street, New York, New York, 10013, website: <http://www.springer.com>



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SYLLABUS OF BASIC EDUCATION
2018

Modern Actuarial Statistics-II – Exam MAS-II

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

LEARNING OBJECTIVES set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as applying the Metropolis-Hastings algorithm or building a decision tree, but that the candidate would still be expected to explain conceptually in the context of an examination.

KNOWLEDGE STATEMENTS identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

READINGS support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weights. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the “*Syllabus Update*” for this exam for any changes to this *Syllabus*.

Materials for Study, 2018 Exam MAS-II

Exam MAS-II-1

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SYLLABUS OF BASIC EDUCATION
2018

Modern Actuarial Statistics-II – Exam MAS-II

A thorough knowledge of calculus and probability is assumed. Given the material covered on this exam, we assume that the candidate has knowledge of linear algebra concepts at the level commonly assumed as a prerequisite to taking an undergraduate level course in regression analysis. Candidates are expected to have mastered the concepts in Exam MAS-I. For those candidates who have obtained a waiver for Exam MAS-I through the transition rule that granted credit for Exam MAS-I by having credit for Exam S - Statistics and Probabilistic Models or through examinations administered by the Institute and Faculty of Actuaries (United Kingdom), Actuaries Institute (Australia), Actuarial Society of South Africa (ASSA), or the Institute of Actuaries of India, it is recommended to review and master the concepts in the paper “Generalized Linear Models” by Larsen¹ and the following Sections in *An Introduction to Statistical Learning, with Applications in R*: 2.1.4, 2.2.1, 2.2.2, 5.1, and 5.2. See [Waivers of Examination](#) page of the CAS website for a complete waiver explanation. While some problems may have an insurance or risk management theme, no prior knowledge of insurance terminology is expected.

A variety of tables will be provided to the candidate with the exam. The tables include values for the standard normal distribution, abridged inventories of discrete and continuous probability distributions, Chi-square Distribution, t-Distribution, and F-Distribution. Since they will be included with the examination, candidates will not be allowed to bring copies of the tables into the examination room.

A guessing adjustment will be used in grading this exam. Details are provided under “Guessing Adjustment” in the “Examination Rules-The Examination” section of the *Syllabus of Basic Education*.

¹ See Syllabus for Exam MAS-I for complete text reference.



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A. Introduction to Credibility

Range of weight for Section A: 5-15 percent

Advances in statistical computing tools have now made it practical to include a form of credibility weighting when building regression type models. For example, what the statisticians call shrinkage in a Linear Mixed Effect Model is a form of least squares credibility weighting. These advanced techniques are covered extensively in Sections B and C. However, candidates should be familiar with the topics listed below as they can serve as a good introduction to those techniques and are still very much in practice today. Specifically, candidates should be familiar with limited fluctuation credibility and be able to calculate estimates using Bayesian credibility procedures. They should also be fluent with Bayesian and Bühlmann (least squares credibility) procedures both for discrete and continuous models.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<ol style="list-style-type: none"> 1. Understand the basic framework of credibility and be familiar with limited fluctuation credibility, including partial and full credibility 2. Understand the basic framework of Bühlmann credibility 3. Calculate different variance components for Bühlmann credibility 4. Calculate Bühlmann and Bühlmann-Straub credibility factor and estimates for frequency, severity, and aggregate loss 5. Understand the basic framework of Bayesian credibility 6. Calculate Bayes estimate/Bayesian premium 7. Bayesian versus Bühlmann credibility for conjugate distributions 8. Calculate credibility estimates using the Nonparametric empirical Bayes Method <p>Range of weight for Learning Objectives A.1 through A.8 collectively: 5-15 percent</p>	<ol style="list-style-type: none"> a. Limited fluctuation credibility, Partial and Full Credibility b. Conjugate priors, Poisson/Gamma, Binomial/Beta, Normal/Normal c. Bühlmann Credibility Continuous d. Bühlmann Credibility Discrete e. Bayesian Analysis Discrete f. Bayesian Analysis Continuous g. Nonparametric Empirical Bayes
READINGS	
<ul style="list-style-type: none"> • Tse, Chapters 6.1-6.3, 7.1-7.4, 8.1-8.2, and 9.1-9.2 	



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B. Linear Mixed Models

Range of weight for Section B: 15-35 percent

This section covers linear models that use a form of credibility weighting for a designated subset of variables in the model called random effects. The candidates will be expected to understand the concepts of shrinkage for Linear Mixed Models as well as how to accommodate models with correlated observations or models where the variance is not assumed to be constant for each observation or a function of the mean. Mixed Models include both Gaussian (Linear Mixed Models) and non-Gaussian (Generalized Linear Mixed Models or Non-Linear Mixed Models) models. This section will only cover Linear Mixed Models. The candidate is expected to understand the linkage between shrinkage and credibility weighting, how to select the appropriate model to induce credibility weighting at the appropriate level when setting up the model structure, and how to account for correlation in the residuals.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Understand the assumptions behind Linear Mixed Models and use that understanding to evaluate how to set up a Linear Mixed Effect Model design to best accomplish the goals of the modeling exercise	<p>a. Characteristics of random and fixed effects explanatory variables for Linear Mixed Models</p> <ul style="list-style-type: none">• How to identify a random effect variable• Interaction between fixed and random effect variables when calculating standard error of estimate <p>b. Implications of correlation matrix choice by model form for Linear Mixed Models</p> <ul style="list-style-type: none">• Independence assumption for observations• Repeated Measures/Longitudinal Studies• Correlation forms for random vs. fixed effect variables• Hierarchical model structure implementation of treatment and design structure• Explicitly model variance as a function of an explanatory variable



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>2. Understand the algorithms behind the numerical solutions for the Linear Mixed Model to enable interpretation of output from the statistical software employed in modeling to make appropriate choices when evaluating modeling options</p>	<ul style="list-style-type: none"> a. Restricted Maximum Likelihood b. Choice between Restricted Maximum Likelihood and Maximum Likelihood c. Estimable vs. predictable functions d. Best Linear Unbiased Predictor and interaction with fixed effects variables e. Shrinkage of Best Linear Unbiased Predictors f. Newton-Raphson vs. Fisher scoring vs. EM algorithm g. Bias in variance estimates of fixed effects h. Credibility adjusted degrees of freedom (Saiterwaite/Kenward Rodgers adjustments) i. Conditional vs. population estimate
<p>3. Understand and be able to select the appropriate model structure and variable selection for a Linear Mixed Model given the behavior of the data set to be modeled by interpreting the model diagnostics and or summary statistics on the variables available in the model along with any graphs depicting how the dependent variable behaves as a function of possible explanatory variables</p> <p>Range of weight for Learning Objectives B.1 through B.3 collectively: 15-35 percent</p>	<ul style="list-style-type: none"> a. Units of replication b. Randomized block designs c. Implication of random effects for model prediction d. Interaction terms for fixed effects vs. random effect variables e. Model selection when covariance structure changes f. Covariance structure g. Selection of fixed vs. random effect class for mixed effect explanatory variables h. Explicitly model variance i. Marginal Model and Implied Marginal Model j. Residual graphs evaluating normality and constant variable assumptions k. Hypothesis tests for fixed and random effects l. Intraclass correlation coefficient m. Know when nested model comparisons are appropriate n. Application of AIC & BIC relative measures of goodness of fit o. Application of Scatter Plots and Box Plots as an aid to model design



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
READINGS	
<ul style="list-style-type: none"> West, Chapters 1, 2 (excluding 2.9.6), 3-8, and Appendix B, Additional Notes on Shrinkage (http://www-personal.umich.edu/~bwest/shrinkage.doc) <p>Chapters 1 and 2 contain an introduction to the modeling concepts underlying Linear Mixed Effect model. Chapters 3 through 8 contain examples that illustrate how to build a Linear Mixed Effect model to accommodate different circumstances. The chapters covering the examples include code from different software packages including SAS, R, SPSS, and HLM. Candidates should focus on understanding the design choices made in modeling, the output from those packages, and how that output was interpreted. Comments on how to make design choices and/or the type of hypothesis test to be employed at a given point in the modeling process expand on the introduction to modeling concepts covered in Chapters 1 and 2 and are a vital part of the reading from West.</p> <p>The matrix notations employed in the readings for specifying linear model forms will be adopted for exam question from this section. Additionally, the format for model output will match that as provided by R software.</p> <p>Similarly, exam questions from this section may contain parameter tables and diagnostic tables or plots of the type shown in the text. Candidates should understand how to interpret these tables. Candidates who become familiar with a statistical language capable of generating this type of output, such as R, will have an easier time understanding and applying the concepts covered in the syllabus material. In particular, candidates that work with the R code examples in the West textbook, along with the datasets provided, will have a better grasp of the material than that obtained by simply reading the textbook. However, for exam questions from this Section, candidates will not be explicitly tested on software code.</p> <p>The book's website has made available the datasets and code introduced in the chapters. It can found at http://www-personal.umich.edu/~bwest/almmussp.html.</p>	



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C. Bayesian Analysis and Markov Chain Monte Carlo

Range of weight for Section C: 40-60 percent

This section covers current techniques in use to apply Bayesian statistics to modeling problems where conjugate prior distributions may not be the best choice. The candidate is expected to be able to apply Bayesian techniques, to understand a model, and to evaluate the resulting goodness of fit by interpreting the diagnostics that are described below. The candidate is also expected to understand why the Bayesian approach is different than the classical (frequentist) procedures.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Understand basis and basics of Bayesian analysis and incorporate that understanding when interpreting model results <ul style="list-style-type: none"> • Difference between Bayesian and classical (frequentist) procedures • How probability is used as a measure of uncertainty • Components of a Bayesian model • Use of simulation to create predictive distributions • Summarizing posterior distributions 	a. Bayes' rule b. Subjectivity c. Likelihood d. Prior distribution e. Posterior distribution f. Posterior predictive distribution g. Credible, confidence, highest posterior density, and prediction intervals
2. Evaluate the different options available when creating and using Bayesian models for a given modeling assignment. Understand how to set up a Bayesian MCMC model and evaluate how a given set of design choices affects the results of a model <ul style="list-style-type: none"> • Recognize benefits and limitations of different kinds and parameterizations of priors • Calculating posterior and posterior predictive distributions for single and multi-parameter models • Linear Regression • Mixture models • Hierarchical models 	a. Conjugacy b. Proper and improper priors c. Informative, non-informative, and regularizing priors d. Hyperparameters e. Exchangeability f. Transformations of parameters g. Sampling from posterior distribution h. Regularization i. Pooling and shrinkage j. Varying effects of intercepts and slopes k. Gaussian Process Regression for continuous varying effects



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
<p>3. Understand Bayesian computation, how Markov Chain Monte Carlo methods are used, and how to evaluate model performance. Interpret and calculate diagnostics of simulation performance to evaluate when a given modeling approach should be used.</p> <ul style="list-style-type: none"> • Simulation and sampling • Conditional sampling • Convergence assessment • Efficient samplers • Hamiltonian Monte Carlo 	<ul style="list-style-type: none"> a. Shortcomings of grid and quadratic approximation b. Markov chains c. Gibbs sampler d. Metropolis and Metropolis-Hastings algorithms e. Warm-up / Burn-in f. Convergence in parameter estimate measurement g. Trace plot h. Acceptance rate i. Within-sequence correlation j. Thinning k. Effective number of samples l. Potential scale reduction (R-Hat or Gelman-Rubin statistic) m. Advantage of Hamiltonian Monte Carlo
<p>4. Understand how to apply model checking, evaluation, comparison, and expansion techniques as an aid to interpreting and evaluating model diagnostics</p> <ul style="list-style-type: none"> • Know how to check model fit to data • Understand limitations of various tests • Understand and calculate measures of model predictive accuracy • Understand and calculate information criteria, their uses and limitations (e.g. bias, dependence on prior, etc.) • Compare models via predictive performance measures • Understand how models can be expanded and what further checks may be needed <p>Range of weight for Learning Objectives C.1 through C.4 collectively: 40-60 percent</p>	<ul style="list-style-type: none"> a. Sensitivity analysis b. External validation c. Posterior predictive checking d. Predictor residual plots e. Counterfactual plots f. Marginal vs population average posterior predictions g. Log predictive density h. Out-of-sample predictive accuracy i. Information criteria measures (AIC, DIC, WAIC) j. Effective number of parameters k. Cross-validation (LOO-CV) l. Model averaging



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LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
READINGS	
<ul style="list-style-type: none">• Ford• McElreath, Chapters 2, 3, 4, 5, 6, 8, 9.2, 10, 11, 12, and 13 <p>While candidates will not be explicitly tested on software code, they are encouraged to work the exercises in the material to get hands-on, practical experience building and interpreting Bayesian models.</p> <p>For instruction on how to obtain the required software and configure the computing environment to run the examples in McElreath, candidates can read the 'Front Matter' section of the text and visit the author's website at http://xcelab.net/rm/software/.</p> <p>For a copy of the R programs in the Ford study note, candidates can find them under mcmc_algorithms.R at https://github.com/pford221/mcmc_algorithms/.</p>	



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D. Statistical Learning

Range of weight for Section D: 10-20 percent

This section introduces candidates to a sample of foundational statistical learning techniques. Both supervised and unsupervised techniques are detailed in the readings and candidates should be able to distinguish between them. The supervised learning techniques are non-parametric in nature, meaning the model cannot easily be described in an equation form – they tend to model flexible, non-linear hypotheses well. The unsupervised learning techniques are useful for reducing the dimensions of the data to aid in the profiling of the data or to facilitate more efficient learning from the data. Candidates are expected to understand the mechanics of these algorithms and recognize their inherent strengths and weaknesses so as to be able to select the most appropriate procedure for the learning task at hand.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Understand the computations behind K-nearest neighbors (KNN) and be able to explain how it works in practice and its relationship with Bayes classifier.	<ul style="list-style-type: none"> a. Classification versus regression for supervised learning b. Bayes classifier c. KNN decision boundary versus Bayes decision boundary
2. Understand the computations involved in building decision trees, the purpose of tree pruning, and how extensions such as bagging, random forest, and boosting can improve the prediction accuracy of tree-based methods.	<ul style="list-style-type: none"> a. Recursive binary splitting for decision trees b. Pruning for decision trees c. Comparison of decision trees versus linear models d. Advantages and disadvantages of decision trees e. Bagging and OOB Error f. Similarity and differences between bagging and random forest g. Sequential learning via boosting h. Gini/entropy application for splitting
3. Understand the purpose of, and the computations behind principle components analysis (PCA) and be able to interpret related software outputs.	<ul style="list-style-type: none"> a. Loading vector and scores for principle component b. Effect of scaling on PCA c. Proportion of variance explained by PCA and scree plots d. Combining many dimensions (variables) into fewer e. Compare purpose of PCA to K-means
4. Be familiar with purpose of, and the computations behind clustering procedures and be able to interpret related software outputs.	<ul style="list-style-type: none"> a. K-means clustering algorithm b. Agglomerative hierarchical clustering algorithm c. Dendrogram d. Dissimilarity measure



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Modern Actuarial Statistics-II – Exam MAS-II

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
Range of weight for Learning Objectives D.1 through D.4 collectively: 10-20 percent	
READINGS	
<ul style="list-style-type: none">James et al., Chapters 1 (Background reading only), 2.2.3, 8, and 10. Exam questions will not be sourced directly from Chapter 1. <p>Programming labs found in sections 2.3, 8.3, and 10.4 demonstrate the implementation of topics covered in the sections above with R, but no new concepts are introduced here. These labs show how to load and work with datasets made available in the ISLR package in R. For information on how to install and load R packages, please refer to section 3.6.1. Examination questions will not explicitly test software code, but careful review of these sections will greatly help the candidates understand and apply these concepts.</p>	



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Complete Text References for Exam MAS-II

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Ford, P., "MCMC Algorithms," CAS Study Note, Version 0.5, April 2018.	Ford	C3	OP
James, G., et al., <i>An Introduction to Statistical Learning, with Application in R</i> , 1 st ed. 2013, Corr. 8 th printing, Springer, 2017. Note: Although page iv of the text identifies it as the corrected 8 th printing, the publisher refers to it as the corrected 7 th printing. Candidates should use the version found in the Complete Online Text References web page for this exam.	James et al.	D1-D4	OP
McElreath, R., <i>Statistical Rethinking: A Bayesian Course with Examples in R and Stan</i> , CRC Press, 2016.	McElreath	C1-C4	B
Tse, Y., <i>Nonlife Actuarial Models, Theory Methods and Evaluation</i> , Cambridge University Press, 2009.	Tse	A1-A8	B
West, B. T.; Welsh, K. B.; and Galecki, A. T., <i>Linear Mixed Models: A Practical Guide Using Statistical Software</i> , 2nd Edition, CRC Press, 2015.	West	B1-B3	B

Source Key

B	Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
NEW	Indicates new or updated material.
OP	All text references marked as Online Publications will be available on a web page titled Complete Online Text References.
SK	Material included in the 2018 Study Kit.
SKU	Material included in both the 2018 CAS Study Kit and the 2018 Update to the 2017 Study Kit.

Items printed in **red** indicate an update, clarification, or change.



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Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for this exam. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

ACTEX Learning (Mad River Books), 4 Bridge Street, P.O. Box 715, New Hartford, CT 06057; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: support@actexamdriver.com ; website: www.actexamdriver.com .

Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; website: http://www.actuarialbookstore.com .

Cambridge University Press, 1 Liberty Plaza, Floor 20, New York, NY 10006 (U.S. address); telephone: (212) 337-5000; e-mail: customer_service@cambridge.org ; website: http://www.cambridge.org .
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Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org ; website: www.casact.org .

CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742; website: http://www.crcpress.com

Springer Science+Business Media LLC, 233 Spring Street, New York, New York, 10013; website: http://www.springer.com .



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Notice about the 2nd Edition

2nd Edition: CAS Online Course 1/CA1, 2nd Edition, is the current version that was effective on September 1, 2014. Exams on this content were offered for the first time on January 15, 2015.

Risk Management and Insurance Operations is called Online Course 1 by the CAS and CA1, 2nd Edition, by The Institutes. Prometric lists this course as CAS1 on its Web site under The Institutes.

Online Course 1/CA1 prepares CAS candidates for a two-hour, seventy-five-point multiple-choice examination. The online course and exam were developed collaboratively with The Institutes. The online course is available through the [Casualty Actuarial Society Online Courses Web Page](#) on The Institutes' Web Site. Similarly, the exam is administered by The Institutes at Prometric test centers during four, two-month testing windows annually.

The CAS will grant a waiver of CAS Online Course 1 to those who have the Chartered Property Casualty Underwriter (CPCU) designation.

The study material for CAS Course 1/CA1 is contained in the online course access. The fee for access to the online course includes one attempt at passing the exam. Candidates are required to purchase the online course to obtain access to the exam. Exam retakes may be purchased separately if needed.

Purchasing the course requires that candidates declare the testing window in which they are planning to take the exam. To register for the exam, a candidate must:

- Call The Institutes at (800) 644-2101 or (610) 644-2100, extension 6000, to register for the exam itself. This will place the candidate on an eligibility list for Prometric.
- Then make an appointment with Prometric for a specific date and time during the testing window. Early registration for the exam is strongly encouraged as seats fill quickly. There is a \$105 fee for changing testing windows.
- Schedule your appointment when you know you will be ready to sit for the exam. Effective January 1, 2012, Prometric will charge a \$50 fee to candidates who reschedule their appointments between 3 to 12 business days of a test date. Changes to the appointment date/time are not permitted within 3 business days of the appointment.

Questions or concerns regarding CAS Online Course 1/CA1 should be directed to The Institutes' Customer Service Department at (800) 644-2101 or (610) 644-2100, extension 6000, or CustomerService@TheInstitutes.org.



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Assignment 1: Introduction to Risk Management

MODULE TITLE	LEARNING OBJECTIVES
Understanding and Quantifying Risk	Describe each of the following in the context of risk: <ul style="list-style-type: none">• Uncertainty• Possibility• Possibility compared with probability
Classifications of Risk	Explain how the following classifications of risk apply and how they help in risk management: <ul style="list-style-type: none">• Pure and speculative risk• Subjective and objective risk• Diversifiable and nondiversifiable risk• Quadrants of risk (hazard, operational, financial, and strategic)
Financial Consequences of Risk	Describe the three financial consequences of risk.
Basic Purpose and Scope of Risk Management	Describe the basic purpose and scope of risk management in terms of the following: <ul style="list-style-type: none">• How risk management is practiced by individuals and organizations• The basic distinction between traditional risk management and enterprise-wide risk management
Loss Exposures	Describe the following elements of property, liability, personnel, and net income loss exposures: <ul style="list-style-type: none">• Assets exposed to loss• Causes of loss, including associated hazards• Financial consequences of loss
Risk Management Benefits	Describe the benefits of risk management and how it reduces the financial consequences of risk for individuals, organizations, and society.
Risk Management Program Goals	Summarize pre-loss and post-loss risk management program goals and the conflicts that can arise as they are implemented.
The Risk Management Process	Describe each of the steps in the risk management process



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Assignment 2: Risk Control

MODULE TITLE	LEARNING OBJECTIVES
Risk Control Techniques	<p>Describe the six categories of risk control techniques in terms of the following:</p> <ul style="list-style-type: none">• Whether each reduces loss frequency, reduces loss severity, or makes losses more predictable• How each can be used to address a particular loss exposure• How they differ from one another
Risk Control Goals	<p>Explain how an organization can use risk control techniques and measures to achieve the following risk control goals:</p> <ul style="list-style-type: none">• Implement effective and efficient risk control measures• Comply with legal requirements• Promote life safety• Ensure business continuity
Application of Risk Control Techniques	<p>Explain how risk control techniques can be applied to property, liability, personnel, and net income loss exposures.</p>
Business Continuity Management	<p>Describe business continuity management in terms of its scope, the process used to implement it, and the contents of a typical business continuity plan.</p>



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Assignment 3: Risk Financing

MODULE TITLE	LEARNING OBJECTIVES
Risk Financing Goals	<p>Explain how individuals or organizations can achieve their overall and risk management goals by fulfilling the following risk financing goals:</p> <ul style="list-style-type: none">• Pay for losses• Manage the cost of risk• Manage cash flow variability• Maintain an appropriate level of liquidity• Comply with legal requirements
Retention and Transfer	<p>Describe the following aspects of retention and transfer:</p> <ul style="list-style-type: none">• Retention funding measures• Limitations on risk transfer measures• The advantages of both retention and transfer
Selecting Appropriate Risk Financing Measures	<p>Explain how the following can affect the selection of the appropriate risk financing measure:</p> <ul style="list-style-type: none">• Ability of a risk financing measure to meet risk financing goals• Loss exposure characteristics• Characteristics specific to an individual or organization
Risk Financing Measures	<p>Explain how an organization meets its risk financing goals by using the following risk financing measures:</p> <ul style="list-style-type: none">• Guaranteed cost insurance• Self-insurance• Large deductible plans• Captives• Finite risk plans• Pools• Retrospective rating plans• Hold-harmless agreements• Capital market solutions



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Assignment 4: Enterprise-Wide Risk Management

MODULE TITLE	LEARNING OBJECTIVES
Traditional Risk Management Versus ERM	Contrast traditional risk management and ERM.
Improving Strategic Decision Making With ERM	Explain how an organization can improve its strategic decision-making by incorporating enterprise-wide risk management (ERM).
ERM in Approaching Business Uncertainties	Explain why ERM is an effective approach to use to face business uncertainties.
Major Risk Management Frameworks and Standards	Summarize the main risk management frameworks and standards.

Assignment 5: Insurance as a Risk Management Technique

MODULE TITLE	LEARNING OBJECTIVES
How Insurance Reduces Risk	Explain how insurance reduces risk through pooling.
Benefits of Insurance	Explain how insurance benefits individuals, organizations, and society.
Characteristics of an Ideally Insurable Loss Exposure	Explain why each of the six characteristics of an ideally insurable loss exposure is important to the insurance mechanism.
Insurability of Commercial Loss Exposures	Explain how the six characteristics of an ideally insurable loss exposure apply to commercial loss exposures.
Insurability of Personal Loss Exposures	Explain how the six characteristics of an ideally insurable loss exposure apply to personal loss exposures.
Government Insurance Programs	Explain how state and federal governments are involved in the insurance market and the rationale for, and level of, their involvement.



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Assignment 6: Overview of Insurance Operations

MODULE TITLE	LEARNING OBJECTIVES
Classifications of Insurers	Explain how insurers have organized to provide property-casualty insurance.
Insurer Goals	Describe the major goals of an insurer.
Constraints on Achieving Insurer Goals	Describe the internal and external constraints that impede insurers from achieving their major goals.
Measuring Insurer Performance	Describe the measurements used to evaluate how successful an insurer is at meeting its established goals.
Functional View of Insurance	Describe the core and supporting functions performed by insurers.

Assignment 7: Insurance Marketing and Distribution

MODULE TITLE	LEARNING OBJECTIVES
Property-Casualty Insurance Marketplace	Describe the following attributes of the competitive property-casualty insurance marketplace: distinguishing characteristics of insurance customers, insurer marketing differentiations, and unique factors in the insurance marketplace.
Insurer Marketing Activities	Explain how typical insurer marketing activities are performed and why they are performed.
Insurance Distributions Systems and Channels	Describe the main types of insurance distribution systems and channels, including the principal characteristics that distinguish one distribution system from another.
Functions of Insurance Producers	Describe the functions performed by insurance producers.
Distribution System and Channel Selection for Insurance Marketing	Describe the key factors an insurer should evaluate during the distribution-system and distribution-channel selection process.



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Assignment 8: The Underwriting Function

MODULE TITLE	LEARNING OBJECTIVES
Purpose of Underwriting	Describe the purpose of underwriting.
Underwriting Activities	Describe the underwriting activities typically performed by line and staff underwriters.
Underwriting Authority	Describe the importance of compliance with underwriting authority in individual account selection.
Constraints in Establishing Underwriting Policy	Describe the constraining factors considered in the establishment of underwriting policy.
Implementing Underwriting Policy	Describe the purposes that underwriting guidelines and underwriting audits serve.
Steps in the Underwriting Process	Summarize the steps in the underwriting process and the purpose of each.
Measuring Underwriting Results	Explain how an insurer's underwriting results are measured and how financial measures can be distorted.

Assignment 9: Underwriting Property and Liability Insurance

MODULE TITLE	LEARNING OBJECTIVES
Underwriting Property Insurance Using the COPE Model	Describe in detail each of the COPE factors used to evaluate property loss exposures.
Property Policy Provision Underwriting Considerations	Explain how insurable interest, policy provisions for valuing losses, and insurance to value affect a loss payment amount under property insurance.
Measures of Potential Loss Severity	Explain how underwriters use policy amount, amount subject, normal loss expectancy (NLE), probable maximum loss (PML), and maximum foreseeable loss (MFL) to measure potential loss severity.
Underwriting Business Income and Extra Expense Coverage	Describe the underwriting considerations for business income and extra expense coverage.
Underwriting Commercial Crime Insurance	Describe the underwriting considerations and risk control techniques associated with employee dishonesty and crimes committed by others.



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MODULE TITLE	LEARNING OBJECTIVES
Underwriting Commercial General Liability Insurance	Describe the loss exposures and the underwriting considerations for commercial general liability insurance.
Underwriting Personal and Commercial Auto Insurance	Describe the underwriting considerations for personal and commercial auto insurance.

Assignment 10: Risk Control and Premium Auditing

MODULE TITLE	LEARNING OBJECTIVES
Insurer Risk Control Goals	Describe the goals of insurer risk control activities.
Risk Control Services Provided by Insurers	Describe the risk control services provided by insurers.
Cooperation Between Risk Control and Other Insurer Functions	Explain how risk control cooperates with other insurer functions.
Reasons for Premium Auditing	Explain why premium audits are conducted.
Premium Auditing Process	Describe the premium auditing process.
Importance of Accurate Premium Audits	Explain why premium audits must be accurate.
Premium Auditing Contributions	Explain how premium auditing contributes to other insurer functions.

Assignment 11: The Claim Function

MODULE TITLE	LEARNING OBJECTIVES
Overview of the Claim Function	Identify the goals of the claim function; the users of claim information, and the parties with whom claim personnel interact.
Claim Department Structure, Personnel, and Performance	Describe the claim departments in terms of the following: <ul style="list-style-type: none">• How they are structured• The types and functions of claim personnel• How their performance can be measured



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MODULE TITLE	LEARNING OBJECTIVES
Measures Used to Ensure Regulatory Compliance	Explain how the following measures are used to ensure regulatory compliance: <ul style="list-style-type: none">• Claim guidelines, policies, and procedures• Controls• Supervisor and manager reviews• Claim audits
Activities in the Claim Handling Process	Summarize the activities performed in the claim handling process and the purpose of each.
The Framework for Coverage Analysis and the Claim Handling Process Case Study	Given a claim scenario, demonstrate how a claim representative can use the claim handling process and framework for coverage analysis to resolve a claim.

Assignment 12: Adjusting Property and Liability Claims

MODULE TITLE	LEARNING OBJECTIVES
Property Claim Handling Process	Explain how and why the activities in the framework for handling property claims are accomplished.
Handling Specific Types of Property Claims	Describe the challenges of handling the following types of property claims: <ul style="list-style-type: none">• Residential dwelling claims• Residential personal property claims• Commercial structure claims• Business income claims• Merchandise claims• Transportation and bailment claims• Catastrophe claims
Liability Claim Handling Process	Explain how and why the activities in the framework for handling a liability claim are accomplished.



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MODULE TITLE	LEARNING OBJECTIVES
Handling Specific Types of Liability Claims	<p>Describe the challenges of handling each of the following types of claims:</p> <ul style="list-style-type: none">• Auto bodily injury liability claims• Auto property damage claims• Premises liability claims• Operations liability claims• Products liability claims• Workers compensation claims• Professional liability claims

Assignment 13: Reinsurance Principles and Concepts

MODULE TITLE	LEARNING OBJECTIVES
Reinsurance and Its Functions	Describe reinsurance and its principal functions.
Reinsurance Sources	Describe the three sources of reinsurance.
Reinsurance Transactions	Describe treaty reinsurance and facultative reinsurance.
Types of Pro Rata and Excess of Loss Reinsurance	Summarize the types of pro rata reinsurance and excess of loss reinsurance and their uses.
Alternatives to Traditional Reinsurance	Describe finite risk reinsurance and other methods that rely on capital markets as alternatives to traditional and non-traditional reinsurance.
Reinsurance Program Design	Describe the factors that should be considered in the design of a reinsurance program.
Reinsurance Program Design Case Studies	Given a case, identify the reinsurance needs of an insurer and recommend an appropriate reinsurance program to meet those needs.



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Assignment 14: Insurer Strategic Management

MODULE TITLE	LEARNING OBJECTIVES
Strategic Management Process	Describe the strategic management process.
The Five Forces and SWOT Methods of Analyzing the Environment	Explain how the Five Forces and SWOT methods can be used to analyze the environment in which an insurer operates.
Determining Strategy at Different Organizational Levels	Explain how strategies are developed at the corporate, business, functional, and operational levels.
Insurers Global Expansion	Describe the strategic reasons, considerations, and approaches for insurers to expand their operations globally.
Strategic Management Case Study	Given information about an insurer's business strategies, conduct a SWOT analysis to evaluate its strategy.

Assignment 15: The Underwriting Cycle

MODULE TITLE	LEARNING OBJECTIVES
The Insurance Underwriting Cycle	Describe the phases of the insurance underwriting cycle and the strategies normally used by insurers and producers during each phase.
Financial Factors Influencing the Underwriting Cycle	Explain how the following financial factors influence underwriting cycles <ul style="list-style-type: none">• Investment income• Capacity• Return on equity• Cash flow
Effects of Supply and Demand on the Underwriting Cycle	Explain how the theory of demand and supply applies to insurance and the underwriting cycle.



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Assignment 16: Actuarial Data Management

MODULE TITLE	LEARNING OBJECTIVES
Data Quality	Summarize: <ul style="list-style-type: none"> The concepts of data quality and information quality The impact of data quality on the actuarial work product
Principles of Data Quality	Given a principle of data quality, provide an example that illustrates the principle.
Data Quality—ASOP No. 23	Given a concept from the Actuarial Standard of Practice No. 23, provide an example of its application or use.
Life Cycle for Insurance Data	For each step in the life cycle for insurance data, describe the purpose, the responsible parties, and errors typically encountered.
Metadata	Summarize metadata including: <ul style="list-style-type: none"> How metadata are defined The actuary's role in creating and sharing metadata How metadata are shared across an organization The data collected under different statistical plans
The Need for Aggregate Insurance Statistical Data	Explain the regulatory and business needs for statistical data.
Types of Statistical Plans	Summarize the relationship of Statistical Plans to insurance rating elements and the two basic types of Statistical Plans: <ul style="list-style-type: none"> Summary-based Statistical Plans Transaction-based Statistical Plans
Insurance Data Elements: Date Fields and Amount Fields in Statistical Plans	Describe the functions of the date field and amount field data elements in a statistical plan.
Insurance Data Elements: Classification or Rating Variable Fields and Exposure Data Elements	Describe the following statistical plan data elements by line of business: <ul style="list-style-type: none"> Classification and Rating Elements Exposure



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Risk Management and Insurance Operations
CAS Online Course 1

MODULE TITLE	LEARNING OBJECTIVES
Techniques and Applications to Improve Information Quality	Summarize the following data quality analysis concepts: <ul style="list-style-type: none">• Exploratory data analysis• Data cubes• Identifying missing data• Descriptive statistics• Box and whisker plots
Auditing Data and the Actuary's Responsibility in Assessing Data Reasonability	Explain the following: <ul style="list-style-type: none">• The purpose and steps of data auditing• An actuary's responsibility in assessing data reasonability



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Study Materials for CAS Online Course 1

The online course itself contains learning objectives and all the educational material to meet these objectives and successfully complete the exam. The course fee includes one attempt at the exam.

The following printed materials are supplemental and may also be purchased from The Institutes, but are not required:

- **Textbook** contains material that is identical to the online course—only in a hardcopy format.
- **Review Notes** is a condensed version of the textbook.
- **Course Guide** contains sample questions and answers.
- **Flashcards** contain key words and phrases.

The materials described above may be purchased individually or in various package combinations.

Questions about potentially defective questions or material should be directed to The Institutes' Customer Service Department at (800) 644-2101 or (610) 644-2100, extension 6000, or CustomerService@TheInstitutes.org.

Publisher and Distributor

CAS Online Course 1/CA1 is available through The Institutes.

The Institutes, 720 Providence Road, Suite 100, Malvern, PA 19355-3433; telephone: (800) 644-2101 or (610) 644-2100 extension 6000; E-mail: CustomerService@TheInstitutes.org ; Website Page for CAS Online Courses: www.aicpcu.org/cas.htm .
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Exam Results

Candidates taking this computer-based test will receive unofficial pass/fail results at the conclusion of their exam. The unofficial pass/fail result will be displayed on the computer screen at the conclusion of the exam. In most test centers, a printed copy of the candidate's unofficial pass/fail result will be available upon completion of the computer-based test from the proctor in the administrative area outside the testing room. The candidate, however, should carefully read the result that is displayed on the computer screen at the conclusion of the exam.

When the official grades have been processed, candidates will receive an e-mail from The Institutes stating that their grades are available. Candidates may then log into their account on The Institutes Website (www.TheInstitutes.org) to access their grades. The grade report for each candidate will show the candidate's overall score on the exam in ten point increments (e.g., 60 to 69%, 70 to 79%, and so on). It will similarly show the candidate's performance by assignment using those same ten point increments.



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Notice about the 3rd Edition

3rd Edition: The CAS Online Course 2/CA2, 3rd Edition, reflects changes in commercial coverage forms and the addition of a new assignment on life insurance, annuities and health insurance. The 3rd Edition became available on September 1, 2015. Exams on this content were offered for the first time on January 15, 2016.

Insurance Accounting, Coverage Analysis, Insurance Law, and Insurance Regulation is called Online Course 2 by the CAS and CA2, 3rd Edition, by The Institutes. Prometric lists this course as CAS2 on its website under The Institutes.

Online Course 2/CA2 prepares CAS candidates for a two-hour, seventy-five-point, multiple-choice examination. The online course and exam were developed collaboratively with The Institutes. The online course is available through the [Casualty Actuarial Society Online Courses Web Page](#) on The Institutes' website. Similarly, the exam is administered by The Institutes at Prometric test centers during four, two-month testing windows annually.

The study material for CAS Course 2/CA2 is contained in the online course access. The fee for access to the online course includes one attempt at passing the exam. Candidates are required to purchase the online course to obtain access to the exam. Exam retakes may be purchased separately if needed.

Purchasing the course requires that candidates declare the testing window in which they are planning to take the exam. To register for the exam, a candidate must:

- Call The Institutes at (800) 644-2101 or (610) 644-2100, extension 6000, to register for the exam itself. This will place the candidate on an eligibility list for Prometric.
- Then make an appointment with Prometric for a specific date and time during the testing window. Early registration for the exam is strongly encouraged as seats fill quickly. There is a \$105 fee for changing testing windows.
- Schedule your appointment when you know you will be ready to sit for the exam. Effective January 1, 2012, Prometric will charge a \$50 fee to candidates who reschedule their appointments between 3 to 12 business days of a test date. Changes to the appointment date/time are not permitted within 3 business days of the appointment.

Questions or concerns regarding CAS Online Course 2/CA2 should be directed to The Institutes' Customer Service Department at (800) 644-2101 or (610) 644-2100, extension 6000, or CustomerService@TheInstitutes.org.



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Assignment 1: Introductory Insurance Accounting

MODULE TITLE	LEARNING OBJECTIVES
Qualitative Accounting Information Criteria	<p>Explain the following qualitative accounting information criteria:</p> <ul style="list-style-type: none">• Understandability• Relevance• Reliability• Comparability and consistency• Lack of bias• Cost-benefit effectiveness
Types of Accounting Frameworks	<p>Describe the frameworks and the intended users and focus of each of the following sets of accounting frameworks:</p> <ul style="list-style-type: none">• Generally Accepted Accounting Principles (GAAP) accounting• Regulatory/supervisory accounting• Tax accounting• Management accounting
Accounting Frameworks and Rule Hierarchies	<p>Explain the concept of a rule hierarchy and the sources of the following accounting frameworks:</p> <ul style="list-style-type: none">• Generally Accepted Accounting Principles (GAAP)• Regulatory/supervisory accounting• Tax accounting
Selected Accounting Concepts	<p>Summarize the following accounting concepts:</p> <ul style="list-style-type: none">• Fair value versus historical cost• Recognition versus measurement• Deferral-matching versus asset-liability• Impairment• Revenue recognition• Reporting segment• Liquidation versus going concern• Change in accounting principle versus change in accounting estimate• Principle-based versus rule-based



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Insurance Accounting, Coverage Analysis,
Insurance Law, and Insurance Regulation
CAS Online Course 2

MODULE TITLE	LEARNING OBJECTIVES
Fundamentals of Insurer Financial Statements	<p>Describe the purpose and primary components of these key schedules of an insurer's financial statements:</p> <ul style="list-style-type: none">• Balance sheet• Income statement• Cash flow statement• Notes and disclosures
Premium Accounting—Revenue Recognition	<p>Explain how and when insurers recognize premium revenue in their financial statements under deferral-matching and asset-liability approaches.</p>
Premium Accounting—Types of Written Premium	<p>Distinguish between the various types of written premium and policy transactions that may not be classified as premium.</p>
Other Premium Accounting Issues	<p>Summarize the implications of these premium accounting issues:</p> <ul style="list-style-type: none">• Financing—premiums versus service charges• Earning premium before it is written• Extended reporting endorsements (definite versus indefinite periods)• Reinsurance lags• Large deductible credits
Unearned Premium	<p>Summarize the purpose of unearned premium and these issues associated with how premiums are earned over time:</p> <ul style="list-style-type: none">• Pro rata and non-pro rata approaches to earning premium• Multiyear policies• Liability adequacy test and the premium deficiency reserve
The Relationship Between Loss Reserves and the Unearned Premium Reserve	<p>Explain the relationship between loss reserves and the unearned premium reserve.</p>



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Insurance Accounting, Coverage Analysis,
Insurance Law, and Insurance Regulation
CAS Online Course 2

MODULE TITLE	LEARNING OBJECTIVES
Loss and Loss Adjustment Expense Accounting	<p>Describe the following issues related to loss and loss adjustment expense (LAE) accounting:</p> <ul style="list-style-type: none">• Loss accounts• Loss cycle• Paid loss versus cash payment• Recoverable amounts• Accounting for discounted reserves• Self-insurer issues
Reinsurance Accounting Basics	<p>Explain the accounting and financial reporting considerations, including how values in insurers' financial reports are influenced by lags in the reporting of reinsurance transactions and bordereau reporting, for these types of reinsurance:</p> <ul style="list-style-type: none">• Assumed reinsurance• Ceded reinsurance• Commutations• Prospective versus retroactive reinsurance
Deposit Accounting	<p>Explain the conditions under which an accounting framework may require deposit accounting for an insurance contract, and the operation of three general forms of deposit accounting rules.</p>

Assignment 2: Insurance Policy Analysis

MODULE TITLE	LEARNING OBJECTIVES
Distinguishing Characteristics of Insurance Policies	<p>Describe the following characteristics of insurance policies, including common exceptions to these characteristics.</p> <ul style="list-style-type: none">• Indemnity• Utmost good faith• Fortuitous losses• Contract of adhesion• Exchange of unequal amounts• Conditional• Nontransferable



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Insurance Accounting, Coverage Analysis,
Insurance Law, and Insurance Regulation
CAS Online Course 2

MODULE TITLE	LEARNING OBJECTIVES
Structure of Insurance Policies	Describe these approaches to insurance policy structure and how they can affect policy analysis: <ul style="list-style-type: none">• Self-contained and modular policies• Preprinted and manuscript policies• Standard and nonstandard forms• Endorsements and other related documents
Types of Policy Provisions	Describe the purpose(s) and characteristics of each of these types of policy provisions in a property-casualty insurance policy: <ul style="list-style-type: none">• Declarations• Definitions• Insuring agreements• Exclusions• Conditions• Miscellaneous provisions
Insurance Policy Analysis	Describe the primary methods of insurance policy analysis.

Assignment 3: Common Policy Concepts

MODULE TITLE	LEARNING OBJECTIVES
Insurable Interest	Given a case, evaluate one or more entities' insurable interests.
Insurance to Value	Explain why insurance to value is important to property insurers, how insurers encourage insurance to value, and what insureds can do to address the problems associated with maintaining insurance to value.
Property Valuation Methods	Explain how property is valued under each of the following valuation methods in property insurance policies: <ul style="list-style-type: none">• Actual cash value• Replacement cost• Agreed value• Functional valuation



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MODULE TITLE	LEARNING OBJECTIVES
Valuation of Liability Claims	Explain how the amount payable for a claim covered under a liability insurance policy is determined.
Reasons for Property Deductibles	Explain how deductibles in property insurance benefit the insured.
Liability Deductibles and Self-Insured Retentions	Explain when and why deductibles and self-insured retentions are appropriate for use in liability insurance.
Other Sources Of Recovery	Describe the multiple sources of recovery that may be available to an insurance policyholder for a covered loss.

Assignment 4: Personal Auto Policy: Liability, Medical Payments, and Uninsured Motorist Coverage

MODULE TITLE	LEARNING OBJECTIVES
Overview of the Personal Auto Policy	Summarize the sections of the Personal Auto Policy.
Declarations	Identify the types of information typically contained on the declarations page of a personal auto policy.
Definitions	Define the words and phrases included in the definitions section of the Personal Auto Policy.
Part A - Liability Coverage	Summarize each of the provisions in Part A - Liability Coverage of the Personal Auto Policy.
Part A - Liability Coverage Case	Given a case describing an auto liability claim, determine whether Part A - Liability Coverage of the Personal Auto Policy would cover the claim and, if so, the amount the insurer would pay for the claim.
Part B - Medical Payments Coverage	Summarize each of the provisions in Part B - Medical Payments Coverage of the Personal Auto Policy.
Part B - Medical Payments Coverage Case	Given a case describing an auto medical payments claim, determine whether Part B - Medical Payments Coverage of the Personal Auto Policy would cover the claim and, if so, the amount the insurer would pay for the claim.
Part C - Uninsured Motorists Coverage	Summarize each of the provisions in Part C - Uninsured Motorists Coverage of the Personal Auto Policy.



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MODULE TITLE	LEARNING OBJECTIVES
UM/UIM Endorsements and State Variations	Describe underinsured motorists coverage in terms of: <ul style="list-style-type: none">• Its purpose• The ways in which it can vary by state
Part C - Uninsured Motorists Coverage Case	Given a case describing an uninsured motorists claim, determine whether Part C - Uninsured Motorists Coverage of the Personal Auto Policy would cover the claim and, if so, the amount the insurer would pay for the claim.

Assignment 5: Personal Auto Policy: Physical Damage, Duties After an Accident, Endorsements, General Provisions

MODULE TITLE	LEARNING OBJECTIVES
Part D - Damage to Your Auto Coverage	Summarize each of the provisions in Part D - Damage to Your Auto of the Personal Auto Policy.
Part D - Damage to Your Auto Coverage Case	Given a case describing an auto physical damage claim, determine whether Part D - Coverage for Damage to Your Auto of the Personal Auto Policy would cover the claim and, if so, the amount the insurer would pay for the claim.
Part E - Duties After an Accident or Loss	Identify the insured's duties following an auto accident or loss (Part E) covered by the Personal Auto Policy.
Part F - General Provisions	Summarize each of the general provisions in Part F of the Personal Auto Policy.
Common Endorsements to the Personal Auto Policy	Identify the Personal Auto Policy endorsements that are used to handle common auto loss exposures.
Personal Auto Coverage Case	Given a case describing an auto claim, determine whether the Personal Auto Policy would cover the claim and, if so, the amount the insurer would pay for the claim.

Assignment 6: Homeowners Property Coverage



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Insurance Accounting, Coverage Analysis,
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MODULE TITLE	LEARNING OBJECTIVES
ISO Homeowners Program	Describe how individuals and families can use the ISO Homeowners insurance program to address their personal risk management needs.
Homeowners Program Structure	Summarize these aspects of the 2011 Homeowners Program: <ul style="list-style-type: none">• Structure of the Homeowners Policy (HO-3)• Key changes in the ISO 2011 Program Revision• Factors important to rating homeowners insurance
HO-3 Section I - Property Coverages	Determine whether the 2011 HO-3 policy provisions in the following Section I - Property Coverages provide coverage for a given loss or loss exposure: <ul style="list-style-type: none">• Coverage A - Dwelling• Coverage B - Other Structures• Coverage C - Personal Property• Coverage D - Loss of Use• Additional Coverages
HO-3 Section I - Perils Insured Against and Exclusions	Summarize each of the 2011 HO-3 policy provisions: <ul style="list-style-type: none">• Perils Insured Against• Exclusions
HO-3 Section I - Conditions	Summarize each of the 2011 HO-3 policy provisions in Section I - Conditions.
2011 HO-3 Section I - Property Coverage Case	Given a scenario describing a homeowners property claim, determine whether the 2011 HO-3 Policy Section I - Property Coverages would cover the claim, and if so, the amount the insurer would pay for the claim.



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Assignment 7: Homeowners Liability, Conditions, Coverage Forms, and Endorsements

MODULE TITLE	LEARNING OBJECTIVES
HO-3 Section II - Liability Coverages	Determine whether the 2011 HO-3 Policy provisions in the following Section II - Liability Coverages provide coverage for a given loss or loss exposure: <ul style="list-style-type: none">• Coverage E - Personal Liability• Coverage F - Medical Payments to Others• Additional Coverages
HO-3 Section II - Exclusions	Determine whether one or more exclusions preclude the coverage provided by Section II of the 2011 HO-3 policy provisions in Section II - Exclusions.
HO-3 Section II - Conditions	Summarize each of these 2011 HO-3 policy provisions: <ul style="list-style-type: none">• Conditions applicable to Section II• Conditions applicable to Sections I and II
Homeowners Coverage Forms and Causes of Loss Comparison Summary to the HO-3	Compare the coverage provided by each of the following 2011 Homeowners policies to the coverage provided by the 2011 HO-3 policy: <ul style="list-style-type: none">• HO-2 Broad Form• HO-5 Comprehensive Form• HO-4 Contents Broad Form• HO-6 Unit-Owners Form• HO-8 Modified Coverage Form
Commonly Used Endorsements that Modify the 2011 ISO Homeowners Policies	Summarize the coverages provided by various 2011 ISO Homeowners policy endorsements.
HO-3 Coverage Case	Given a case describing a homeowners claim, determine whether a 2011 HO-3 Policy that may include one or more endorsements would cover the claim, and, if so, the amount the insurer would pay for the claim.



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Assignment 8: Life Insurance, Annuities and Health Insurance

MODULE TITLE	LEARNING OBJECTIVES
Premature Death Loss Exposures	<p>Describe the financial impact of the premature death personal loss exposure on the following types of family structures:</p> <ul style="list-style-type: none">• Singles without children• Single-parent families• Two-income families• Traditional families• Blended families• Sandwiched families
Types of Life Insurance	Summarize the various types of life insurance.
Sources of Life Insurance	Summarize the distinguishing characteristics of life insurance provided by each of the following sources: individual life insurance, group life insurance, and government-provided life insurance.
Common Life Insurance Contractual Provisions and Riders	Summarize the common life insurance contractual provisions and riders.
Individual Annuities	Summarize the various types of individual annuities.
Disability and Health-Related Personal Loss Exposures	Describe the financial impact of disability and other health-related personal loss exposures on individuals and families.
Disability Income Insurance	<p>Summarize the distinguishing characteristics of each of the following types of disability income insurance:</p> <ul style="list-style-type: none">• Individual disability income insurance• Group disability income insurance• Social Security disability income program
Health Insurance Plans	<p>Describe the characteristics of the following nongovernment programs for providing healthcare benefits:</p> <ul style="list-style-type: none">• Traditional health insurance plans• Managed-care plans• Consumer-directed health plans



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Assignment 9: Commercial Property Insurance, Part I

MODULE TITLE	LEARNING OBJECTIVES
Overview of the Commercial Property Insurance	Describe commercial property insurance in terms of these elements: <ul style="list-style-type: none">• The major categories of loss exposures that can be covered• The components of a commercial property coverage part
BPP Covered Property	Determine whether a described item of property qualifies as Covered Property under one or more of these categories in the Building and Personal Property Coverage Form: <ul style="list-style-type: none">• Building• Your Business Personal Property• Personal Property of Others
BPP Additional Coverages and Coverage Extensions	Determine which of the additional coverages and coverage extensions of the Building and Personal Property Coverage Form apply to a described loss.
Causes of Loss—Basic Form and Broad Form	Determine whether the cause of a described loss is a covered cause of loss under either the Causes of Loss—Basic Form or the Causes of Loss—Broad Form.
Cause of Loss—Special Form	Determine whether the cause of a described loss is a Covered Cause of Loss under the Causes of Loss—Special Form.
BPP Limits of Insurance and Deductibles	Apply the Limits of Insurance and Deductible provisions of the Building and Personal Property Coverage Form to a described loss.



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Assignment 10: Commercial Property Insurance, Part II

MODULE TITLE	LEARNING OBJECTIVES
BPP Loss Conditions and Additional Conditions	Explain how each of the Loss Conditions and Additional Conditions affects coverage under the Building and Personal Property Coverage Form.
BPP: Optional Coverages	Explain how each of the following optional coverages described in the BPP modifies the basic coverage of the BPP: <ul style="list-style-type: none">• Agreed Value• Inflation Guard• Replacement Cost• Extension of Replacement Cost to Personal Property of Others
Commercial Property Conditions	Summarize each of the Commercial Property Conditions.
Common Policy Conditions	Explain how each of the conditions contained in the Common Policy Conditions affects coverage under a commercial property coverage part.
Commercial Property Endorsements	Explain how each of these documents modifies the Building and Personal Property Coverage Form: <ul style="list-style-type: none">• Ordinance or Law Coverage endorsement• Spoilage Coverage endorsement• Flood Coverage endorsement• Earthquake and Volcanic Eruption Coverage endorsement• Peak Season Limit of Insurance endorsement• Value Reporting Form
Factors Affecting Commercial Property Premiums	Identify the factors that affect commercial property insurance premiums
Determining Whether the BPP Covers a Loss	Given a case, determine whether, and for what amount, a described loss would be covered by a commercial property coverage part that includes the Building and Personal Property Coverage Form and any of the three causes of loss forms.



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Assignment 11: Commercial General Liability Insurance, Part I

MODULE TITLE	LEARNING OBJECTIVES
Overview of Commercial General Liability Insurance	Describe commercial general liability insurance in terms of these elements: <ul style="list-style-type: none">• The types of losses that can be covered by general liability insurance• The components of a commercial general liability coverage part
CGL Coverage A - Insuring Agreement	Determine whether a described claim meets the conditions imposed by the Coverage A insuring agreement of the Commercial General Liability Coverage Form (occurrence version).
CGL Coverage A - Exclusions	Determine whether any of the exclusions applicable to Coverage A of the Commercial General Liability Coverage Form eliminate coverage for a described claim.
CGL Coverage B - Personal and Advertising Injury Liability	Determine whether a described claim meets the conditions imposed by the Coverage B insuring agreement of the Commercial General Liability Coverage Form and whether any of the Coverage B exclusions eliminate coverage for the claim.
CGL Coverage C - Medical Payments	Determine whether a described claim meets the conditions imposed by the Coverage C insuring agreement of the Commercial General Liability Coverage Form, and whether any of the Coverage C exclusions eliminate coverage for the claim.
CGL Supplementary Payments	Summarize the supplementary payments of the Commercial General Liability Coverage Form.



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Assignment 12: Commercial General Liability Insurance, Part II

MODULE TITLE	LEARNING OBJECTIVES
CGL Who Is an Insured Provisions	Determine whether a described person organization is an insured under the Commercial General Liability Coverage Form.
CGL Limits of Insurance	Explain how the following limits of insurance in the CGL Coverage Form are applied: <ul style="list-style-type: none">• Each occurrence limit• Personal and advertising injury limit• Damage to premises rented to you limit• Medical expense limit• General aggregate limit• Products-completed operations aggregate limit
CGL Conditions	Apply the Commercial General Liability Conditions to claims or other interactions between the insurer and the insured.
Rating CGL Coverage	Explain how the premium for CGL coverage is determined.
Determining Whether the CGL Covers a Claim Case	Given a case, determine whether, and for what amount, the Commercial General Liability Coverage Form (occurrence version) covers a described claim.



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Assignment 13: Specialty Coverages

MODULE TITLE	LEARNING OBJECTIVES
Commercial Excess and Umbrella Liability Insurance	<p>Describe commercial excess liability insurance and commercial umbrella liability insurance in terms of these characteristics:</p> <ul style="list-style-type: none">• The three basic types of commercial excess liability insurance• The provisions commonly found in commercial umbrella liability policies that distinguish them from other types of commercial liability policies
Professional Liability and Management Liability Insurance	<p>Describe professional liability insurance and management liability insurance in terms of these aspects:</p> <ul style="list-style-type: none">• How they differ from each other• How they differ from commercial general liability policies• The common types of professional and management liability policies
Environmental Insurance	<p>Describe the purpose and characteristics of each of these types of environmental insurance policies:</p> <ul style="list-style-type: none">• Site-specific environmental impairment liability (EIL) policies• Underground storage tank compliance policies• Remediation stop-loss policies• Contractors pollution liability policies• Environmental professional errors and omissions liability policies
Aircraft Insurance	<p>Describe aircraft insurance in terms of these characteristics:</p> <ul style="list-style-type: none">• The purposes-of-use categories that insurers used to classify aircraft• The coverages that can be included in an aircraft policy
Cyber Risk Insurance	<p>Describe the types of losses that can be covered by each of the insuring agreements generally available in cyber risk insurance policies.</p>



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MODULE TITLE	LEARNING OBJECTIVES
Insuring Foreign Operations	Explain how an organization domiciled in the United States can insure foreign loss exposures that would not be covered under standard property and liability insurance policies.
Terrorism Endorsements for Commercial Property and Liability Forms	Summarize the purpose and provisions of the terrorism endorsements developed by Insurance Services Office, Inc., and the National Council on Compensation Insurance, Inc.
Types of Surety Bonds	Summarize the guarantee provided by the particular types of surety bonds within the following bond classifications: <ul style="list-style-type: none">• Contract bonds• License and permit bonds• Public official bonds• Court bonds• Miscellaneous bonds

Assignment 14: Insurance Law, Part I

MODULE TITLE	LEARNING OBJECTIVES
Tort Law	Explain these concepts: <ul style="list-style-type: none">• Tort as distinguished from other offenses• Classifications of tort• Application of laws in tort cases
Negligence	Describe negligence claims in terms of: <ul style="list-style-type: none">• The elements of negligence• The required proof of negligence
Defenses Against Negligence Claims	Describe these defenses against negligence claims: Comparative negligence, releases and exculpatory clauses, immunity, statutes of limitations and repose, tortfeasor's capacity.
Liability of Landowners or Occupiers of Land	Explain how negligence applies to landowners or occupiers of land.



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MODULE TITLE	LEARNING OBJECTIVES
Intentional Torts Part 1 of 2	<p>Describe these intentional torts, the circumstances under which they can occur, and common defenses to them:</p> <ul style="list-style-type: none">• Battery• Assault• False imprisonment and false arrest• Intentional infliction of emotional distress• Defamation (libel and slander)• Invasion of the right of privacy
Intentional Torts Part 2 of 2	<p>Describe these intentional torts, the circumstances under which they can occur, and common defenses to them:</p> <ul style="list-style-type: none">• Fraud• Bad faith, or outrage• Interference with relationships between others• Misuse of legal process• Trespass• Nuisance• Conversion
Liability in Extraordinary Circumstances	<p>Explain how liability attaches as a result of the unique circumstances presented by the following:</p> <ul style="list-style-type: none">• Ultrahazardous activities• Ownership and/or possession of animals• Escape of toxic substances

Assignment 15: Insurance Law, Part II

MODULE TITLE	LEARNING OBJECTIVES
Products Liability	<p>Describe these causes of action for products liability and the possible defenses to them:</p> <ul style="list-style-type: none">• Misrepresentation• Breach of warranty• Strict liability and negligence
Professional Liability	<p>Describe professional and directors and officers liability.</p>



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MODULE TITLE	LEARNING OBJECTIVES
Damages in Tort Suits	Describe the types of damages a court can award a plaintiff for a tort claim.
Equitable Remedies	Explain these equitable remedies: <ul style="list-style-type: none">• Specific performance• Injunction
Factors Affecting Amounts and Payment of Damages	Summarize these legal concepts related to negligence damages and remedies: <ul style="list-style-type: none">• <i>Restitutio in integrum</i>• Mitigation of damages• Aggravated damages• Structured settlements and judgments
Liability Concepts Affecting Tort Claims	Explain how any of these concepts can affect a tort claim: <ul style="list-style-type: none">• Joint tortfeasor's liability• Expanded liability concepts• Vicarious liability• Good Samaritan issues• Class actions
Trends in Tort Litigation	Summarize these trends in tort litigation: <ul style="list-style-type: none">• Class action litigation• Litigation funding• Punitive damages• Tort reform

Assignment 16: Insurance Regulation

MODULE TITLE	LEARNING OBJECTIVES
Economic Impact of the Insurance Industry	Explain the economic impact of the insurance industry.
The Objectives of Insurance Regulation	Describe the objectives of insurance regulation.
The Sources of Insurance Regulation	Describe the three sources from which insurance regulatory powers originate: <ul style="list-style-type: none">• Legislation• Judicial review• Administrative agencies



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MODULE TITLE	LEARNING OBJECTIVES
The Structure of Insurance Regulations	Describe the structure of insurance regulations.
Elements of Rate Regulation and Ratemaking	Describe the following elements of rate regulation and ratemaking: <ul style="list-style-type: none">• Purpose and unique qualities of the insurance industry• Actuarial ratemaking principles and considerations in rate regulation• Insurance advisory organizations
Types of Rate Regulations	Compare the following types of rate regulation: <ul style="list-style-type: none">• Prior approval• File and use• Use and file• Open competition• Flex rating• Government-mandated rates
Effects of Rate Regulation on Insurers	Summarize the effects of rate regulation on these aspects of insurance: <ul style="list-style-type: none">• Resources required for complying with rate regulations• The underwriting cycle• Insurers' decision making regarding where to operate



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Study Materials for CAS Online Course 2

The online course itself contains learning objectives and all the educational material to meet these objectives and successfully complete the exam. The course fee includes one attempt at the exam.

The following printed materials are supplemental and may also be purchased from The Institutes, but are not required:

- **Textbook** contains material that is identical to the online course—only in a hardcopy format.
- **Review Notes** is a condensed version of the textbook.
- **Course Guide** contains sample questions and answers.
- **Flashcards** contain key words and phrases.

The materials described above may be purchased individually or in various package combinations.

Questions about potentially defective questions or material should be directed to The Institutes' Customer Service Department at (800) 644-2101 or (610) 644-2100, extension 6000, or CustomerService@TheInstitutes.org.

Publisher and Distributor

CAS Online Course 2/CA2 is available through The Institutes.

The Institutes, 720 Providence Road, Suite 100, Malvern, PA 19355-3433; telephone: (800) 644-2101 or (610) 644-2100 extension 6000; E-mail: CustomerService@TheInstitutes.org ; Website Page for CAS Online Courses: www.aicpcu.org/cas.htm .
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Exam Results

Candidates taking this computer-based test will receive unofficial pass/fail results at the conclusion of their exam. The unofficial pass/fail result will be displayed on the computer screen at the conclusion of the exam. In most test centers, a printed copy of the candidate's unofficial pass/fail result will be available upon completion of the computer-based test from the proctor in the administrative area outside the testing room. The candidate, however, should carefully read the result that is displayed on the computer screen at the conclusion of the exam.

When the official grades have been processed, candidates will receive an e-mail from The Institutes stating that their grades are available. Candidates may then log into their account on The Institutes Website (www.TheInstitutes.org) to access their grades. The grade report for each candidate will show the candidate's overall score on the exam in ten point increments (e.g., 60 to 69%, 70 to 79%, and so on). It will similarly show the candidate's performance by assignment using those same ten point increments.

VALIDATION BY EDUCATIONAL EXPERIENCE 2018 REQUIREMENTS

Introduction

VEE Process—How to Get VEE Credit

VEE-Corporate Finance (Prior to July 1, 2018)

VEE-Accounting and Finance (Starting July 1, 2018)

VEE-Economics (Prior to July 1, 2018)

VEE-Economics (Starting July 1, 2018)

Validation by Educational Experience Details

VEE Directory: Approved Courses/Experiences

INTRODUCTION

As part of basic education, the CAS requires Validation by Educational Experience (VEE) topics. Validation of these topics is required in addition to the preliminary education exams listed below. The CAS, in conjunction with the Canadian Institute of Actuaries and the Society of Actuaries, has implemented VEE requirements for the following topics:

Prior to July 1, 2018	VEE-Corporate Finance VEE-Economics
Starting July 1, 2018	VEE-Accounting and Finance VEE-Economics

The preliminary education exams are:

- Exam 1 - Probability
- Exam 2 - Financial Mathematics
- Exam 3F - Models for Financial Economics; starting July 1, 2018 Investment and Financial Markets

In addition to the preliminary education requirements listed above (i.e., VEE requirements and various exams), Exams MAS-I, MAS-II, 5, and 6 (6C, 6U or 6T), Online Courses 1 and 2, and the CAS Course on Professionalism are required for Associateship. The syllabi for the examinations are provided in the Materials for Study for Examination section of this Syllabus. Details about the process for obtaining credit for the VEE topics are provided below. VEE topics are not prerequisites for the preliminary examinations and may be fulfilled independently of the preliminary exam process.

VEE PROCESS-HOW TO GET VEE CREDIT

Validation by Educational Experience can be accomplished in any of the following ways:

1. **College Course(s)**
Complete one or more courses offered by a college or university and approved by the CAS, CIA, and SOA. Candidates must receive a grade of B- or better in each course. If the institution does not use letter grading, an appropriate translation will be determined. A directory of approved courses is available from the VEE Information section of the CAS Web Site.
2. **Standardized Examinations and Other Educational Experiences**
Achieve a pre-set score on a standardized examination or other educational experience as approved by the CAS, CIA, and SOA. A list of approved standardized exams and other educational experiences is available from the VEE Information section of the CAS Web Site.

Step 1: Approval of Courses/Experiences

The VEE Administration Committee (VEEAC) will determine which college courses, standardized exams, and other educational experiences are appropriate for VEE credit. Before a candidate may submit an application to receive individual credit for a VEE topic, the course or educational experience itself must first be approved and listed on either the Directory of Approved VEE Courses/Experiences or the Standardized Exams and Other Educational Experiences list. Each list identifies the educational institution, the approved courses/experiences by VEE topic, a unique approval code for each course/experience, and the years for which the courses/experiences are approved.

If a VEE Course/Experience does not appear on either list, approval must be requested by completing an official VEE course/experience approval application form and submitting it along with the required documentation. The application form is available in the Exam Applications and Order Forms section. The VEEAC will review the course/experience.

The guidelines that the VEEAC will use to determine whether specific courses or educational experiences are appropriate to fulfill the VEE requirements are provided in the next three sections of this Syllabus.

Step 2: Approval of Individual VEE Credits for Candidates

Candidates who have credit for at least two actuarial examinations may submit an application for their own VEE credits. In addition to the application, candidates will be required to arrange for an official transcript to be submitted to the VEE administrator. The Application for Validation by Educational Experience Credit includes specific directions. Only courses/experiences that are listed in the online [Directory of Approved VEE Courses/Experiences](#) or the Standardized Exams and Other Educational Experiences list may be used for VEE credit. If a course/experience is not on the approved list, the candidate may submit the course for approval according to the procedures described in Step 1 above.

Candidates may combine two approved courses/experiences to complete a VEE topic requirement. For example, an approved microeconomics course from a university may be combined with an approved macroeconomics course from another school or provider. In these cases candidates should include approval codes from both approved courses on their individual VEE credit application form. Corporate finance courses, however, must be completed in the combinations shown in the directory. No alternate combinations will be accepted without an additional course approval application process.

Note: Candidates may not submit VEE credit applications for partial credit (e.g., an microeconomics course may not be submitted alone, but must be accompanied on the same application by an approved macroeconomics course). Candidates may not submit for VEE credit for a topic until they have completed all requirements for that topic. Specific questions may be sent to vee@soa.org.

Once a candidate's application and documentation of the required grade on an approved course/experience have been validated, credit for the specific VEE topic will be granted. The candidate will be sent a written response to

each application.

VEE-CORPORATE FINANCE (Prior to July 1, 2018)

The following guidelines for the Validation by Educational Experience (VEE) requirement for Corporate Finance will be used by the VEE Administration Committee to determine whether specific courses or educational experiences are appropriate to fulfill the VEE requirements. Details about submitting a course for approval as well as obtaining individual VEE credit are provided at the beginning of this section on VEE. The Directory of Approved VEE Courses/Experiences and the Standardized Exams and Other Educational Experiences are available in the VEE Information section of the CAS Web Site.

The typical corporate finance program covers the topics below in two semesters with an introductory course followed by a more advanced semester. If the second course covers most of the topics, then only the second course will be required. Where the topics are split across two semesters or courses, both will be required. The exceptional case where the corporate finance topics are covered in only one course, with no finance prerequisite, will also be considered, however, this will typically be at a more advanced level than a course designed for general business students.

Most of the topics listed below should be covered:

- Definitions of key finance terms: stock company; capital structure
- Key finance concepts: financing companies; characteristics and uses of financial instruments; sources of capital; cost of capital; dividend policy; personal and corporate taxation
- Factors to be considered by a company when deciding on its capital structure and dividend policy
- Impact of financial leverage and long/short term financing policies on capital structure
- Characteristics of the principal forms of financial instruments issued or used by companies, and the ways in which they may be issued
- How a company's cost of capital relates to the investment projects the company wishes to undertake
- Definitions of key finance terms: financial instruments – bond, stock, basic options (calls, puts); dividends; price to earnings ratio
- Structure of a stock company and the different methods by which it may be financed
- Calculate value of stocks
- Measures of financial performance: balance sheet; income statement; statement of cash flows; financial ratios (e.g., leverage, liquidity, profitability, market value ratios); net present value; the payback, discounted payback models; internal rate of return and profitability index models
- Assessment of financial performance using various measures: balance sheet; income statement; statement of cash flows, financial ratios (e.g., leverage, liquidity, profitability, market value ratios); net present value; the payback, discounted payback models; internal rate of return and profitability index models

VEE-ACCOUNTING and FINANCE (Starting July 1, 2018)

The following guidelines for the Validation by Educational Experience (VEE) requirement for Accounting and Finance will be used by the VEE Administration Committee to determine whether specific courses or educational experiences are appropriate to fulfill the VEE requirements. Details about submitting a course for approval as well as obtaining individual VEE credit are provided at the beginning of this section on VEE. The Directory of Approved VEE Courses/Experiences and the Standardized Exams and Other Educational Experiences are available in the VEE Information section of the CAS Web Site.

While this material may be entirely covered in a course or courses that cover both topics, it is more likely that separate courses will be used for accounting and for finance. If distinct courses are used, the application should indicate which are for the accounting topic and which are for the finance topic. The typical finance program covers the topics below in one semester with an introductory course. Should the topics be split across two semesters or courses, both will be required. Most of the topics listed below should be covered:

Accounting

- Describe the basic principles of personal and corporate taxation and the taxation of investments held by institutions.
- Explain why companies are required to produce annual reports and accounts.
- Explain fundamental accounting concepts and terms, and describe the main sources of accounting regulation.
- Explain the purpose and interactions between the income statement, balance sheet, and cash flow statements.
- Explain the value of reporting on environmental, social and economic sustainability and other alternatives to traditional financial reporting, and describe possible contents of such reports.
- Explain the basic structure of company and group accounts.
- Explain the purpose of the main components of company accounts and interpret them.
- Construct simple statements of financial position and profit or loss.
- Calculate and interpret financial and accounting ratios.

Finance

- Explain the characteristics of various forms of equity capital from the point of view of the issuer and the investor.
- Explain the characteristics of various forms of long-term debt capital from the point of view of the issuer and the investor.
- Explain the characteristics of various forms of short- and medium-term financing from the point of view of the issuer and the investor.
- Calculate weighted-average cost of capital.
- Explain the main methods of capital budgeting.
- Calculate a project's investment return.

VEE-ECONOMICS (Prior to July 1, 2018)

The following guidelines for the Validation by Educational Experience (VEE) requirement for Economics will be used by the VEE Administration Committee to determine whether specific courses or educational experiences are appropriate to fulfill the VEE requirements. Details about submitting a course for approval as well as obtaining individual VEE credit are provided at the beginning of this section on VEE. The Directory of Approved VEE Courses/Experiences and the Standardized Exams and Other Educational Experiences are available in the VEE Information section of the CAS Web Site.

Typically, the VEE requirement for Economics will be met if a candidate has completed two economics courses, one course covering microeconomics and the other covering macroeconomics. Most of the topics listed below should be covered:

Microeconomics

- Interaction between supply and demand in the provision of a product and the way in which equilibrium market prices are determined
- Elasticity of demand and supply and the effects on a market of different levels of elasticity
- How rational utility maximizing agents make consumption choices
- How profit-maximizing firms make short-run and long-run production choices
- Different types of competition, or lack of it, and the practical effect on supply and demand

Macroeconomics

- Structure of public sector finances of an industrialized economy
- GDP, GNP, and Net National Product. How these concepts are used in describing the economy and in making comparisons between countries, and the limitations of these concepts
- Propensity to save or to consume by the private sector or the corporate sector and how it affects the economy
- Impact of fiscal and monetary policy and other forms of government intervention on different aspects of the economy, and in particular on financial markets

- Role of exchange rates and international trade in the economy and the meaning of the term balance of payments
- Major factors affecting the rate of inflation, the level of interest rates, the exchange rate, the level of unemployment, and the rate of economic growth in the economy of an industrialized country

VEE-ECONOMICS (Starting July 1, 2018)

The following guidelines for the Validation by Educational Experience (VEE) requirement for Economics will be used by the VEE Administration Committee to determine whether specific courses or educational experiences are appropriate to fulfill the VEE requirements. Details about submitting a course for approval as well as obtaining individual VEE credit are provided at the beginning of this section on VEE. The Directory of Approved VEE Courses/Experiences and the Standardized Exams and Other Educational Experiences are available in the VEE Information section of the CAS Web Site.

Typically, the VEE requirement for economics will be met if a candidate has completed two economics courses, one course covering microeconomics and the other covering macroeconomics. If distinct courses are used, the application should indicate which are for the microeconomics topic and which are for the macroeconomics topic. Most of the topics listed below should be covered:

Microeconomics

- Explain the concept of utility and how rational utility maximizing agencies make consumption choices.
- Explain the elasticity of supply and demand and the effects on a market of the different levels of elasticity.
- Explain the interaction between supply and demand and the way in which equilibrium market prices are achieved.
- Explain various pricing strategies that can be used by firms.
- Explain the core economic concepts involved in choices made by businesses with respect to short-run and long-run investment and production choices.
- Explain competitive markets and how they operate.
- Explain profitability in markets with imperfect competition.

Macroeconomics

- Explain basic macroeconomic measures (e.g., GDP) used to compare the economies of countries.
- Describe the structure of public finances for an industrialized country.
- Explain the effect of fiscal and monetary policy on the economy, including the effect on financial markets.
- Explain the role of international trade, exchange rates and the balance of payments in the economy.
- Explain the effect of savings and consumption rates on the economy.
- Explain the major factors affecting the level of interest rates, the rate of inflation, the exchange rate, the level of employment and the rate of growth for an industrialized country.
- Describe the function of money in the economy.
- Explain the relationship between money and interest rates.
- Explain how macroeconomic policies affect business