Exam 5

CASUALTY ACTUARIAL SOCIETY
AND THE
CANADIAN INSTITUTE OF ACTUARIES

Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

October 28, 2019

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 53.5 point examination consists of 25 problem and essay questions.

2. For the problem and essay questions, the number of points for each full question and part of a question is indicated at the beginning of the question or part. Answer these questions on the lined sheets provided in your Examination Envelope. Use dark pencil or ink. Do not use multiple colors or correction fluid/tape.

   - Write your Candidate ID number and the examination number, 5, at the top of each answer sheet. For your Candidate ID number, four boxes are provided corresponding to one box for each digit in your Candidate ID number. If your Candidate ID number is fewer than 4 digits, begin in the first box and do not include leading zeroes. Your name, or any other identifying mark, must not appear.
   - Do not answer more than one question on a single sheet of paper. Write only on the front lined side of the paper – **DO NOT WRITE ON THE BACK OF THE PAPER**. Be careful to give the number of the question you are answering on each sheet. If your response cannot be confined to one page, please use additional sheets of paper as necessary. Clearly mark the question number on each page of the response in addition to using a label such as "Page 1 of 2" on the first sheet of paper and then "Page 2 of 2" on the second sheet of paper.
   - The answer should be concise and confined to the question as posed. When a specified number of items are requested, do not offer more items than requested. For example, if you are requested to provide three items, only the first three responses will be graded.
   - In order to receive full credit or to maximize partial credit on mathematical and computational questions, you must clearly outline your approach in either verbal or mathematical form, showing calculations where necessary. Also, you must clearly specify any additional assumptions you have made to answer the question.

CONTINUE TO NEXT PAGE OF INSTRUCTIONS

3. Do all problems until you reach the last page of the examination where "END OF EXAMINATION" is marked.

   All questions should be answered according to the United States statutory accounting practices and principles, unless specifically instructed otherwise. SAP refers to Statutory Accounting Principles, and GAAP refers to Generally Accepted Accounting Principles. NAIC refers to the National Association of Insurance Commissioners.

4. Prior to the start of the exam you will have a **fifteen-minute reading period** in which you can silently read the questions and check the exam booklet for missing or defective pages. A chart indicating the point value for each question is attached to the back of the examination. Writing will NOT be permitted during this time and you will not be permitted to hold pens or pencils. You will also not be allowed to use calculators. The supervisor has additional exams for those candidates who have defective exam booklets.

5. Your Examination Envelope is pre-labeled with your Candidate ID number, name, exam number and test center. Do not remove this label. Keep a record of your Candidate ID number for future inquiries regarding this exam.

6. Candidates must remain in the examination center until two hours after the start of the examination. The examination starts after the reading period is complete. You may leave the examination room to use the restroom with permission from the supervisor. To avoid excessive noise during the end of the examination, candidates may not leave the exam room during the last fifteen minutes of the examination.

7. At the end of the examination, place all answer sheets in the Examination Envelope. Please insert your answer sheets in your envelope in question number order. Insert a numbered page for each question, even if you have not attempted to answer that question. Nothing written in the examination booklet will be graded. Only the answer sheets will be graded. Also place any included reference materials in the Examination Envelope. BEFORE YOU TURN THE EXAMINATION ENVELOPE IN TO THE SUPERVISOR, BE SURE TO SIGN IT IN THE SPACE PROVIDED ABOVE THE CUT-OUT WINDOW.

8. If you have brought a self-addressed, stamped envelope, you may put the examination booklet and scrap paper inside and submit it separately to the supervisor. It will be mailed to you. Do not put the self-addressed stamped envelope inside the Examination Envelope. Interoffice mail is not acceptable.

   If you do not have a self-addressed, stamped envelope, please place the examination booklet in the Examination Envelope and seal the envelope. You may not take it with you. Do not put scrap paper in the Examination Envelope. The supervisor will collect your scrap paper.

   Candidates may obtain a copy of the examination from the CAS Web Site.

   All extra answer sheets, scrap paper, etc. must be returned to the supervisor for disposal.

CONTINUE TO NEXT PAGE OF INSTRUCTIONS

9. Candidates must not give or receive assistance of any kind during the examination. Any cheating, any attempt to cheat, assisting others to cheat, or participating therein, or other improper conduct will result in the Casualty Actuarial Society and the Canadian Institute of Actuaries disqualifying the candidate's paper, and such other disciplinary action as may be deemed appropriate within the guidelines of the CAS Policy on Examination Discipline.

10. The exam survey is available on the CAS Web Site in the "Admissions/Exams" section. Please submit your survey by November 11, 2019.

END OF INSTRUCTIONS

1. (1.75 points)

Given the following quarterly exposure information:

Calendar Year and Quarter	Written Exposures	Earned Exposures
2017 Q 1	100	5.00
2017 Q 2	450	247.50
2017 Q 3	400	427.50
2017 Q 4	100	52.50
2018 Q 1	125	53.75
2018 Q 2	550	528.75
2018 Q 3	475	562.50
2018 Q 4	30	59.00

- The company started writing business on January 1, 2017.
- The company stops writing business on December 31, 2018.
- The quarterly earnings pattern was set by analyzing historical experience across the industry and is not uniform.
- All policies are annual.
- All policies are written on the first day of the quarter.
- There are no policy cancellations and no mid-term adjustments.

a. (0.5 point)

Calculate the 2017 policy year earned exposures as of March 31, 2018.

b. (0.25 point)

Calculate the in-force exposures as of May 31, 2018.

c. (0.5 point)

Calculate the calendar year 2018 unearned exposures.

d. (0.5 point)

Calculate the calendar year 2019 quarter 1 earned exposures.

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2. (1.75 points)

Given the following policies for an insurance company:

Policy	Effective Date	Expiration Date	Written Premium
A	March 1, 2017	February 28, 2018	1,200
B	June 1, 2017	November 30, 2017	1,500
C	July 1, 2017	June 30, 2018	2,000
D	October 1, 2017	September 30, 2018	750
E	January 1, 2018	December 31, 2018	900
F	April 1, 2018	September 30, 2018	1,650
G	August 1, 2018	July 31, 2019	1,350

a. (0.25 point)

Calculate the written premium for the fiscal year ending July 31, 2018.

b. (0.25 point)

Calculate the in-force premium as of December 15, 2018.

c. (0.5 point)

Calculate the 2018 calendar year written premium if Policy C is cancelled on March 31, 2018.

d. (0.5 point)

Discuss if it is appropriate for this insurer to estimate earned premium for the current year by averaging the in-force premium at the end of the current year and prior year.

e. (0.25 point)

Identify one potential use of in-force premium other than estimating earned premium.

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3. (3 points)

Given the following information:

Current Rate Review	
Number of Exposures	20,000
Indicated Rate Change before credibility	7.9%
Projected Frequency	3.0%
Annual Loss Trend	-1.0%
Annual Premium Trend	1.5%
Target Effective Date	January 1, 2019

Prior Rate Review	
Indicated Rate Change	8.0%
Implemented Rate Change	3.5%
Effective Date	January 1, 2017

Normal Distribution Table	
p	z(p)
0.800	0.842
0.850	1.036
0.900	1.282
0.950	1.645
0.975	1.960
0.990	2.326

- The loss experience is considered fully credible if there is a 90% probability that the observed experience is within 2.5% of its expected value.

a. (2.25 points)

Calculate the credibility-weighted indicated rate change using the classical credibility approach and trended present rates as the complement of credibility.

b. (0.75 point)

Identify three other complements of credibility appropriate for first dollar ratemaking.

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4. (2.5 points)

Given the following information for an insurance company that sells claims-made policies:

- Exposure levels are constant.
- Loss costs increase by 3% each report year.
- An equal number of claims are reported each year.
- All claims are reported within four years of occurrence.

	Loss Cost by Report Year Lag			
Report Year	0	1	2	3
2014	100	100	100	100
2015	103	103	103	103
2016	106	106	106	106
2017	109	109	109	109
2018	113	113	113	113

a. (0.75 point)

Demonstrate and briefly explain why a claims-made policy will cost less than an occurrence policy.

b. (1 point)

Demonstrate and briefly explain whether a claims-made policy or an occurrence policy would be more underpriced if the actual loss cost trend by report year is 10%.

c. (0.75 point)

Briefly describe one difference between occurrence policies and claims-made policies regarding each of the following:

i. Coverage trigger
ii. Loss development
iii. Investment income

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5. (1.5 points)

Given the following to be used in developing a rate indication effective January 1, 2021:

- All policies are annual.
- Rates are expected to be in effect for one year.
- The selected annual loss trend is 2%.

a. (0.5 point)

Calculate the loss trend factor applied to losses from accident year 2018.

b. (0.5 point)

Calculate the loss trend factor applied to losses from policy year 2018.

c. (0.5 point)

Explain why trending and developing losses do not result in overlapping adjustments.

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6. (2.25 points)

a. (1 point)

Discuss whether there is a need to explicitly account for the following costs in primary ratemaking:

i. Proportional reinsurance
ii. Non-proportional reinsurance

b. (0.5 point)

Identify two sources of investment income considered in the total profit provision.

c. (0.75 point)

Briefly discuss whether trending is necessary for the following:

i. Variable expenses
ii. Fixed expenses when using the exposure-based projection method
iii. Fixed expenses when using the premium-based projection method

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7. (4.5 points)

Given the following data as of December 31, 2018:

Accident Year	Cumulative Reported Loss + ALAE ($000s) as of (months) 12	24	36
2016	3,440	4,107	4,522
2017	3,427	4,109	
2018	3,545		

Calendar Year	Earned Premium ($000s)	Fixed Expenses ($000s)
2016	10,500	1,155
2017	12,000	3,600
2018	12,500	1,500

Rate Change History	
Effective Date	Change
July 1, 2017	5%
July 1, 2018	2%

4%	Annual loss and ALAE trend
3%	Annual premium trend
60%	Expected Loss and ALAE Ratio
30%	Variable Expense Ratio
5%	Profit and Contingencies Provision
7%	ULAE Provision (as % of Loss and ALAE)
1.031	36-to-ultimate tail factor

- In 2017 the company implemented a new policy issuance system.
- Rates are in effect for one year.
- All policies are annual.
- Exposures are written evenly throughout each calendar year.

Calculate the indicated rate change for policies effective January 1, 2020 using the reported Bornhuetter-Ferguson technique for the last three accident years.

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8. (1.75 points)

An insurer's retention model predicts the following:

% Change in Premium	Retention Ratio	
	First Renewal	Second Renewal
0%	85%	0%
5%	75%	0%

The following information is known:

0.00%	Discount rate
$0	Fixed expenses
$0	Implementation costs
$1,000	Premium per policy
$800	Loss & LAE per policy

- Senior management will consider only the following at renewal:
  i. No rate change
  ii. +5% rate change

a. (1.25 points)

Select the rate change that will maximize the insurer's profit.

b. (0.5 point)

Briefly evaluate the selected rate change with respect to the *Statement of Principles Regarding Property Casualty Insurance Ratemaking*, citing one relevant principle.

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9. (1.75 points)

a. (0.5 point)

Briefly describe one similarity and one difference between the purposes of risk classification and individual risk rating.

b. (0.5 point)

Briefly describe a situation for each of the following:

i. A classification rating plan is more appropriate than individual risk rating
ii. Neither a classification rating plan nor individual risk rating is necessary

c. (0.75 point)

Briefly describe three reasons a rating characteristic might not be included in a classification rating plan.

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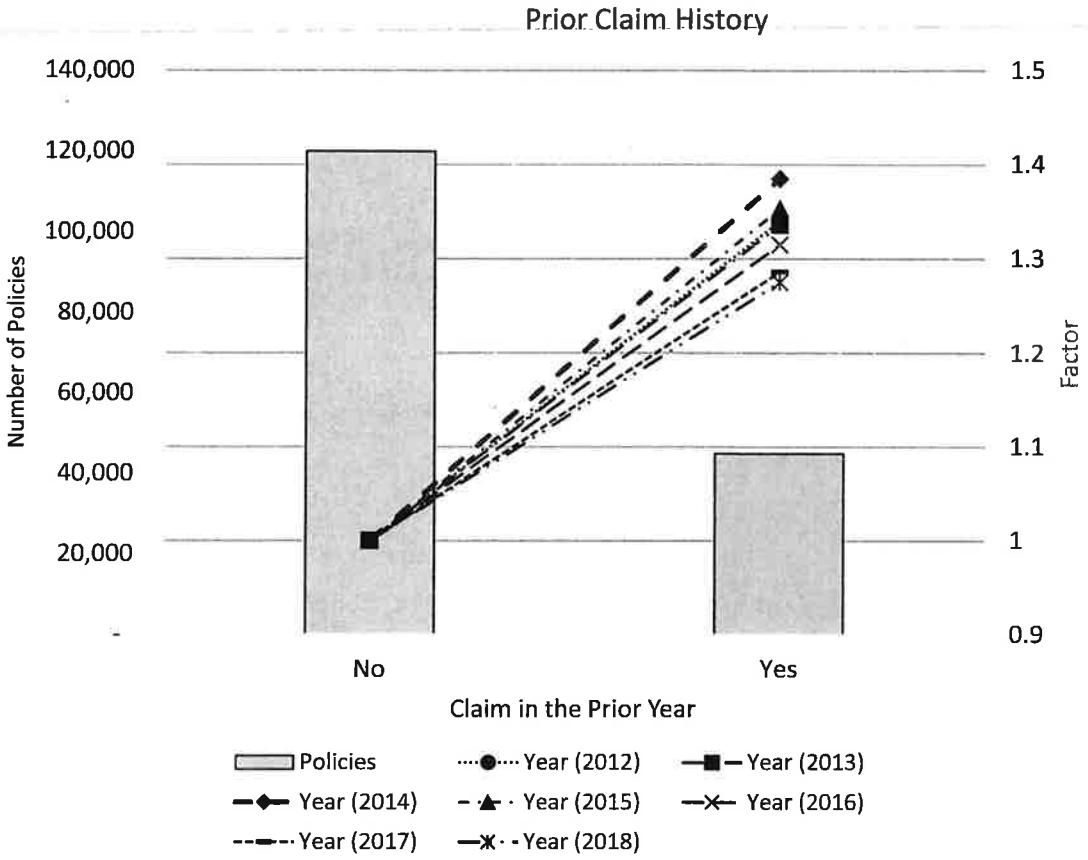
10. (1.75 points)

The following graph shows pure premium relativities produced by a generalized linear model (GLM). The variable indicates whether the risk has had a claim in the most recent prior year or not.



a. (0.5 point)

Describe the type of test for which the above graph is used.

b. (0.25 point)

Briefly state the conclusion that can be drawn from the above graph, using the test described in part a.

c. (1 point)

Describe two other tests to consider when evaluating the inclusion of this variable in the model.

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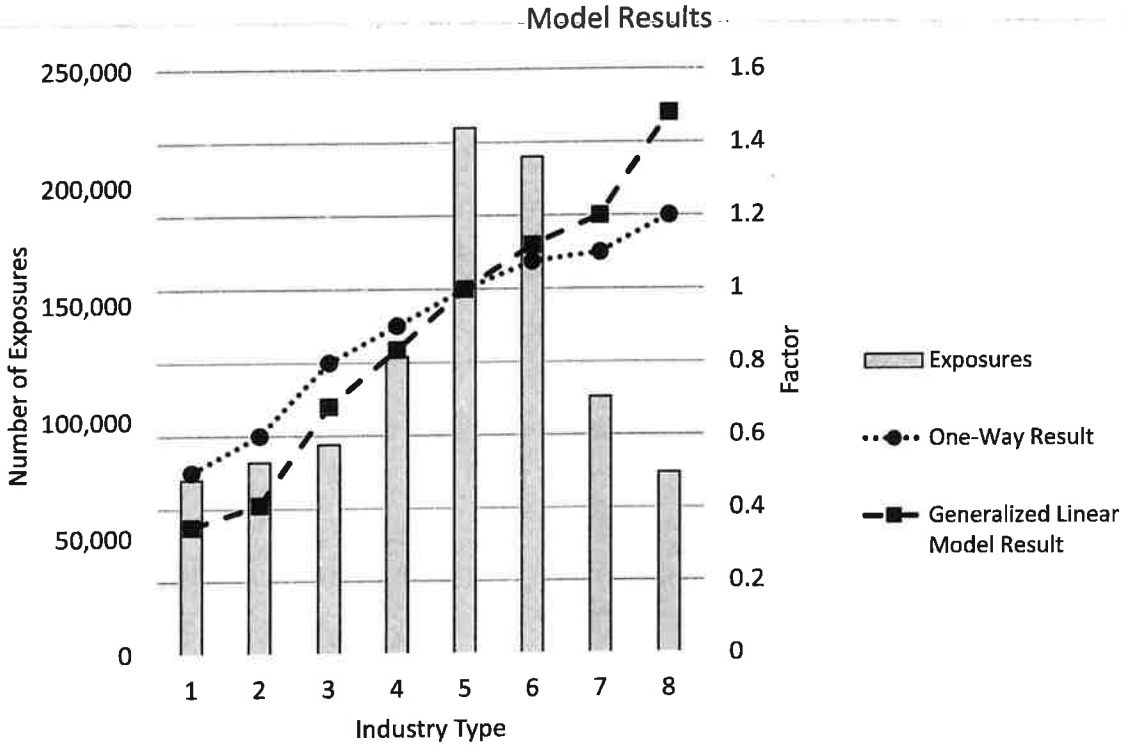
11. (1.25 points)

The graph below shows frequency model results for industry types. The same data and assumptions are used in both models.



a. (0.25 point)

Briefly discuss why the relativity for both line graphs match for industry 5.

b. (0.5 point)

Explain why the models in part a. above produce different results.

c. (0.5 point)

Describe how the use of one-way results might impact profitability for an insurance company.

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12. (1.75 points)

Given the following information:

		State A		Countrywide	
Vehicle Type	Vehicle Use	Exposures	Losses ($)	Exposures	Losses ($)
Car	Pleasure	2,500	500,000	30,000	6,600,000
Car	Work	1,000	500,000	25,000	16,250,000
Truck	Pleasure	0	0	40,000	14,400,000
Truck	Work	3,000	300,000	50,000	8,500,000

- An actuary is developing a pure premium estimate for trucks used for work in state A.
- The actuary is using experience from all other states as a complement of credibility.

a. (1.25 points)

Calculate the complement of credibility using Harwayne's Method.

b. (0.5 point)

Briefly describe two advantages of using the current rate as a complement of credibility instead of calculating the complement with Harwayne's method.

CONTINUED ON NEXT PAGE

13. (1.75 points)

Given the following information:

Policy Limit	Claims	% of Claims at Policy Limit
$50,000	145	100%
$100,000	550	60%
$200,000	875	40%

- All claim payments are either 50% of the policy limit or 100% of the policy limit.
- $50,000 is the basic limit.

Calculate the indicated increased limit factor for the $200,000 limit.

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14. (2 points)

Given the following:

Home Value	$300,000
Insured Value	$250,000
Amount of Loss	$260,000

a. (1 point)

Calculate the amount paid by the policyholder at the time of loss under the following:

i. Coinsurance percentage of 80%

ii. Coinsurance percentage of 90%

b. (0.5 point)

Describe how coinsurance provisions promote equitable rates.

c. (0.5 point)

Describe how coinsurance provisions promote adequate rates.

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15. (2 points)

A workers compensation annual policy for a large insured is expiring on January 1, 2020. The following changes have taken place at the insured since the policy was last issued on January 1, 2019:

- The insured has implemented a new job-specific training program to reduce the expected number of claims.
- The insured has doubled the number of their employees.

a. (0.5 point)

Briefly describe how each of these changes could be accounted for in the final premium for the January 1, 2020 renewal policy.

b. (1 point)

Describe how each of these changes are accounted for in the final premium on January 1, 2024 if the insured has no additional changes over the next four years.

c. (0.5 point)

Describe one additional rating mechanism that would benefit the company if the insured has grown substantially larger and more operationally complex between January 1, 2020 and January 1, 2024.

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16. (1.5 points)

a. (0.75 point)

List three components of an unpaid claims estimate.

b. (0.75 point)

Briefly describe how an inadequate unpaid claims estimate can impact the decision-making of each of the following parties:

i. Internal management
ii. Investors
iii. Regulators

CONTINUED ON NEXT PAGE

17. (2.25 points)

a. (0.75 point)

Identify three changes in an insurance company's internal environment that could distort the paid or reported development patterns.

b. (1.5 points)

Briefly describe how each change identified in part a. above may be observed in a diagnostic triangle.

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18. (1.75 points)

Given the following data evaluated as of December 31, 2018:

Accident Year	Cumulative Paid Claims ($000) as of (months)			
	12	24	36	48
2015	1,200	2,325	2,900	3,100
2016	1,800	3,300	4,100	
2017	1,500	2,800		
2018	1,700			

Accident Year	Case Outstanding ($000) as of (months)			
	12	24	36	48
2015	1,500	800	400	160
2016	2,000	1,150	575	
2017	1,750	975		
2018	2,200			

1.15	48-Ult paid claim to prior case outstanding development factor

- There is no paid or reported development beyond 60 months.

a. (1.5 points)

Estimate unpaid claims for accident year 2018 as of December 31, 2018 using a case outstanding development technique.

b. (0.25 point)

Briefly describe a scenario where it would be appropriate to use the case outstanding development technique.

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19. (3 points)

Given the following data as of December 31, 2018:

Accident/ Calendar Year	Cumulative Reported Claims ($000s)	Earned Premium ($000s)
2016	7,200	10,400
2017	6,300	11,000
2018	4,700	11,500

Cumulative Age-to-Ultimate Factors			
12-Ult	24-Ult	36-Ult	48-Ult
1.764	1.260	1.050	1.000

Annual Trends	
Claims	3.0%
Premium	2.0%

Effective Date	Rate Change
July 1, 2016	4.0%
July 1, 2017	2.0%

- All policies have an annual term and are written evenly throughout the year.

Calculate ultimate claims for accident year 2017 using the Cape Cod technique.

CONTINUED ON NEXT PAGE

20. (2.75 points)

Given the following:

Closed Claim Counts					
Year	12	24	36	48	Count
2015	308	555	642	647	647
2016	356	563	678		683
2017	358	575			684
2018	402				795

Cumulative Paid Claims ($000s)				
Accident Year	12	24	36	48
2015	375	745	906	916
2016	397	750	922	
2017	422	762		
2018	385			

- A court decision on December 31, 2018 will increase future claim payments by 20%.
- All claims are closed by age 48.
- There is no severity trend.

a. (2.25 points)

Use the frequency-severity disposal rate technique to estimate unpaid claims for accident year 2018.

b. (0.5 point)

Describe an advantage of using the frequency severity technique over a paid development technique in part a. above.

CONTINUED ON NEXT PAGE

21. (2.75 points)

Given the following:

Reported Claims ($000) as of (months)				
Accident Year	12	24	36	48
2015	1,100	1,650	1,675	1,680
2016	1,250	1,680	1,750	
2017	1,200	1,800		
2018	1,500			

Reported Claim Counts as of (months)				
Accident Year	12	24	36	48
2015	108	115	115	115
2016	112	120	120	
2017	104	110		
2018	106			

Paid Claims ($000) as of (months)				
Accident Year	12	24	36	48
2015	560	1,325	1,650	1,680
2016	650	1,350	1,720	
2017	615	1,305		
2018	625			

Closed Claim Counts as of (months)				
Accident Year	12	24	36	48
2015	78	106	114	115
2016	80	111	118	
2017	75	99		
2018	82			

5.0%	Annual severity trend

- Exposures have remained constant throughout all accident years.

Calculate unpaid claims for accident year 2018 using the reported Berquist-Sherman technique.

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22. (2.25 points)

Given the following data as of December 31, 2018:

Cumulative Paid Claims ($000) Gross of Salvage & Subrogation as of (months)			
Accident Year	12	24	36
2015	17,500	21,500	24,000
2016	19,000	23,500	25,700
2017	18,500	22,800	
2018	18,100		

Cumulative Received Salvage and Subrogation ($000) as of (months)			
Accident Year	12	24	36
2015	1,150	4,050	5,300
2016	1,180	4,300	5,680
2017	1,200	4,250	
2018	850		

1.40	12 to ultimate development factor for paid claims gross of salvage & subrogration

- There is no development beyond 36 months.

a. (1.75 points)

Estimate the salvage and subrogation recoverable for accident year 2018 using the ratio approach. Justify the selected ultimate salvage and subrogation ratio.

b. (0.5 point)

Briefly discuss two advantages of the ratio approach as compared to the development approach.

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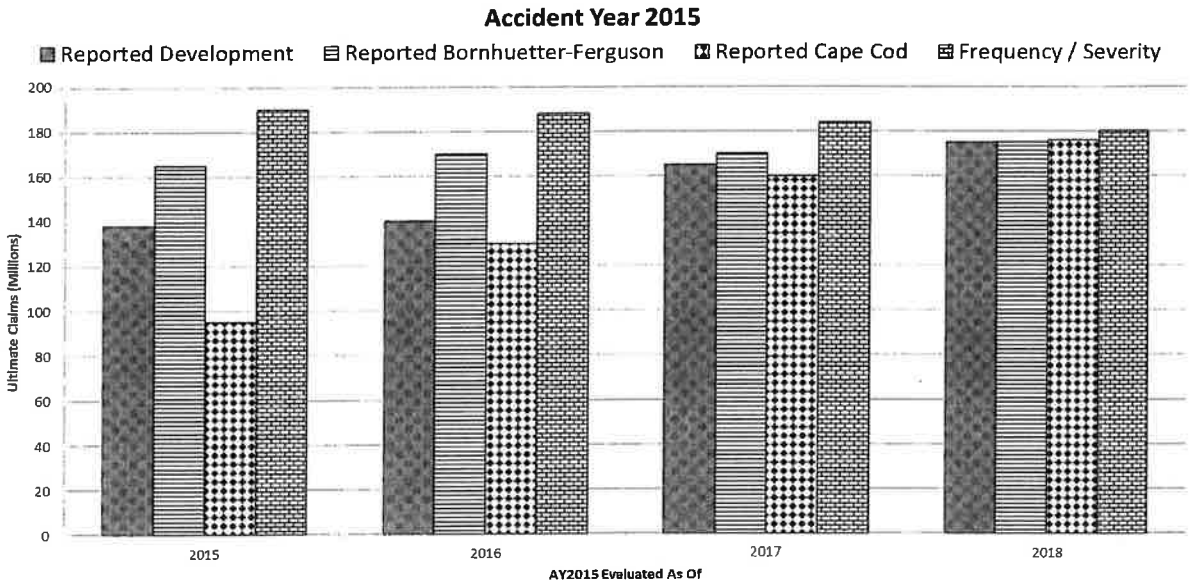
23. (2 points)

Given the following information for accident year 2015:



- Tort reform enacted January 1, 2015, resulted in a drastic increase in severity.

Discuss the year-over-year progression of each technique in response to the law change.

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24. (2.25 points)

Given the following information, as of December 31, 2018:

Calendar Year	Paid Claims	Incurred Claims	Paid ULAE
2015	18,700	35,500	1,870
2016	19,200	36,500	1,890
2017	18,900	36,400	1,910
2018	19,800	37,400	1,990

Report Year	Earned Premium	Paid Claims	Reported Claims	Percent Unreported
2015	77,600	22,400	29,500	10.7%
2016	78,000	14,300	26,200	23.1%
2017	77,800	5,500	20,700	55.9%
2018	77,900	2,800	19,000	76.3%

- The expected claims ratio for this book of business is 45%.
- All policies are claims-made.

a. (1.5 points)

Calculate unpaid ULAE at December 31, 2018 using the Kittel refinement.

b. (0.75 point)

Fully describe how the calculation in part a. above would change if the policies for this book of business were occurrence instead of claims-made.

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25. (1.75 points)

Given the following information for a company:

5.00	12-Ultimate Gross Paid Claims Development Factor
3.30	24-Ultimate Gross Paid Claims Development Factor
12,000,000	Accident Year 2018 Paid Gross Claims @ 12 Months

Incremental Gross Industry Payment Pattern for 12 to 24 Months, by Quarter				
Age	12-15	15-18	18-21	21-24
Percent Paid	50%	35%	10%	5%

1,450,000	Accident Year 2018 Actual Net Paid Claims for 15-18 Months

- The company maintains a quota share reinsurance agreement where they cede 30% of the business.
- Ultimate losses are estimated using the paid development technique.

a. (1.25 points)

Calculate the accident year 2018 expected net paid claims for the period 15 to 18 months, based on the following:

i) claims emerge uniformly between evalution points.
ii) the industry payment pattern.

b. (0.5 point)

Recommend whether to change the net estimated unpaid based on the actual results for accident year 2018 in the 15-to-18 month period.

END OF EXAMINATION

Exam 5
Basic Techniques for Ratemaking and Estimating Claim Liabilities

POINT VALUE OF QUESTIONS

QUESTION	TOTAL POINT VALUE OF QUESTON	SUB-PART OF QUESTION (a)	(b)	(c)	(d)	(e)	(f)	(g)
1	1.75	0.50	0.25	0.50	0.50			
2	1.75	0.25	0.25	0.50	0.50	0.25		
3	3.00	2.25	0.75					
4	2.50	0.75	1.00	0.75				
5	1.50	0.50	0.50	0.50				
6	2.25	1.00	0.50	0.75				
7	4.50	4.50						
8	1.75	1.25	0.50					
9	1.75	0.50	0.50	0.75				
10	1.75	0.50	0.25	1.00				
11	1.25	0.25	0.50	0.50				
12	1.75	1.25	0.50					
13	1.75	1.75						
14	2.00	1.00	0.50	0.50				
15	2.00	0.50	1.00	0.50				
16	1.50	0.75	0.75					
17	2.25	0.75	1.50					
18	1.75	1.50	0.25					
19	3.00	3.00						
20	2.75	2.25	0.50					
21	2.75	2.75						
22	2.25	1.75	0.50					
23	2.00	2.00						
24	2.25	1.50	0.75					
25	1.75	1.25	0.50					
26	0.00							
27	0.00							
28	0.00							
29	0.00							
30	0.00							
31	0.00							
32	0.00							
33	0.00							
34	0.00							
35	0.00							
36	0.00							
37	0.00							
38	0.00							
39	0.00							
40	0.00							
41	0.00							
42	0.00							
43	0.00							
44	0.00							
45	0.00							
TOTAL	53.50							

FALL 2019 EXAM 5 – SAMPLE ANSWERS AND EXAMINER'S REPORT

The Syllabus and Examination Committee has prepared this Examiner's Report as a tool for candidates preparing to sit for a future offering of this exam. The Examiner's Report provides:

- A summary of exam statistics.
- General observations by the Syllabus and Examination Committee on candidate performance.
- A question-by-question narrative, describing where points were commonly achieved and missed by the candidate.

The report is intended to provide insight into what the graders for each question were looking for in responses that received full or nearly-full credit. This includes an explanation of common mistakes and oversights among candidates. We hope that the report aids candidates in mastering the material covered on the exam by providing valuable insights into the differences between responses that are comprehensive and those that are lacking in some way.

Candidates are encouraged to review the Future Fellows article from June 2013 entitled "Getting the Most out of the Examiner's Report" for additional insights.

EXAM STATISTICS:

- Number of Candidates: 732
- Available Points: 53.5
- Passing Score: 37.0
- Number of Passing Candidates: 209
- Raw Pass Ratio: 28.6%
- Effective Pass Ratio: 31.8%

GENERAL COMMENTS:

- Candidates should note that the instructions to the exam explicitly say to show all work; graders expect to see enough support on the candidate's answer sheet to follow the calculations performed. While the graders made every attempt to follow calculations that were not well-documented, lack of documentation may result in the deduction of points where the calculations cannot be followed or are not sufficiently supported.
- Candidates should justify all selections when prompted to do so. For example, if the candidate selects an all year average and the question prompts a justification of all selections, a brief explanation should be provided for the reasoning behind this selection. Candidates should note that a restatement of a numerical selection in words is not a justification.
- Incorrect responses in one part of a question did not preclude candidates from receiving credit for correct work on subsequent parts of the question that depended upon that response.
- Candidates should try to be cognizant of the way an exam question is worded. They must look for key words such as "briefly" or "fully" within the problem. We refer candidates to the Future Fellows article from December 2009 entitled "The Importance of Adverbs" for additional information on this topic.

- Some candidates provided lengthy responses to a "briefly describe" question, which does not provide extra credit and only takes up additional time during the exam.
- Candidates should note that the sample answers provided in the examiner's report are not an exhaustive representation of all responses given credit during grading, but rather the most common correct responses.
- In cases where a given number of items were requested (e.g., "three reasons" or "two scenarios"), the examiner's report often provides more sample answers than the requested number. The additional responses are provided for educational value, and would not have resulted in any additional credit for candidates who provided more than the requested number of responses. Candidates are reminded that, per the instructions to the exam, when a specific number of items is requested, only the items adding up to that number will be graded (i.e., if two items are requested and three are provided, only the first two are graded).
- It should be noted that all exam questions have been written and graded based on information included in materials that have been directly referenced in the official Syllabus, which is located on the CAS website. The CAS takes no responsibility for the content of supplementary study materials and/or manuals produced by outside corporations and/or individuals which are not directly referenced in the official Syllabus.

QUESTION 1	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): A1**
SAMPLE ANSWERS	
Part a: 0.5 point	
Sample 1 5+ 247.7 + 427.5 + 52.5 + 53.75 - .05*125 = 780 *Sample 2* 100 * 1.0 + 450 * 1.0 + 400* 0.55 + 100 * 0.1 = 780	
Part b: 0.25 point	
400 + 100 + 125 + 550 = 1175	
Part c: 0.5 point	
Sample 1 2230 – 1936.5 = 293.5 *Sample 2* 550 * .05 + 475 * 0.5 + 30 * 0.95 = 293.5 *Sample 3* 317.5 – 24 = 293.5	
Part d: 0.5 point	
(550 + 475 + 30) * 0.05 = 52.75	
EXAMINER'S REPORT	
Candidates were expected to demonstrate knowledge of the determination and relationships among written, earned, and in-force exposures. Candidates were expected to determine the earning pattern based on quarterly written and earned exposures, which was provided. The exposures were not earned evenly, and candidates struggled with determining the earning pattern. Many candidates incorrectly assumed an even earning pattern and proceeded with the calculation on that basis.	
Part a	
Candidates were expected to determine the earned exposures for policy year 2017 as of the end of the Q1 2018. The earning pattern was not uniform, so the candidate needed to recognize the amount earned in Q1 to get the correct answer. Common mistakes included: • Calculating an incorrect earnings pattern. • Assuming an even earning pattern instead of the actual pattern.	
Part b	
Candidates were expected to calculate the in-force exposure based on the written exposures provided. A common mistake was adding the incorrect quarters together.	
Part c	
Candidates were expected to calculate the calendar year 2018 unearned exposures.	

Common mistakes included:

- Assuming a uniform earning pattern.
- Not accounting for the unearned written exposures from 2017.
- Applying the earning pattern to the earned exposures instead of the written exposures.

Part d

Candidates were expected to calculate the earned exposures for the quarter subsequent to the end of written exposures. The candidates were expected to use the correct earnings pattern.

Common mistakes included:

- Using an even earnings pattern.
- Using the incorrect exposures (i.e. unearned exposures instead of in-force exposures) as the basis for calculating the earned in Q1.

QUESTION 2

TOTAL POINT VALUE: 1.75 | **LEARNING OBJECTIVE(S): A2**

SAMPLE ANSWERS

Part a: 0.25 point

Sample 1

750 + 900 + 1650 = 3300

Sample 2

WP from 8/1/17 to 7/31/18
This includes policies D, E & F
750 + 900 + 1650 = 3300

Part b: 0.25 point

Sample 1

900 + 1350 = 2250

Sample 2

Inforce Prem as of Dec. 15, 2018
+ E 900
+ G 1350
2250

Part c: 0.5 point

Sample 1

900 + 1650 + 1350 – (3/12)* 2000 = 3400

Sample 2

CY 2018 Written: Policy E, F, G. And C Cancelled.
E.F.G. Total Written: 900 + 1650 +135 0 = 3900
C cancelled: -2000 X (3/12) = -500
Total Written = 3900 – 500 = 3400

Sample 3

2018 CY WP = 2018 CY EP + Δ unearned prem

2018 CY EP = 1200(2/12) + 2000(3/12) + 750(9/12) + 900(12/12) + 1650(6/6) + 1350(5/12) = 4375

Unearned Prem @ 12/31/17 = 1200(2/12) + 2000(6/12) + 750(9/12) = 1762.50
@ 12/31/18 = 1350(7/12) = 787.5

2018 CY WP = 4375 + (787.5 – 1762.5) = 3400

Part d: 0.5 point

Sample 1

No, it does not take into account if the book is growing/shrinking. This book is not written uniformly and has little data. The estimate would be volatile.

Sample 2
This is not an appropriate estimation in this example because not all policies have the same duration nor are they written uniformly throughout the year.

Sample 3
Given policies are not written uniformly throughout the year, plus some policies (i.e. pol B, F) has less than a year premium, using the average of in force will not be correct.

Sample 4
No, it is not appropriate for this insurer to estimate EP that way. Not all policies are annual and premium is written at different amounts during different times of the yr. This would not be a good/accurate indication.

Part e: 0.25 point

Sample 1
Inforce premium can be used to calculate the impacts of rate changes.

Sample 2
Determine current potential for loss.

Sample 3
In-force premium could be used to estimate how much reinsurance to purchase.

Sample 4
We can compare in-force prem at different times to see if the book is shrinking or expanding.

Sample 5
Used to estimate seasonality of the business throughout the year.

EXAMINER'S REPORT

Candidates were expected to demonstrate knowledge of in-force premium, written premium, and earned premium. They were expected to know how to calculate premium using different aggregation methods, and some practical applications of different premium types.

Part a

Candidates were expected to know how to calculate written premium over a calendar year from August 1, 2017 to July 31, 2018.

Common mistakes included:

- Selecting a fiscal year that was greater than or less than 12 months (e.g. June 1, 2017 to July 31, 2018)
- Adding up the written premium for all policies, rather than limiting them to a 12 month fiscal year

Part b

Candidates were expected to calculate the in-force premium as of December 15, 2018.

Common mistakes included:

- Assuming that policy F was 12 months, and was still in-force on December 15, 2018

Part c

Candidates were expected to identify policies E, F, and G as being written in 2018. Candidates were also expected to recognize how the cancellation of policy C effects 2018 written premium.

Common mistakes included:

- Assuming that since policy C was originally written in 2017, that its cancellation in March 2018 did not affect 2018 calendar year written premium
- Calculating 2018 calendar year earned premium instead of written premium

Part d

Candidates were expected to identify why it was inappropriate to estimate earned premium by averaging the in-force premium, especially as it pertains to the insurer in this question.

Saying "timing of policies", "different effective dates" or "cancellation of policies", without additional detail, was not enough to receive full marks. Any insurance company that writes multiple policies will have different effective dates. Candidates were expected to connect the idea that the more uniform their policies were written, the more accurate the estimate would be.

Common mistakes included:

- Mentioning "stability of company" without specifying which elements of the company needed to be stable.
- Saying that the method of using in-force premium to estimate earned exposures was appropriate in the general case, without identifying any restrictions that would make the estimation method inaccurate.
- Showing the calculation without discussing the reasons that the calculation was inappropriate.

Part e

Candidates were expected to identify a practical application of in-force premium.

Common mistakes included:

- Answers that defined in-force premium rather than describe a way to use in-force premium (e.g.: "see the size of the business", "see a list of policies in-force")
- Answers that involved estimating earned premium, despite the question asking for "other than estimating earned premium"
- Using in-force premium to calculate a retention rate without considering changing premium per risk and how much new business was written in the year
- Using in-force premium to calculate unearned premium without describing the calculation
- Using in-force premium to calculate a loss ratio
- Using in-force premium to calculate a loss frequency

QUESTION 3

TOTAL POINT VALUE: 3 | **LEARNING OBJECTIVE(S): A3, A8**

SAMPLE ANSWERS

Part a: 2.25 points

Sample 1

Trend period is from 1/1/2017 to 1/1/2019 – 2 years

Complement = (loss trend/premium trend)^2 x (indicated rate change/implemented rate change)
= (1-1%)/(1+1.5%)^2 x (1+8%)/(1+3.5%)
=0.9927

Expected claim counts = # of exposures x projected frequency
=20,000 x 3% = 600

Full Credibility = (1.645/2.5%)^2 = 4330 claims
Z = SQRT(600/4330) = 37.2%

Credibility-weighted indicated rate change = 37.2% x 1.079 + (1-37.2%) x 0.9927
=1.0248 >>> +2.48%

Sample 2

(1.645/0.025)^2 = 4329.64 >>> Number of claims needed for full credibility
4329.64/0.03 = 144321.3 >>> Number of exposure needed

Z = SQRT(20000/144321) = 0.372

1.079(0.372) + (1-0.372)(1.08/1.035)(0.99^2/1.015^2) = 1.0248

2.48% indicated rate change

Part b: 0.75 point

Any three of the following:

- Competitors rate information
- Loss costs of larger related group (i.e. company's countrywide date; regional; etc.)
- Rate change of larger related group
- Industry benchmarks
- Harwayne's method

EXAMINER'S REPORT

Candidates were expected to understand a credibility weighted indication and how to calculate credibility and the complement of credibility. Candidates generally struggled with the calculation of credibility; that is, not knowing how to use the data given to calculate credibility.

Part a

Candidates were expected to calculate the credibility of the given data, calculate the complement of credibility, and, given the results of those answers and the indicated change before credibility, calculate the final credibility weighted indication.

Common mistakes included:

- Not using the correct z-score from the given normal distribution table
- Not getting the correct number of claims for full credibility
- Not getting the correct number of exposures for full credibility
- Not getting the correct credibility
- Assuming a credibility percentage instead of calculating one
- Not getting the correct trend period
- Not getting the correct residual indication
- Not getting the correct net trend
- Not getting the correct trended present rate indication
- Not applying the credibility and/or the complement to the correct numbers

Part b

Candidates were expected to list three alternative methods for calculating a complement of credibility for first dollar ratemaking.

A common mistake was not listing three applicable methods.

QUESTION 4

TOTAL POINT VALUE: 2.5 | **LEARNING OBJECTIVE(S): A3**

SAMPLE ANSWERS

Part a: 0.75 point

Sample 1

Since claim costs are increasing, the claims made policy is not as affected due to no report lag, where as there is report lag for occurrence policies.

- 2014 claims made loss costs= 100+100+100+100 = 400
- 2014 occurrence loss costs = 100+103+106+109 = 418 > 400 claims made policy

Sample 2

The claims made policy will cost less than the occurrence policy because loss costs are increasing. The losses have more time to develop in the occurrence policy due to report lag & settlement lag, whereas the claims made policy only has settlement lag.

For example, take 2015.
Claims made cost = 103 x 4 = 412
Occurrence cost = 103+106+109+113=431
Occurrence > claims made

Sample 3

A claims-made policy doesn't have report lag beyond the policy term, while an occurrence policy may have a report lag of many years. Since claim costs are increasing, there will be more time for trend to impact an occurrence policy.

Part b: 1.00 point

Sample 1

An occurrence policy would be more underpriced because the annual loss cost trend compounds for future years of IBNYR. In this example the price for a 2014 claims-made policy vs that of an occurrence policy for modified trend is seen below:
C-M:100(4) = 100 -> Not Underpriced; Occ:100 + 110 + 121 + 133.1 = 464.1 -> 46.1 Underpriced

Sample 2

Claims-Made: 100 + 100 + 100 + 100 = 400
Occurrence: 100 + 100(1.1) + 100(1.1^2) + 100(1.1^3) = 464.1 but only charging 418
So, occurrence is more underpriced because the trend difference compounds.

Sample 3

Claims-made policy would be less underpriced because it's less reactive to any changes.
Loss Cost for 2015 C-M: 440 vs 412
Loss Cost for 2015 Occ: 100*(1.1 + 1.1^2 + 1.1^3 + 1.1^4) = 510.51 vs 431
C-M Difference: 412 – 440 = -28
Occ Difference: 431 – 510 = -79

Sample 4

RY 2015 LC: 110 +110 +110 +110 = 440
RY 2015 Original: 103 * 4 = 412 -> 6.8% increase

AY 2015 LC: 110 + 121 + 133.1 + 146.41 = 510.51
AY 2015 Original: 103 + 106 + 109 + 113 = 431 -> 18.4% increase

Because Occurrence policies have reporting lag on top of the settlement lag, an occurrence policy would be more underpriced if the actual loss cost trend by report year is 10%.

Sample 5

A claims-made policy would be less underpriced because it is less impacted by the change in loss cost trend. The occurrence policy has both report lag and settlement lag, while the claims-made policy only has settlement lag, which reduces the time until the claims are closed, so less time for losses to be impacted by trends.

Part c: 0.75 point

Sample response for i. Coverage Trigger:

- Occurrence: when claim occurs/date of loss, Claims-made: when claim is reported/report date

Sample responses for ii. Loss Development:

- Occurrence has more loss development because there is pure IBNR and IBNER whereas claims-made has no pure IBNR because all claims are known at the end of the policy term
- Occurrence has report and settlement lag whereas claims-made only has settlement lag

Sample responses for iii. Investment Income:

- Occurrence policies have report lag and settlement lag so there is more time for investment to earn compared to CM policy where there is no report lag
- There is more time between premium collection and claims payment for occurrence policies due to report lag. As such, occurrence policies will earn more investment income
- There is more time for premium to be invested for occurrence policies since it takes longer for claims to be developed (due to pure IBNR) and paid out.

EXAMINER'S REPORT

Candidates were expected to understand the principles of Claims-Made policies. They were expected to know the loss development characteristics of Claims-Made and Occurrence policies, and the effect these differences have on ratemaking for both policy types.

Part a

Candidates were expected to demonstrate why claims-made policies would cost less than occurrence policies. Both written and numerical responses that illustrate the loss cost difference were accepted. In both cases, candidates were expected to recognize that occurrence policies would be more impacted by increasing loss costs (i.e. positive trend).

Common mistakes included:

- Not mentioning the impact of trend.
- Incorrectly calculating the loss costs.

Part b

Candidates were expected to understand how a change in loss trends will affect the pricing for Claims-Made and Occurrence policies. Candidates were also expected to demonstrate why occurrence policies would be more underpriced as a result the change in trends. Both written and numerical responses that illustrate and compare the change in loss costs of claims-made and occurrence policies, due to the changing trend, were accepted.

Common mistakes included:

- Incorrectly applying the 10% trend to the table of claims by report year and lag. Candidates were not required to calculate the complete table, only what was necessary to calculate the new loss costs.
- Incorrectly calculating the loss cost using the 10% trend
- Failing to compare the change in loss costs between claims-made and occurrence policies
- Explaining why an occurrence policy is underpriced or why there is little underpricing for a claims-made policy, but not both. Both were not necessary if the candidate provided correct calculations of the new loss costs with 10% trend.

Part c

Candidates were expected to describe the difference between occurrence and claims-made policies with respect to coverage trigger, loss development and investment income.

The most common error was failure to identify the underlying cause for more/less development or more/less investment income/time.

Other common mistakes include:

(i) Coverage trigger:
- Stating report year/accident year
- Stating that a loss needs to occur and be reported within the policy term to be covered in a claims-made policy

(ii) Loss Development:
- Simply stating that claims-made policies do not have IBNR without following up with additional details that clarify whether it is pure IBNR vs IBNER
- Stating that claims-made policies have no development beyond policy term
- Simply stating that claims-made policies are shorter-tailed than occurrence policies without explaining why they are shorter
- Simply stating more/less development

(iii) Investment income:
- Stating that occurrence policies have more time or more reserves for investment without any additional support
- Stating that claims-made have shorter time between claim occurrence and claim payment instead of between premium collection and claims payment/settlement

QUESTION 5	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE(S): A3**

SAMPLE ANSWERS

Part a: 0.5 point

Sample 1

Trend from 7/1/18 to 1/1/22

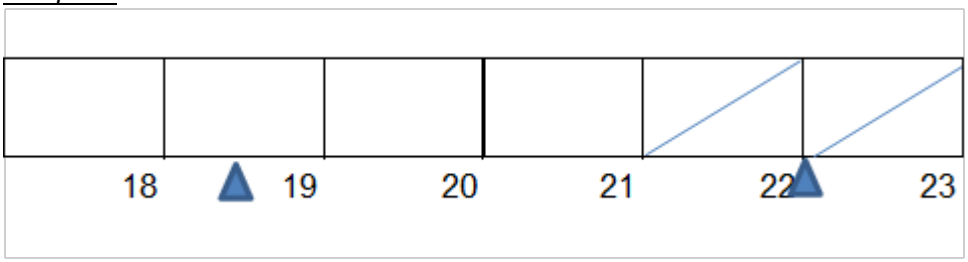
Loss trend factor = $1.02^{3.5} = 1.072$

Sample 2

Avg. future accident date = 1/1/2022

$1.02^{3.5} = 1.072$

Sample 3



$1.02^{3.5} = 1.072$

Part b: 0.5 point

Sample 1

Trend from 1/1/19 to 1/1/22

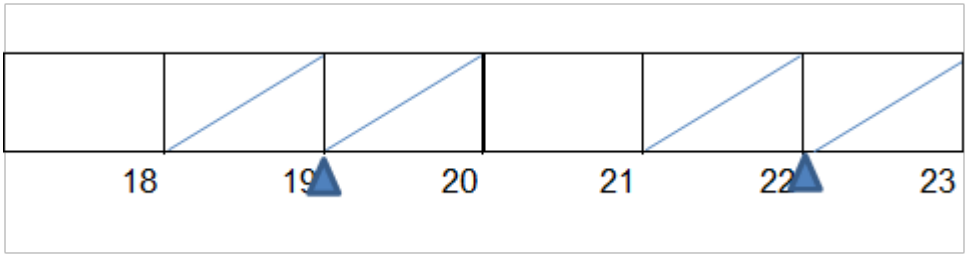
Loss trend factor = $1.02^{3} = 1.061$

Sample 2

Avg. future accident date = 1/1/2022

$1.02^{3} = 1.061$

Sample 3



$1.02^{3} = 1.061$

Part c: 0.5 point

- Development takes losses from current amounts to the final expected amount to be paid. Trending takes losses from a prior period and puts them in line with another, future period. They are making two different adjustments.

- Developing losses brings losses to their ultimate value. Trending losses adjusts losses to reflect the cost levels for the future period.
- No overlap because developing losses brings them to their ultimate losses and trending brings them forward to future cost level.
- Developing losses takes the current reported/paid loss and projects how much will ultimately be paid to close all of the claims for a particular accident year. Trending takes the losses from a particular accident year and projects what they would be in a future time period.
- Developing losses brings losses to the ultimate amount that will be paid to cover and close all claims. Trending losses makes sure that the loss levels are reflective of loss cost levels of the future policy period being priced.

EXAMINER'S REPORT

Candidates were expected to demonstrate knowledge of loss trends, in particular the dates used for trending, and the relationship between loss trend and loss development.

Part a

Candidates were expected to indicate the trend dates leading to a trend period, which should have been incorporated with the loss trend given (2%) to come to the loss trend factor.

Common mistakes included:

- Trending to the average written date of the prospective period (7/1/2021) instead of the average loss date.
- Stating that the trend is calculated from average earned dates instead of average loss dates.

Part b

Candidates were expected to indicate the trend dates leading to a trend period, which should have been incorporated with the loss trend given (2%) to come to the loss trend factor. Indicating that the trend end date was the same as part (a) was acceptable.

Common mistakes included:

- Trending to the average written date of the prospective period (7/1/2021) instead of the average loss date.
- Stating that the trend is calculated from average earned dates instead of average loss dates
- Incorrectly calculating the policy year 2018 average loss date or indicating that the average policy year loss date is the same as the average accident year loss date in part (a).

Part c

Candidates were expected to explain loss trend and loss development. Stating that trend and development do not overlap was not necessary, as this was given in the question.

Common mistakes included:

- Stating that trending and developing ensures rates are at the correct level.
- Stating that development is done on already trended losses or trending is done on already developed losses.
- Stating that development involves IBNR and trend involves inflation without further detail on why there is not overlap

- Stating that trend evaluates an on-level ultimate.
- Describing trend as moving vertically through the loss triangle and development as moving horizontally through the loss triangle without sufficient additional explanation.

QUESTION 6

TOTAL POINT VALUE: 2.25 | **LEARNING OBJECTIVE(S): A4**

SAMPLE ANSWERS

Part a: 1.0 point

Sample responses for i. proportional reinsurance:

- Proportional reinsurance does not need to be accounted for since it affects losses and premiums equally and doesn't distort the loss ratio
- Don't need because premium and claim ceded in same proportion so the ultimate indicated rate change

Sample responses for ii. non-proportional reinsurance:

- Should be addressed explicitly because amounts aren't proportional to total and will distort triangles and loss ratios
- Non-prop does need to be accounted for in ratemaking because premium and losses may be ceded disproportionately resulting in change to Net L/R and Rate Indication
- Yes, Stop Loss or EOL would cause changes to the Loss Ratio

Part b: 0.50 point

Any two of the following, without having answers that are too similar to each other:

- PHDR supplied funds(UEP, Reser)
- Investor supplied funds
- Capital from investors
- Unearned premium
- Loss reserves
- IBNR or Case Reserve
- Stocks
- Bonds
- Mutual funds
- Real estate
- Dividends
- Interest
- Capital gains

Part c: 0.75 point

Sample response for variable expense:

Vary with premium and premium is usually trended so no need to trend VE

Sample responses for fixed expenses when using the exposure-based projection method:

- If exposure is inflation sensitive and expenses trend at different rate then necessary
- If exposure in non-inflation sensitive then … need trending
- Trend can be used if fixed expense trend is different from exposure trend
- Fixed expenses using exposure based need to be trended if the underlying exposure is not inflation sensitive

Sample responses for fixed expenses when using the premium-based projection method:

- only necessary if expense trend differs from premium trend
- Assuming that fixed expenses trend at the same rate as premium then no trending, but, if they trend at different rates then trending necessary

EXAMINER'S REPORT

Candidates were expected to understand and know how to use reinsurance costs, investment income and expenses in ratemaking.

Part a

Candidates were expected to understand and articulate how reinsurance costs need to be accounted for in primary ratemaking.

In a proportional reinsurance contract the same percentage of premium and loss is ceded and therefore does not impact the primary loss ratio.

In a non-proportional reinsurance contract premium and loss are not ceded proportionally and therefore will distort the primary loss ratio if not considered.

Common mistakes included:

- Restating what proportional and non-proportional reinsurance are without taking a position regarding ratemaking implication.
- Mixing up proportional and non-proportional reinsurance.

Part b

Candidates were expected to identify two sources of investment income.

A wide variety of answers were accepted, including many answers that were not mentioned in the text.

Common mistakes included:

- Identifying collected premium as a source of investment income (as opposed to Unearned Premium)
- Identifying underwriting income and investment income as sources of investment income. These are the two sources of total income, not investment income.

Part c

Candidates were expected to understand when trending is necessary for variable and fixed expenses.

Variable expenses, by definition, are a percentage of premium and will automatically change when premium changes. Therefore, there is no need to trend variable expenses.

When using the exposure-based projection method fixed expenses can trend at a different rate than exposures and may therefore need to be trended. Candidates did not necessarily have to understand that some exposures are already inflation sensitive. An example of why or why not to trend fixed expenses relative to the type of exposure was acceptable. Stating that fixed expenses can trend at a different rate than payroll was acceptable.

When using the premium-based projection method fixed expenses need to be trended independently unless fixed expenses are assumed to trend at the same rate as premium. This is an explicit assumption that needs to be made, unlike variable expenses which are defined to be a ratio to premium.

Common mistakes included:

- Referring to loss trend instead of fixed expense trend.
- Stating that there is no need to trend fixed expense if exposure is/isn't inflation sensitive.
- Stating that fixed expenses don't need to be trended when using the premium-based projection method because fixed expense has been ratio-ed to premium.

QUESTION 7

TOTAL POINT VALUE: 4.5 | **LEARNING OBJECTIVE(S): A5, B3**

SAMPLE ANSWERS

	12-24	24-36	36-48
2016	1.194	1.101	
2017	1.199		
Average	1.1965	1.101	1.031
CDF	1.358	1.135	1.031

		BF (000's)	Trend	ULAE	Ult. Trend. Loss+LAE (000's)
2016	$4522+10500*.6*(1-1.031^{-1})$ =	4711.43	$1.04^{4.5}$	1.07	6014.32
2017	$4109+12000*.6*(1-1.135^{-1})$=	4965.39	$1.04^{3.5}$	1.07	6094.72
2018	$3545+12500*.6*(1-1.358^{-1})$=	5522.17	$1.04^{2.5}$	1.07	6517.44

2016 = 1.071 -> OL factor
2017 = 1 .875 1.00625 -> 1.064 OL factor
1.05 .125
2018= 1 .125
1.05 .75 1.046 -> 1.024 OL factor
1.071 .125

	EP	OL	Trend	Trended OLEP	LR	Avg LR = 45.72%	FE Ratio
16	10500	1.071	1.03^4.5	12845.36	46.82%		11%
17	12000	1.064	1.03^3.5	14159.67	43.04%		30%
18	12500	1.024	1.03^2.5	13781.71	47.29%		12%

2017 FE Ratio caused by system implementation, assume one time and exclude; avg 16 and 18 -> 11.5%

Indicated rate change = (45.72% + 11.5%) / (1 – 0.3 -0.05)-1 = -12.0%

EXAMINER'S REPORT

Candidates were expected to demonstrate knowledge of completing an overall rate level indication using the loss ratio method, including calculating development factors, calculating on-level factors using rate change history, trending and developing loss, on-leveling and trending premium, applying a ULAE load, and incorporating an appropriate fixed expense load.

Common mistakes included:

- Not accounting for outlier fixed expense year in 2017.
- Using On-leveled earned premium (OLEP) as the base for the expected loss in the Bornhuetter-Ferguson (BF) method.
- Using OLEP as the base for the fixed expense load.
- Assuming all expenses were variable.

- Using the development method to develop loss instead of the BF method.
- Adding LDFs (rather than multiplying) to calculate CDFs.
- Including fixed expense in the L&LAE Ratio.
- Trending reported losses in the BF method.
- Calculating rate indications for each year individually.

QUESTION 8

TOTAL POINT VALUE: 1.75 | **LEARNING OBJECTIVE(S): A5, A6**

SAMPLE ANSWERS

Part a: 1.25 points

Sample 1

Scenario 1: No rate change

Year	Premium	Losses & Expenses	Profit	Retention: No Rate Change	Adjusted Profit
current	1000	800	200	1	200
1st renewal	1000	800	200	0.85	170
Total	2000				370

Scenario 2: 5% rate increase

Year	Premium	Losses & Expenses	Profit	Retention: Rate Change	Adjusted Profit
current	1000	800	200	1	200
1st renewal	1050	800	250	0.75	187.5
Total	2050				387.5

Sample 2

Scenario 1: No rate change

Year	Premium	Losses & Expenses	Profit	Retention: No Rate Change	Adjusted Profit
1st renewal	1000	800	200	0.85	170

Scenario 2: 5% rate increase

Year	Premium	Losses & Expenses	Profit	Retention: Rate Change	Adjusted Profit
1st renewal	1050	800	250	0.75	187.5

Sample 3

Scenario 1: No rate change

Year	Premium	Losses & Expenses	Profit	Retention: No Rate Change	Adjusted Profit
current	1000	800	200	1	200
1st renewal	1000	800	200	0.85	170
Total	2000				370

Profit as % of Premium (not required, but also acceptable to use) 18.5%

Scenario 2: 5% rate increase

Year	Premium	Losses & Expenses	Profit	Retention: Rate Change	Adjusted Profit
current	1000	800	200	1	200
1st renewal	1050	800	250	0.75	187.5
Total	2050				387.5

Profit as % of Premium (not required, but also acceptable to use) 18.9%

Sample 4

Scenario 1: No rate change

Year	Premium	Losses & Expenses	Profit	Retention: No Rate Change	Adjusted Profit
1st renewal	1000	800	200	0.85	170

Profit as % of Premium (not required, but also acceptable to use) 17.0%

Scenario 2: 5% rate increase

Year	Premium	Losses & Expenses	Profit	Retention: Rate Change	Adjusted Profit
1st renewal	1050	800	250	0.75	187.5

Profit as % of Premium (not required, but also acceptable to use) 17.9%

- Recommend 5% rate change

Part b: 0.5 point

Sample 1

Principle 1: A rate is an estimate of the expected value of future costs.

- The strategy from part a violates the principle if it focuses solely on maximizing profit for the insurer without considering the expected value of future costs.
- While there is a profit, variable costs and risk loads/UW profit are needed to cover inherent risks and could still be deemed a fair rate

Sample 2

Principle 2: A rate provides for all costs associated with the transfer of risk

- The strategy violates the principle if the focus is solely on profit and does not reflect estimated loss costs
- A profit is made even without a rate increase.
- While there is a profit, variable costs and risk loads/UW profit are needed to cover inherent risks and could still be deemed a fair rate

Sample 3

Principle 3: A rate provides for the costs associated with an individual risk transfer.

- The strategy violates the principle if the focus is solely on profit and does not reflect estimated loss costs
- While there is a profit, variable costs and risk loads/UW profit are needed to cover inherent risks and could still be deemed a fair rate

Sample 4

Principle 4: A rate is reasonable and not excessive, inadequate, or unfairly discriminatory if it is an actuarially sound estimate of the expected value of all future costs associated with an individual risk transfer.

- given lack of other assumptions and which lines of business and market condition, it's hard to evaluate whether the rate is excessive or inadequate.
- all insured is receiving the same price, therefore, it's not unfairly discriminatory

EXAMINER'S REPORT

Candidates were expected to understand retention ratio, lifetime value, optimized pricing and the CAS Ratemaking Principles.

Part a

Candidates were expected to calculate and compare the profit under each scenario while considering the rate change and retention ratio.

Stating an assumption regarding total number of policies in the book was acceptable but not required.

Candidates received credit for using profit or for using profit as a percentage of premium as the basis for recommendation.

Common mistakes included:

- Applying the retention rate only to premium and not loss.
- Not applying the rate increase to the 1st year renewal premium.

Part b

Candidates were expected to reference one of the 4 CAS Ratemaking Principles and make appropriate comments on how Part a is evaluated based on the quoted principle.

Common mistakes included:

- Referencing the 4th principle but failing to evaluate all components of the principle.
- Referring to affordability issues, which is not part of the CAS Ratemaking Principles.

QUESTION 9	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): A7, A11**

SAMPLE ANSWERS

Part a: 0.5 point

- Risk classification and individual risk rating both attempt to price the risk using historical data. Risk classification groups risks into categories and assigns relativities based on their experience relative to one another. Individual risk rating uses more of the risk's own historic data to price the risk.
- Similarity: both consider risk characteristics to determine a rate
  Difference: risk classification groups similar risks together to determine the rating whereas individual risk rating looks at each risk separately
- Similarity: both are designed to match the appropriate premium with the expected loss of the insured
  Difference: risk classifications measure the propensity for loss for groups of insureds with similar characteristics, while individual risk rating is tailored to the individual insured
- Similarity: ratemaking is being done at a more granular level to avoid adverse selection
  Difference: risk classification categorizes you in a homogenized group of individuals with similar characteristics vs individual risk rating, where a rate is being produced based on your risk characteristics

Part b: 0.5 point

Sample Responses for Part i

- When the company is covering all small risks
- Many risks with similar characteristics
- When rating homogeneous groups of risks

Sample Responses for Part ii

- Rate set by state regulators
- If expected loss costs are the same for every exposure
- There is no competition in the market and all risks are appeared to be equally risky

Part c: 0.75 point

Any three of the following:

- Rating characteristic is not statistically significant
- Correlated with other characteristics
- Data is not credible enough
- Difficult to verify
- It may not be objective
- Too expensive to implement
- No historical precedent
- Violates insureds privacy
- No causality relationship with expected loss
- It may not be controllable by the insured
- If the rating variable were to make insurance unaffordable
- Not allowed by law

EXAMINER'S REPORT

Candidates were expected to understand the purposes of both risk classification and individual risk rating, understand the circumstances under which each are appropriate, and know the considerations for selecting a rating characteristic.

Part a

Candidates were expected to describe one way that the purposes of risk classification and individual risk rating are similar and one way that they are different.

Common mistakes included:

- Identifying the purpose of both risk classification and individual risk rating as rate adequacy overall rather than for an individual or group.
- Identifying the purpose of risk classification as rate development for a group rather than rate differentiation for multiple groups.
- Identifying the purpose of risk classification as grouping similar risks without explaining how those groups are used in risk classification.

Part b

Candidates were expected to understand when risk classification is more appropriate than individual risk rating and when neither are necessary, and determine a situation under which each scenario would be true.

Common mistakes included:

- Identifying the situation as thin data or a new line of business.
- Identifying a product or risk characteristic without explaining how it satisfies the condition of the scenario.

Part c

Candidates were expected to understand what an actuary should consider when deciding whether to include a rating characteristic and provide three reasons it might not be included in a classification rating plan.

Common mistakes included:

- Describing fewer than three reasons.
- Identifying duplicate reasons.
- Identifying a reason a rating characteristic would be more likely to be included in the classification rating plan, such as being affordable to insureds or having a causal relationship to expected losses.

QUESTION 10	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): A8**
SAMPLE ANSWERS	
Part a: 0.5 point	
Sample 1 The graph shows the Consistency Test. It checks the result of the GLM to see if all the years have a consistent slope and are consistent over the years. *Sample 2* Consistency Test. Tests the model for various years to see if the prediction/estimates are consistent over time. *Sample 3* Consistency Test. The test looks at the pattern of the relativity over several years to see if the variable is statistically significant to use in the model. *Sample 4* The test is to verify that the relativities are stable when you examine them across many individual years. *Sample 5* To answer whether the presence of claims will have a significant impact on individual rates. In addition, the graph will provide insight on how similar the impact is among different years.	
Part b: 0.25 point	
Sample 1 The relativities of having a claim history for all years are consistent. *Sample 2* The trend is consistent over the years. The upward line suggests the existence of claim in the prior year is correlated with higher losses. So reasonable to include the claim in the prior year in the model. *Sample 3* The lines are trending upward consistently indicating that the variable is significant and reliable to include in the model.	
Part c: 1.0 point	
Any two of the following: Statistical Test – Look at the Chi-square test to test the null hypothesis. A chi-square test p-value less than 5% shows the null hypothesis should be rejected and the variable is predictive and should be included in the model. (Similar answers for T-test or F-Test.) Judgmental – Check to see if the relativities make common sense and is intuitive. Standard Error Test – If the range around the estimate is wide, it may not be statistically significant. If the intervals are tight then the variable should be included.	

EXAMINER'S REPORT

Candidates were expected to know the GLM consistency test graph, what it represents, and two other tests used in assessing whether to include a variable in the GLM or not.

Part a

Candidates were expected to know that the graph is used for the consistency test and that it reflects a stable variable to use in the GLM.

Common mistakes included:

- Not knowing what the graph represents and what it is used for
- Stating that the graph was evaluating whether a variable should be included, without any mention of consistency over years

Part b

Candidates were expected to assess what specific graph reflected – consistency of the shape/slope.

Common mistakes included:

- Not knowing the use of the graph
- Stating that the pattern was not consistent/stable because the slopes were not relatively similar

Part c

Candidates were expected to demonstrate knowledge of two other tests used in evaluating whether a variable is appropriate to include in the GLM or not.

Common mistakes included:

- Listing tests that are not used in evaluating a variable's appropriateness
- Listing tests generally used for assessing the appropriateness of the GLM as a whole (not a specific variable)
- Not providing the correct explanation for a specific test they listed
- Mixing the name of a type of test with the explanation for a different type of test

QUESTION 11

TOTAL POINT VALUE: 1.25	**LEARNING OBJECTIVE(S): A8**

SAMPLE ANSWERS

Part a: 0.25 point

- This is the base level for industry type and thus both relativities equal 1.0
- Since industry 5 has the most exposures, it is the base level for the variable
- Because industry 5 level is the base level of relativities

Part b: 0.5 point

- The GLM would account for correlation between variables (distributional bias) while the one-way approach (univariate) would not
- A one-way result does not acknowledge correlations between rating variables whereas a GLM does
- There could be exposure distribution bias that is corrected for in the GLM but not in the one-way result model
- GLM account for interaction, one way do not
- one way does not correct for exposure correlation

Part c: 0.5 point

- One way results can lose profit for factors below the base. Industry 1-4 are given lower factors than the GLM. They can also lose profit from charging too high a factor above the base and losing renewals and new customers from this.
- If the GLM results produce a more accurate estimate of expected losses at an individual insured level, and competitors are using these rating variables, then using one-way results could cause the insurer to be adversely selected against, and profitability would diminish over time.
- They may lead to excessive or inadequate rates for some segments due to double counting effect in the presence of exposure correlation. This can lead to adverse selection, which will decrease profit.
- Assuming the GLM result is more accurate, using the one-way result will hurt the profitability because of overcharging from some industries and undercharging for others. This will result in anti-selection

EXAMINER'S REPORT

Candidates were expected to understand the differences between GLM and one-way models and explain how using less sophisticated models could produce inaccurate pricing which could lead to adverse selection and ultimately deteriorating profitability.

Part a

Candidates were expected to know that both the one-way model and the GLM set Industry 5 as the base level.

Common mistakes Included:

- Not indicating that Industry 5 was set as the base level.
- Only stating that the industry 5 had the most exposures and therefore the most credibility, but not indicating it was the base level.

Part b

Candidates were expected to explain the main differences between one-way and GLMs, i.e. that GLMs consider all variables and account for exposure correlation and variable interactions; and the one-way models do not.

A common mistake was stating that the results were different because of exposure correlations, but not explaining how the models treat them differently.

Part c

Candidates were expected to understand that the one-way model would produce less accurate results which would lead to adverse selection and deteriorating profitability.

Common mistakes included:

- Failing to explain that inaccurate pricing could lead to adverse selection.
- Only stating that it would result in overcharging/undercharging risks without explaining how it would impact the profitability of company.
- Failing to state that it would negatively impact profitability.
- Indicating that one-way is always higher or lower than GLM.
- Comparing one-way analysis to not doing anything at all rather than comparing to the GLM.

QUESTION 12

TOTAL POINT VALUE: 1.75 | **LEARNING OBJECTIVE(S): A8**

SAMPLE ANSWERS

Part a: 1.25 points

Sample 1

Assume "All Other States" means the complement uses other states, not including State A.

Calculation for "All Other States":

	Exposure	Losses	Pure Premium
Car (Pleasure)	(30,000 – 2,500) = 27,500	(6,600,000 – 500,000) = 6,100,000	$221.82
Car (Work)	24,000	15,750,000	$656.25
Truck (Pleasure)	40,000	14,400,000	$360.00
Truck (Work)	47,000	8,200,000	$174.47

Calculate "All Other" pure premium with State A exposures:

$$\frac{\$221.82 \times 2500 + \$656.25 \times 1000 + \$360 \times 0 + \$174.47 \times 3000}{2500 + 1000 + 3000} = \$266.80$$

Calculate State A Pure Premium:

$$\frac{(\$500{,}000/2500)*2500 + (\$500{,}000/1000)*1000 + (\$300{,}000/3000)*3000}{2500 + 1000 + 3000 + 0} = \$200.00$$

Adjustment Factor = $200.00 / $266.80 = 0.7496

"Other States" Adj. Truck (Work) Pure Premium = Complement = 0.7496 x $174.47 = $130.78

Part b: 0.5 point

Sample Responses for Advantage 1

- The current rate is much easier to calculate then doing Harwayne's method.
- Using the current rate is easier to calculate as it involves simple trending which is an advantage over Harwayne's method.
- Using Current Rate is much easier to calculate than Harwayne's method, so it saves time.
- Harwayne's method is more difficult to compute.
- No calculation needed for current rate.

Sample Responses for Advantage 2

- The current rate has a more direct logical relationship to the base rate than Harwayne's method, so it is easier to explain and present.
- Since the current rate is easier to calculate, it is easier to explain the logical relationship to the subject experience, which is another advantage.
- Harwayne's method doesn't have an easy logical (or simple) relationship to the subject, which can make it hard to explain.

EXAMINER'S REPORT

Candidates were expected to understand and correctly apply Harwayne's Method to determine a complement of credibility for given data.

Part a

Candidates were expected to use the given table of data and calculate all the necessary steps of the Harwayne's Method to determine the complement of credibility to be used for Work Trucks.

Common mistakes included:

- Not subtracting State A exposures and losses from the Countrywide data before calculating the Countrywide Pure Premiums.
- Not weighting the individual Countrywide Pure Premiums (i.e. Car/Work, Car/Pleasure, Truck/Work, Truck/Pleasure) with State A's exposure distribution, but instead using the Countrywide distribution.
- Reversing the numerator and denominator of the Adjustment Factor (i.e. calculating 1/Adj. Factor)
- Only using a subset of the data given (e.g. using only Truck data, or just the Work data) instead of the entire data table of data.

Part b

Candidates were expected to know the 2 advantages of using the Current Rate Method to determine a complement as opposed to using Harwayne's Method.

Common mistakes included:

- Stating availability of the data as an advantage. Both methods have available data, so this is not an advantage.
- Stating that the Current Rate was easier to explain but not stating why.
- Stating that Current Rate method would minimize disruption.

QUESTION 13

TOTAL POINT VALUE: 1.75 | **LEARNING OBJECTIVE(S): A8**

SAMPLE ANSWERS

Sample 1

$$\text{LAS (\$50k)} = \frac{145*50{,}000 + 550*50{,}000 + 875*50{,}000}{145 + 550 + 875} = 50{,}000$$

$$\text{LAS (\$50xs50)} = \frac{100{,}000*550*60\% + 100{,}000*550*40\%*50\% - 550*50{,}000 + 50{,}000*875}{550 + 875} = 42{,}281$$

$$\text{LAS (\$100xs100)} = \frac{200{,}000*875*40\% + 200{,}000*875*60\%*50\% - 100{,}000*875}{875} = 40{,}000$$

$$\text{ILF(\$200k)} = \frac{40{,}000 + 42{,}281 + 50{,}000}{50{,}000} = 2.646$$

Sample 2

LAS(50k xs 0) = 50,000

$$\text{LAS(50k xs 50k)} = \frac{330(50{,}000) + 875(50{,}000)}{330 + 875} \quad \frac{(330 + 875)}{(550 + 875)}$$

$$= 42{,}280.7$$

$$\text{LAS(100k vs 100k)} = \frac{350(100{,}000)}{350} \quad \frac{(350)}{(875)}$$

$$= 40{,}000$$

$$\text{ILF for 200k Limit} = \frac{50{,}000 + 42{,}280.7 + 40{,}000}{50{,}000}$$

$$= 2.65$$

EXAMINER'S REPORT

Candidates were expected to use the censored data and as much data as available at each limit, to calculate limited average severities and ultimately the increased limit factor. Correct splitting of the claim sizes were required for the claims from each set of policies. Candidates needed to calculate three LAS amounts using data from all policy limits equal to or above that amount, and combine using the probability that losses are above the limit.

Common mistakes included:

- Not using data from multiple policy limits for each LAS (where appropriate)
- Calculating LAS(150k xs 50k)
- Using censored data for policy limits below the LAS layer
- Double-counting the probability terms

QUESTION 14

TOTAL POINT VALUE: 2 | **LEARNING OBJECTIVE(S): A10**

SAMPLE ANSWERS

Part a: 1 point

Sample 1

i. a = min(250/(.8*300),1) = 1.
Amount of loss paid by policyholder = 260,000 – 250,000 = 10,000

ii. a = min(250/(.9*300),1) = .926
Indemnity payment = .926*260,000 = 240,740
Total paid by policyholder = 260,000 – 240,740 = 19,260

Sample 2

i. 250/(300*.8) = 1.042, 0% coinsurance penalty
Loss > ins value, 260,000 – 250,000 = 10,000

ii. 250/(300*.9) = .926, 7.4% coinsurance penalty
Policyholder pays: .074*260,000 = 19,240

Sample 3

i. Insured value = 250/300 = 83.33%, no penalty since > coins requirement
Policyholder pays 260,000 – 250,000 = 10,000

ii. 260,000*(.8333/.9) = 240,731, policyholder pays 260,000 – 240,731 = 19,269

Sample 4

i. Insured value must be at least 300K*(.8) = 240K. Given insured value of 250K (>240K) then insurer will pay the full loss limit of 250K.
Policyholder pays 260K – 250K = 10K

ii. Insured value must be at least 300K*(.9) = 270K. Insured value is less than 270K thus insurer will pay 250K/(300K*.9) = $240,740.
Policyholder pays 260,000 – 240,740 = 19,260

Part b: 0.5 point

- Coinsurance shares losses with underinsureds so ITV insureds do not have excessive rates.
- Coinsurance penalizes those underinsureds by reducing the indemnity payments, so that both fully-insured and underinsureds yield the same losses ➔ equitable i.e. we aren't subsidizing underinsureds with fully insureds
- When some of the insureds insure their property to value but some don't, those who don't insure to value will have penalty of indemnity, so it promotes equitable rates.
- If the insurer assumes all policies are insured to full value but they aren't, then rates will be inequitable between those that are insured to full value and those that are underinsured. The coinsurance provision lowers the paid losses to those that are

underinsured so that the premiums reflect the true expected losses and rates are equitable.

Part c: 0.5 point

- Coinsurance reduces the losses by forcing underinsureds to undertake a portion of the loss in order to reach an adequate rate.
- Coinsurance provisions promote adequate rates by penalizing and thus discouraging underinsurance. Underinsured exposures are usually underpriced because policies are priced assuming full coverage.
- Coinsurance promotes adequate rates by incentivizing risks to insure to the appropriate value. Thus, the insurer will not be exposed to unknown levels of risk and can rate similar risks accordingly.
- It encourages insured to insure to value as there is a coinsurance penalty for underinsureds. When insurance to value happens across the book, the insurer can get the correct exposure which results in correct rates → results in adequate rate.

EXAMINER'S REPORT

Candidates were expected to know how to calculate the coinsurance penalty, as well as explain how the coinsurance penalty promotes both equitable and adequate rates.

Part a

Candidates were expected to calculate the penalty as well as calculate the amount owed by the policyholder.

Common mistakes included:

- Calculating the amount paid by the insurer instead of the amount paid by the policyholder.
- Incorrectly assuming the question was asking about copayments instead of the coinsurance requirement. For example, some candidates assumed all insureds pay 20% of the losses, sharing them with the insurer.

Part b

Candidates were expected to describe how coinsurance provisions promote equitable rates.

Common mistakes included:

- Referencing a penalty without saying it applied to losses or at the time of loss.
- Referencing a penalty without saying it applied only to underinsureds.
- Confusing the definitions of equitable and adequate rates.

Part c

Candidates were expected to describe how coinsurance provisions promote adequate rates.

Common mistakes included:

- Rewording the question and never explaining how coinsurance provisions make rates adequate.
- Stating that coinsurance provisions guaranteed or required insurance to value when it only encourages or promotes insurance to value.
- Confusing the definitions of equitable and adequate rates.

QUESTION: 15

TOTAL POINT VALUE: 2 | **LEARNING OBJECTIVE(S): A11**

SAMPLE ANSWERS

Part a: 0.5 point

Sample responses for the new training program:

- Underwriting can reflect the training program via schedule rating, lower premium

Sample responses for the increase in employees:

- Manual premium increases due to doubling # of employees
- Exposures have doubled
- Higher employees contributes to higher premium, which may qualify the insured for a policy discount due to decreasing fixed expenses as a percentage of premium.

Part b: 1.0 point

Sample response for the new training program:

- This benefit should manifest itself in the claim experience.
- There should be no schedule rating adjustment as this will be reflected in the experience modification factor.

Sample response for the new training program:

- No changes to manual rates; premiums would still be higher due to number of employees

Part c: 0.5 point

- May consider using a high deductible WC policy if losses are growing with the company. If the insurer is becoming more complex, could mean more potential for loss. The high ded would cut down on prem costs.
- Retrospective rating will review the rates each year for expenses and capped losses, and adjust premium each year (subject to max and minimum). This will be able to account for the larger book and complexity of expenses.
- Premium discount since insured should be large enough that the fixed expense portion of the premium is a lower percentage of premium
- Self-insured retention for the insured to participate in its insurance exposures.

EXAMINER'S REPORT

Candidates were expected to understand how the short-term and long-term premium calculation is impacted due to insured changes. Candidates were expected to demonstrate an understanding of rating mechanisms.

Part a

Candidates were expected to know when to apply schedule rating versus manual rating and the affect the policyholder's actions have on the final premium.

Common mistakes included:

- Discussing discounts for the training program, but no identification of what discount (schedule/underwriting) applies
- Providing general commentary about premium increasing or decreasing, but no demonstration of how the insured's actions affect the premium calculation.

Part b
Candidates were expected to demonstrate an understanding of when experience rating applies and that the schedule modifications applied in part a. are removed. Candidates were also expected to demonstrate an understanding of how exposures are applied in the rating process. Common mistakes included: • Providing discussion related to how the long-term impact of the changes would affect loss experience with no demonstration of how that would be reflected in the premium calculation. • Not recognizing that the discount given in part a. should be removed once the training program would be reflected in the experience.
Part c
Candidates were expected to identify a rating mechanism not relied upon in parts a. and b. and describe when the rating mechanism applies or what the rating mechanism is used for. Common mistakes included: • Discussing experience rating, introduction of a new rating variable, application of GLMs or commentary on ways that insured can reduce its loss experience.

QUESTION 16

TOTAL POINT VALUE: 1.5 | **LEARNING OBJECTIVE(S): B1**

SAMPLE ANSWERS

Part a: 0.75 point

Sample 1

- Case reserves
- Incurred but not yet reported (IBNYR)
- Incurred but not enough reported (IBNER)

Sample 2

Unpaid case, development on known claims, reopened claims

Sample 3

- Case outstanding
- Claims in transit
- IBNR

Sample 4

- Future development on reported claims
- Claims incurred but not recorded
- Pure IBNR

Sample 5

Unpaid = Case + IBNER + IBNYR

Part b: 0.75 point

Sample responses for i. Internal Management

- Internal management might decide to lower rates
- Might make a wrong decision to expand business that is unprofitable
- They could loosen underwriting guidelines
- Internal management might spend capital on large projects
- If unpaid is overstated, they may make wrong decision to raise price or exit a business

Sample responses for ii. Investors

- Investors might think profit is larger than it is
- Company will be overvalued and attract investors
- Company will look better than it is and investors will want to invest more
- If the unpaid claims are overstated, investors may think the investment is very poor and the company will lose potential investors.

Sample responses for iii. Regulators

- Regulators would not intervene until it is too late
- Regulators may not catch potential insolvency in time to help company
- Regulators will think the company is doing fine and not take any action
- Regulators might not approve a needed rate increase

- If the unpaid claims are overstated, the regulators may restrict the company from underwriting new business.

EXAMINER'S REPORT

Candidates were expected to know the components of unpaid claims estimates and understand the importance of accurate unpaid claims estimates from the perspective of various stakeholders.

Part a

Candidates were expected to list three distinct parts of an unpaid claims estimate.

Common mistakes included:

- Listing claims-related expenses (such as ULAE, ALAE or LAE) or recoveries without describing them as unpaid.
- Describing the methods or considerations for selecting an unpaid claims estimate without stating the components of the unpaid claims estimate.

Part b

Candidates were expected to explain how inadequate unpaid claims estimates can impact various stakeholders.

Common mistakes included:

- Listing general considerations such as pricing or underwriting without an analysis of how inadequacy might impact the stakeholder's decision.

QUESTION 17

TOTAL POINT VALUE: 2.25 | **LEARNING OBJECTIVE(S): B2**

SAMPLE ANSWERS

Part a: 0.75 point

Any three of the following, without having answers that are too similar to each other:

- Increase (decrease) in case reserve adequacy
- Increase (decrease) in settlement rate, Speedup (slowdown) in case settlement
- Paying out claims faster
- Prioritization of large vs small claims
- Change in mix of business
- Change in policy limits or change the deductible offered
- Change in underwriting rules
- Change in reporting process, such as introducing a new call center
- Growing/shrinking in book of business that change the average accident date
- Reinsurance program change
- Change subrogation procedure to increase recoveries
- Company implement new rule requiring insured to report claims faster
- Take a more aggressive litigative stance on claims
- Start a fraud detection department
- Change in how claims are processed, such as introducing new technology
- Increased risk control (safety programs)

Part b: 1.5 points

Sample Responses for "Increase (decrease) in case reserve adequacy"

- A triangle of case outstanding/open claim count will show an increase
- The paid-to-reported ratio could be used. If case O/S adequacy increases the ratio would decrease going down columns

Sample Responses for "Increase in settlement rate" / "Paying out claims faster"

- Look at disposal rate. Could show increase in disposal rate which is evidence of speedup in settlement rate
- Look at paid to reported triangle and see if paid/reported is increasing down column
- Closed-to-reported claim counts triangle will show an increasing trend down the column

Sample Responses for "Prioritization of large vs small claims"

- If small claims are prioritized and closed quickly, # Closed/# reported ratio triangle would observe an increase in early maturities. Also average paid severity would decrease at early maturities
- Average paid severity (or incremental paid severity) would decrease at early maturities since smaller claims are being closed
- Average case o/s increases as later maturities down the column since only large claims are left open

Sample Responses for "Change in Mix of Business", "Change in underwriting rules"

- Look at triangles separated by mix of business. % reported for mix 1 or % reported for mix 2. This could tell you if one mix is experiencing more claims
- You can observe this with average severity triangles (reported or paid). If you see shifts in severity that can imply the mix of business is changing

Sample Responses for "Change in policy limits or change the deductible"

- Check average paid severity to see if there is an increase

Sample Responses for "Change in reporting process, such as introducing a new call center"

- Changes in claim reporting pattern can be assessed using the age-to-age development factor of reported claim counts and ratio of reported claim count to exposure. Increase in ratio across years implies faster claim reporting
- Look at ratio of reported loss to on-level premium. The introducing of a new call center could lead to an increase in the first column if reporting speeds up

Sample Responses for "Growing/shrinking in book of business that change the average accident date"

- Start by looking at the paid or reported claim age to age development factor triangles. LDFs will be distorted and likely increasing because the average accident date is shifting towards the end of the period and LDFs will be from claims that had less time to develop
- Look at reported claim count triangle – one might see claims count development factors increase in the first period due to shifting of average accident date to later in the year
- For change in average accident date, could look at disposal rates (or reported claims) by quarter instead of annual to see if the earlier maturity disposal rates are decreasing

Sample Responses for "Reinsurance program change"

- Look at ratio of net to gross reported claim triangle, check if the ratio is changing significantly from prior years

Sample Responses for "Change subrogation procedure to increase recoveries"

- Reported subrogation claims to reported claims showing an increase down a column would be an indicator of increased subrogation
- A triangle of salvage and subrogation to paid losses can be created to observe any changes to the recoveries. This will cause the paid or incurred pattern to shift so could observe regular paid or reported triangle as well

Sample Responses for "Company implement new rule requiring insured to report claims faster"

- If it's required to report claims, may speed up reporting – would see higher ratio of reported counts per exposure at earlier maturities

Sample Responses for "Take a more aggressive litigative stance on claims"

- Split claim counts into two triangles – those that go through litigation vs the total #. If you see an increase in claim counts that go through litigation coupled with increases down the column of ALAE severity triangles, this implies more claims are taken to litigation

- Look at closed to reported claim count triangle. If claims are being taken to court, they won't be closed as quickly so ratios down the columns should decrease
- Look at the ratio of the paid to reported claims (not including ALAE). If this triangle shows a lower paid to reported value down the triangle columns by development period, claim defense may be getting stronger
- This can be observed in a Paid ALAE to Paid Claims triangle down column – an increase would indicate more money is spent on ALAE (Lawyers)

Sample Responses for "Start a fraud detection department"

- Ratio of reported claims to earned premium. If this ratio decreases down the column after introduction of a new fraud analytics tool, this could suggest the change was positive
- Use a triangle showing claim counts without pay / reported claim counts – the latest diagonal should show an increase in ratio versus historical levels

Sample Responses for "Change in how claims are processed, such as introducing new technology"

- The ratio of # closed / # reported should be higher down the column
- If a new claim system is implemented, this could speed up claim settlement. Look for an increasing pattern in the disposal rate triangle along the diagonal

Sample Responses for "Introduction of Safety Programs"

- More safety programs (ie risk control) can lead to better loss experience – look at reported claims to earned premium to see if this decreases over time

EXAMINER'S REPORT

The candidates were expected to understand practices that can distort development patterns and how to use development triangles as a diagnostic tool.

Part a

Candidates were expected to provide examples of "internal" changes to an insurance company's practice that can lead to distortion of paid/loss triangles.

Common mistakes included:

- Discussing changes that are external to the company, such as tort reform.
- Discussing events that are outside of the company's control, such as large losses or catastrophe
- Providing two examples that are too similar to each other, such as "paying claims faster" and "increase in settlement rate"

Part b

Candidates were expected to identify a development triangle that can be used to diagnostic the change stated in part a. and provide a description of how it should change (e.g., increase/decrease, down the column or in the latest diagonal).

Common mistakes included:

- Stating the correct diagnostic triangle but providing no explanation
- Identifying a diagnostic triangle that wouldn't show the identified change.
- Giving the wrong direction of change
- Simply stating that there will be changes or distortions in the diagnostic triangle

QUESTION 18

TOTAL POINT VALUE: 1.75 | **LEARNING OBJECTIVE(S): B3**

SAMPLE ANSWERS

Part a: 1.5 points

Sample 1

Incremental Paid Claims

AY	12	24	36	48
2015	1200	1125	575	200 (=3100-2900)
2016	1800	1500	800	
2017	1500	1300		
2018	1700			

Case to Prior Case

AY	12-24	24-36	36-48
2015	0.532	0.50	0.40 (=160/400)
2016	0.575	0.50	
2017	0.557		
Selected	0.555	0.50	0.40

Incremental Paid to Prior Case

AY	12-24	24-36	36-48	48-Ult
2015	0.75	0.719	0.50 (=200/400)	
2016	0.75	0.696		
2017	0.742			
Selected	0.747	0.708	0.50	1.15

Case Outstanding

AY	12	24	36	48
2018	2200	1221	610.5	244.2 (=610.5*0.4)

Paid on Case

AY	12	24	36	48
2018	1700	1693.40	804.47	280.83 (=244.2*1.15)

AY 2018 Unpaid Claims = 1693.4 + 804.47 + 280.83 = 3093.94

Sample 2

AY 2015 Ultimate Paid Claims = 48-Ult Paid to Prior Case O/S * Prior Case O/S at 48 months + Paid Claims at 48 months
= 1.15 * 160 + 3100 = 3284

Paid Development Factors

AY	12-24	24-36	36-48	48-Ult
2015	1.938	1.247	1.069	1.059 (=3284/3100)
2016	1.833	1.242		
2017	1.867			
Average	1.879	1.245	1.069	1.059

12-Ult Factor = 1.879 * 1.245 * 1.069 * 1.059 = 2.648

Reported Claims

AY	12	24	36	48	Ult
2015	2700	3125	3300	3260 (=3100+160)	3284 (=Paid Ultimate)
2016	3800	4450	4675		
2017	3250	3775			
2018	3900				

Reported Development Factors

AY	12-24	24-36	36-48	48-Ult
2015	1.157	1.056	0.988	1.007 (=3284/3260)
2016	1.171	1.051		
2017	1.162			
Average	1.163	1.054	0.988	1.007

12-Ult Factor = 1.163 * 1.054 * 0.988 * 1.007 = 1.219

Case O/S 12-Ult Development Factor = ((1.219 – 1) * 2.648) / (2.648 – 1.219) + 1.00 = 1.4058

AY 2018 Unpaid Claims = 2200 * 1.4058 = 3092.76

Part b: 0.25 point

Sample 1

When pricing a claims-made policy which has no pure IBNR.

Sample 2

It is appropriate to use this method with short-tailed lines of business when nearly all of the claims have been reported in the first period of development.

Sample 3

For self-insured companies that only have case outstanding data and can use industry paid/reported CDF's to calculate the unpaid factor.

EXAMINER'S REPORT

Candidates were expected to know the mechanics and assumptions of the Case Outstanding method and be able to apply one of the methods to the provided data. They were also expected to know when the Case Outstanding method is appropriate to use.

Part a

Candidates were expected to calculate the 2018 Accident Year Unpaid Claims using the Case Outstanding method of their choosing.

Common mistakes included:

- Calculating Ultimate Claims and not Unpaid Claims
- Not including the 48-Ultimate Paid on Prior Case development factor or applying the factor incorrectly
- Using another method besides one of the two Case Outstanding methods
- Using Cumulative Paid Claims and development factors instead of Incremental Paid Claims and factors
- Using current year Case Outstanding instead of prior year Case Outstanding when calculating Paid on Prior Case Ratios

Part b

Candidates were expected to provide a scenario where using the Case Outstanding method would be appropriate or preferred over other methods.

Common mistakes included:

- Listing an assumption of the method rather than a scenario
- Describing scenarios where the method would not be appropriate to use

QUESTION 19	
TOTAL POINT VALUE: 3	**LEARNING OBJECTIVE(S): A2, B3**

SAMPLE ANSWERS

Sample 1

Via parallelogram method, average rate level is:
2016: 0.875(1) + 0.125(1.04) = 1.005
2017: 0.125(1) + 0.75(1.04) + 0.125(1.04)(1.02) = 1.0376
2018: 0.125(1.04) + 0.875(1.04)(1.02) = 1.0582

On-level factors to bring to 2018 level:
2016: 1.0608/1.005 = 1.0557
2017: 1.0608/1.0376 = 1.0224
2018: 1.0608/1.0582 = 1.002

Trended, On-Level Used-Up Earned Premium, at 2018 level:
2016: 10,400 x 1.0557 x 1.02^2 x 1/1.05 = 10,879
2017: 11,000 x 1.0224 x 1.02 x 1/1.26 = 9,106
2018: 11,500 x 1.002 x 1 x 1/1.764 = 6,536
Sum = 26,521

Trended Claims
2016: 7,200 x 1.03^2 = 7,638
2017: 6,300 x 1.03 = 6,489
2018: 4,700 x 1 = 4,700
Sum = 18,827

Estimated Claims Ratio = 18,827/26,521 = 0.710
De-trend back to 2017 levels: 0.710(1.02/1.03) = 0.703

Calculate AY 2017 Ultimate Claims (use On-Level EP)
AY 2017 Ult (000) = 6,300 + 0.703(1 – 1/1.26)(11,000)(1.0224) = 7,932

Sample 2

AY	On-level prem factors
2016	(1.02 x 1.04) / (0.125 x 1.04 + 0.875 x 1) = 1.0555
17	(1.02 x 1.04) / (.125 x 1 + .75 x 1.04 + .125 x 1.02 x 1.04) = 1.0224
18	(1.02 x 1.04) / (0.125 x 1.04 + .875 x 1.02 x 1.04) = 1.0025

AY	AY 17 on-level factors
2016	1.0555 / 1.0225 = 1.0324
2017	1
2018	0.9805

AY	claim trend	prem trend	% reported

2016	(1.03)	(1.02)	95.24%
17	1	1	79.37%
18	(1.03)^-1	(1.02)^-1	56.69%

AY	claim	prem (used up)
16	7416	10430.196
17	6300	8730.7
18	4563.107	6266.885
	18279	25428

ECR = 18279 / 25428 = 71.89%

AY 17 ultimate claims
11000 x 71.89% x (1-79.37%) + 6300
7,391,400

EXAMINER'S REPORT

Candidates were expected to calculate ultimate claims for a single accident year using the Cape Cod technique. This included adjusting historical premium and claims using the given rate changes and annual trends.

Aside from the two solutions shown, candidates could choose various combinations of trending/detrending and on-leveling/de-leveling, which are all mathematically equivalent and result in the same final answer.

Common mistakes included:

- Failing to detrend and back out rate change from expected claims ratio to be on 2017 level.
- Developing claims to ultimate for use in expected claims ratio calculation.
- Failing to calculate used up premium, and instead using full trended on-level earned premium in expected claims ratio calculation.
- Selecting or averaging individual expected claims ratios for each accident year, as opposed to calculating a single expected claims ratio for all years combined.
- Using incorrect trend periods when trending premium and claims.
- Only calculating expected ultimate claims equal to earned premium times expected claims ratio, when the correct ultimate should be based on reported claims plus expected unreported claims.
- Calculating ultimate claims for the wrong accident year.

QUESTION 20

TOTAL POINT VALUE: 2.75 | **LEARNING OBJECTIVE(S): B3, B4**

NOTE FROM THE SYLLABUS AND EXAMINATION COMMITTEE

The Closed Claim Count triangle was mislabeled in the question, where the first column was labeled "Year" and not "Accident Year" and the final column was labeled "Count" and not "Ultimate Count". This was unintended and was considered during grading.

SAMPLE ANSWERS

Part a: 2.25 points

Sample Response:

Disposal Rate

Accident Year	12	24	36	48
2015	0.476	.858	.992	1.000
2016	0.521	.824	.993	
2017	0.523	.841		
2018	0.506			
Selected	0.507	0.841	0.992	1.000

Incremental Claim Counts:

Accident Year	12	24	36	48
2018	402	266	121	6

$266 = \frac{(795-402)}{1-0.506}(0.841 - 0.507)$ $121 = \frac{(795-402)}{1-0.506}(0.992 - 0.841)$ $6 = \frac{(795-402)}{1-0.506}(1.000 - 0.992)$

Incremental Paid Loss:

Accident Year	12	24	36	48
2015	375	370	161	10
2016	397	353	172	
2017	422	340		
2018	385			

Incremental closed claims

Accident Year	12	24	36	48
2015	308	247	87	5
2016	356	207	115	
2017	358	217		
2018	402			

Incremental paid severity

Accident Year	12	24	36	48
2015	1.218	1.498	1.851	2.000
2016	1.115	1.705	1.496	
2017	1.179	1.567		
2018	0.958			
Selected		1.590	1.673	2.000

Final unpaid claims = 1.2*(1.590 * 266 + 1.673*121+2.000*6) =764,848

Part b: 0.50 point

Sample responses:

- The frequency-severity technique allows for an explicit adjustment to severity to handle change in legal environment
- The frequency-severity technique can use alternate assumptions about disposal rates or claim speedups/slow-downs.
- The frequency-severity technique allows for changes in trend or development
- The frequency-severity technique allows for the separation of frequency and severity into parts, enabling greater insight into the impact of each
- The frequency-severity technique allows for more stable estimates at early maturities when the claim is long-tailed/highly leveraged.

EXAMINER'S REPORT

Candidates were expected to apply the frequency-severity disposal rate technique and know how to adjust the data to deal with a sudden increase in severity due to a change in the legal environment.

Part a

Candidates were expected to calculate unpaid for a single accident year using the frequency-severity disposal rate technique and correctly increase this number by 20% to account for the tort change.

Common mistakes included:

- Not allocating the accident year 2018 claim counts by year.
- Using the paid development technique.
- Incorrectly calculating severity, either by calculating a cumulative-to-date severity or using an incremental loss dollar amount divided by a cumulative or ultimate count.
- Attempting to calculate one unpaid frequency value and one unpaid severity factor.
- Neglecting to add the tort factor or applying it incorrectly.

Part b

Candidates were expected to successfully describe one advantage of the frequency-severity method over the paid development method.

Other common mistakes included:

- Mentioning case reserve adequacy, despite neither the disposal rate frequency-severity technique nor the paid development technique using case reserves
- An incomplete answer that identified a difference between the methods but didn't describe why the frequency severity technique was advantageous
- Providing "advantages" that are true for both methods or not always true for either method.

QUESTION 21

TOTAL POINT VALUE: 2.75 | **LEARNING OBJECTIVE(S): B5**

SAMPLE ANSWERS

Case outstanding

Accident Year	12	24	36	48
2015	540	325	25	0
2016	600	330	30	
2017	585	495		
2018	875			

Open claim counts

Accident Year	12	24	36	48
2015	30	9	1	0
2016	32	9	2	
2017	29	11		
2018	24			

Average case OS

Accident Year	12	24	36	48
2015	18.0	36.1	25.0	
2016	18.8	36.7	15.0	
2017	20.2	45.0		
2018	36.5			

Detrended average case OS

Accident Year	12	24	36	48
2015	31.5	40.8	14.3	0.0
2016	33.1	42.9	15.0	
2017	34.7	45.0		
2018	36.5			

Adjusted case OS = detrended / open

Accident Year	12	24	36	48
2015	945	367	14	0
2016	1,058	386	30	
2017	1,007	495		
2018	875			

Adjusted incurred loss = paid + adj OS

Accident Year	12	24	36	48
2015	1,505	1,692	1,664	1,680
2016	1,708	1,736	1,750	
2017	1,622	1,800		
2018	1,500			

Age-to-age

Accident Year	12	24	36	48
2015	1.125	0.983	1.009	
2016	1.016	1.008		
2017	1.110			
2018				

Sample 1

Straight Average	1.084	0.996	1.009
A-U	1.089	1.005	1.009

	Incurred	A-U	Ult	Paid	Unpaid
2018	1,500	1.089	1633.7	625	1,009

Sample 2

Weighted Average	1.081	0.996	1.009
A-U	1.087	1.005	1.009

	Incurred	A-U	Ult	Paid	Unpaid
2018	1,500	1.087	1630.7	625	1,006

EXAMINER'S REPORT

Candidates were expected to know the steps required to adjust the average case outstanding triangle in the reported Berquist-Sherman technique and calculate an estimated unpaid amount after adjusting the reported triangle for changes in case outstanding adequacy.

Candidates were not required to write out full triangles as long as the candidate demonstrated understanding of how to de-trend the average case outstanding triangle and create an adjusted reported triangle using those results.

Common mistakes included:

- Calculating the estimated ultimate, but not subtracting the 2018 paid amount to derive an unpaid estimate.
- Calculation errors in creating the adjusted reported loss triangle after de-trending the average case outstanding triangle.

QUESTION 22

TOTAL POINT VALUE: 2.25 | **LEARNING OBJECTIVE(S): B6**

SAMPLE ANSWERS

Part a: 1.75 points

Sample 1

Ratio of S&S / paid claims

AY	12	24	36
15	0.0657	0.1884	0.2208
16	0.0621	0.1830	0.2210
17	0.0649	0.1864	
18	0.0470		

AY	12-24	24-36
15	2.867	1.172
16	2.947	1.208
17	2.872	

AY	ult ratio
15	0.2208
16	0.2210
17	0.1864x1.19=0.221
18	0.0470x2.895x1.19=0.1619

The 2018 ult ratio seems a bit low, I'll assume it's due to a random fluctuation on the early 12 month maturity that's low and judgmentally select 0.21 as the ratio

S&S recoverable = (18,100x1.4x0.221 – 850) x 1000 = 4,750,140

Sample 2

Ratio of S&S / paid claims

AY	12	24	36
15	0.066	0.188	0.221
16	0.062	0.183	0.221
17	0.065	0.186	
18	0.047		

Because the ratio difference from AY 2015-2017 is less. So we use 0.221 as the ultimate salvage and subrogation ratio.

Salvage and subrogation for AY 2018 = 18100 x 1000 x 1.40 x 0.221 = 5600140

Sample 3

Ratio of S&S to gross paid claims

AY	12	24	36
15	6.57%	18.84%	22.08%
16	6.21%	18.30%	22.10%
17	6.49%	18.64%	

18 4.70%

ATA factor

AY	12-24	24-36	36-Ult
15	2.87	1.17	
16	2.95	1.21	
17	2.87		
Simple avg	2.90	1.19	1

We can see that S&S in AY 2018 seems to be lower than previous years, assume this will be the future pattern so I will use 4.70% instead of average ratio of 2015-2017

S&S recoverable for AY 2018 = 18100x1.4x4.70%x2.9x1.19-850 = 3260

Part b: 0.5 point

Sample 1

1. The ratio approach calculates ultimate ratios of salvage and subrogation to paid claims as a diagnostic. If a ratio of a particular year seems unreasonable, a more appropriate ratio can be used.
2. The LDFs based on the ratio approach tend to be less leveraged than the LDFs based on received salvage and subrogation dollars.

Sample 2

- Can easily judgmentally select a more appropriate ratio
- More stable in earlier development not heavily leveraged like development approach

Sample 3

1) The LDFs of ratios are tend to be less volatile than LDFs of dollars
2) It recognizes the relationship between S&S and paid claims

EXAMINER'S REPORT

Candidates were expected to understand the method of estimating salvage and subrogation through the ratio approach and the benefits of using the ratios over development of S&S dollars.

Part a

Candidates were expected to apply the development method to the ratios calculated and from S&S and paid claims.

Credit was also awarded if candidates recognized the 2015 and 2016 ultimate ratios were fully developed and could be used to determine the 2018 ultimate without providing ratio development tables, however, justification was required in the selection to receive full credit.

Common mistakes included:

- Calculating the ultimate S&S, but not calculating the recoverable
- Developing S&S dollars directly to determine Ultimate S&S
- Calculating ultimate losses using paid development triangle rather than the stated 12-Ult factor

Part b

Candidates were expected to know two advantages of the ratio approach over dollar development.

Common mistakes included:

- Listing only one reason
- Identifying a relationship between S&S and claims/losses but not specifying paid claims/losses
- Stating that ratio adjusts for changes in mix of business

QUESTION 23	
TOTAL POINT VALUE: 2	**LEARNING OBJECTIVE(S): B8**

SAMPLE ANSWERS

Sample Responses for Reported Development Method

- Historical loss development factors were too low. With the increase in severity, the estimate as of 2015 was too low. As more data at new severity levels become available, loss development factors increased, and so did estimates of ultimate.
- With no modification for tort reform in development factors, we expect to see large upward swings year-over-year as the higher severity is added to reported losses subsequent to 2015. We do see a near $20M jump from 2016 to 2017 from this.
- Relies on calculating age to age and age to ultimate factors for loss development. A drastic increase in severity will flow through into loss triangles, but it will take time to fully be recognized. This is why ultimate claims increase each year until they eventually level out.

Sample Responses for Bornhuetter-Ferguson Method

- Looks stable, but increases slightly. Stable because the expected claims ratio would have been selected to incorporate increase in severity. The actual claims portion would not change. Reported estimate would get higher over time and when weighted together, cause a slight increase in ultimate losses.
- This method is a credibility weighting of expected and development. Since the method doesn't give a lot of weight to immature years, you could incorporate the expected increase in severity in your selection of an expected loss ratio, causing the method to be more stable over time.
- Uses reported losses and combines that with an expected claims ratio times earned premium times percent unreported. Since we can choose the expected claims ratio, we can have that part increase immediately to react to the higher severity. However, the initial reported losses may not have fully been affected by tort reform changes right away, so that's why reported B-F method still needs to increase slightly each year until 2018.
- B-F is in between the frequency/severity and reported development methods because it is a credibility weighting of the development and expected methods. Development method is under projected while the expected looks like it is adjusted for the severity change.

Sample Responses for Reported Cape Cod Method

- Uses historical data to calculate expected claims ratio which would have been too low. This weighted with the low reported estimate would have resulted in a very low estimate initially. As more data increases loss development factors and the expected claims ratio, estimate increases.
- Considers experience in selecting an expected claims ratio. As such, at an early maturity this method may be relying too much on prior experience, with the lower severity. This causes this method to increase significantly as higher severity experience comes in.
- With no modification to historic loss ratios for tort reform, we should also see large upward increase in estimates year-over-year as the higher severity slowly enters both the

actual and the historic loss ratios. However, because historic loss ratios will continue to be lower, there should be the most movement here, which we observe with roughly $20M increases in estimates each year.
- Least responsive as the a priori has taken experience from the historical years and does not take into account the tort reform.

Sample Responses for Frequency/Severity Method

- When severity of claims changed, the result would have been most immediately captured in the estimate using this technique. While it overestimates the ultimate claims slightly, we see that it is closest when compared to the ultimate claims at 2018.
- This technique is able to directly account for severity trend changes so it is one of the most accurate estimates at early ages.
- Allows for assumptions about external environment, inflationary trend, and claims handling practice to be incorporated easily. This allowed for the method to react right away to the increased severity.
- The technique backs out frequency and severity separately and then adjusts each individually for changes such as the severity increase due to tort reform. By adjusting severity separately, this technique can respond quickly to the severity increase, which is shown by the highest ultimate claims in each year.

EXAMINER'S REPORT

Candidates were expected to understand both the mechanics and assumptions of the four techniques illustrated to develop ultimate claim estimates, and understand the effect of tort reform changes on each of the estimation techniques over time.

Common mistakes included:

- Stating direction of change in ultimate losses in a method without further explanation.
- Stating a method was responsive/not responsive to tort reform without further explanation.
- Stating expected claims ratio was unaffected by tort reform in B-F method without further explanation.
- Confusion in a priori expected claims ratio used in B-F method versus Cape Cod method.
- Stating the reported development technique doesn't take tort change into account without further explanation.
- Defining each method without explaining impact of the tort reform.

QUESTION 24	
TOTAL POINT VALUE: 2.25	**LEARNING OBJECTIVE(S): B3, B7**

SAMPLE ANSWERS

Part a: 1.5 points

Sample 1

Kittel claims basis = .5 (Paid) + .5 (Inc)

		ULAE Ratio
2015	.5 (18700) + .5 (35500) = 27100	1870/27100 = .069
2016	27850	0.068
17	27650	0.069
18	28600	0.07
		Select straight avg,
		see no pattern
		assume random variation
		.069 = w*

unpaid ULAE = .069 (.5 (Case + IBNER) +Pure IBNR)

Use BF Reported Method to estimate ult claims

2015	29500 + 77600 (.45) 0.107 =	33236.44
2016	26200 + 78000 (.45) 0.231 =	34308.1
17	20700 + 77800 (.45) 0.559 =	40270.49
18	19000 + 77900 (.45) 0.763 =	45747
		Total est ult 153562

Total Paid = 22400 + 14300 + 5500 + 2800
= 45,000
Total Rept = 95400
case = 95400 - 45000 = 50400
claims made data so no pure IBNR all
must be IBNER
IBNER = 153562 - 95400 = 58162

unpaid ULAE = .069 (.5 (50400 + 58162) + 0) =
$3,745

Sample 2

Year	Ratio of the Paid ULAE to average of paid and incurred
2015	$1870 / \frac{1}{2}(18{,}700+35{,}500) = 7\%$
2016	6.8%
2017	7%
2018	7%
Select	7%

Case + IBNER = Ultimate - Paid for the claims-made policies
Will estimate ultimate claims using BF method

RY	Case + IBNER
2015	29,500 + 77,600 x 0.45 x 10.7% - 22,400 = 10,836.4
2016	20,008
2017	34,770
2018	42,947
Total	108,562

Unpaid ULAE at Dec 31, 2018 = 7% x ($\frac{1}{2}$ x 108,562 + 0) = 3800

Part b: 0.75 point

Sample 1

Unpaid ULAE is calculated by w [Pure IBNR + 0.5 (Case + IBNER)]. If it is occurrence policy, we would have the pure IBNR component in ULAE calculation.

Sample 2

You would have to estimate the amount of pure IBNR and then multiply the ULAE ratio by the sum of 100% of the pure IBNR and 50% of the sum of the case reserve and IBNER.

EXAMINER'S REPORT

Candidates were expected to know how to estimate unpaid ULAE using the Kittel refinement, and describe the difference between occurrence and claims-made policies under the Kittel refinement.

Part a

Candidates were expected to estimate the ULAE ratio under Kittel refinement, use Incurred Bornhuetter-Ferguson method to estimate the total IBNR, and calculate the Unpaid ULAE under the assumptions of the Kittel refinement.

Common mistakes included:

- Using the wrong basis as the denominator to calculate ULAE ratio
- Calculating IBNR, case and unpaid ULAE for only one year
- Including wrong components, such as ultimate or reported, in the formula under Kittel refinement
- Giving wrong weights for each component of the formula
- Treating the IBNR for claims made policies as pure IBNR
- Not including the IBNR component in the calculation of unpaid ULAE
- Only identifying formula for Kittel refinement but not doing any calculation

Part b

Candidates were expected to know the different components of IBNR for between the claims made policies and the occurrence policies, and how Kittel refinement treats pure IBNR (IBNYR) and IBNER differently.

Comment mistakes included:

- Failing to identify occurrence policies would include pure IBNR (IBNYR)
- Giving wrong weights to pure IBNR and IBNER under Kittel refinement
- Answering question from perspective of claims-made rather than occurrence

QUESTION 25	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): B8**

SAMPLE ANSWERS

Part a: 1.25 points

Sample 1

Unpaid = 12,000,000 x (5-1) = 48,000,000
Gross Expected Paid 12-24 = 48,000,000 x (1/3.3 – 1/5) / (1 – 1/5) = 6,181,818
i) Net Expected Paid 15-18 = 6,181,818 x 0.7 x 25% = 1,081,818
ii) Net Expected Paid 15-18 = 6,181,818 x 0.7 x 35% = 1,514,545

Sample 2

Gross Expected Paid 12-24 = 12,000,000 x (5/3.3 – 1) = 6,181,818
i) Net Expected Paid 15-18 = 6,181,818 x 0.7 x 25% = 1,081,818
ii) Net Expected Paid 15-18 = 6,181,818 x 0.7 x 35% = 1,514,545

Part b: 0.50 point

Sample 1

Industry factors may be distorted as the industry factors are not a perfect match to company development. I would not raise the projection.
I would also not lower the projection based on company factors. Unless the reason for the discrepancy is due to a change that has happened since the original projections, such as a large loss recovery.

Sample 2

I do not recommend changing the net estimated unpaid based on the actual results of the company. The actual and estimated are close to each other. The variation can be because of the leveraged development factors of paid claims at early maturities. The industry estimates may not be appropriate for the company because of differences in policy types, claim settlement methods and development.

Sample 3

No, industry pattern reflects typical payment pattern (more development earlier in year) and is a better assumption than even development by quarter. The estimate using this method is very close in line to the actual net emergence of $1.45M.

EXAMINER'S REPORT

Candidates were expected to calculate the projected net payments for the 15-18 month period under the two scenarios provided (Uniform and Industry emergence patterns within the 12-24 month interim periods). Candidates were expected to recommend and justify whether or not to change the unpaid projection.

FALL 2019 EXAM 5 – SAMPLE ANSWERS AND EXAMINER'S REPORT

Part a

Candidates were expected to calculate the projected net payments within the 15-18 month period using each of the assumptions provided (Uniform and Industry emergence patterns within the 12-24 month interim periods).

Common mistakes included:

- Not applying the 70% quota share.
- Calculating the emergence for the wrong period (ex. 12-15 months).
- Only providing a response under one assumption (Uniform/Industry) but not both.

Part b

Candidates were expected to recommend and justify whether to change the unpaid projection. Candidates were expected to provide justification by comparing actual to expected and evaluating the appropriateness of the uniform/industry assumptions.

Common mistakes included:

- Providing only a recommendation but no justification.
- Citing changes in case adequacy (the question uses paid data).