Exam 5

CASUALTY ACTUARIAL SOCIETY
AND THE
CANADIAN INSTITUTE OF ACTUARIES

Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

October 22, 2018

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 55.00 point examination consists of 24 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.

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

CONTINUE TO NEXT PAGE OF INSTRUCTIONS

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.

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 5, 2018.

END OF INSTRUCTIONS

1. (2.5 points)

An insurer is considering changing the exposure base for boat owners line of business from boat-years to the insured value of the boat.

The insurer offers the following coverages for boat owners:

i. Liability coverage pays for damages to another boat or injuries of people not on the insured's boat.
ii. Physical damage coverage pays for damages to the insured's boat caused by common risks, such as sinking, fire, storms, theft, and collision.

Using three criteria for a good exposure base, evaluate the effectiveness of the proposed change in exposure base for both liability and physical damage coverages and provide a recommendation for the preferred exposure base.

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2. (2 points)

Given the following premium and loss information:

Premium Transactions					
Policy	Original Effective Date	Original Expiration Date	Transaction Effective Date	Full-Term Premium ($)	Notes
A	July 1, 2016	June 30, 2017	July 1, 2016	800	Start of New Policy
A	July 1, 2016	June 30, 2017	April 1, 2017	400	Additional Premium for Endorsement
B	April 1, 2017	March 31, 2018	April 1, 2017	1,000	Start of New Policy
C	October 1, 2017	September 30, 2018	October 1, 2017	500	Start of New Policy
C	October 1, 2017	September 30, 2018	April 1, 2018	N/A	Policy Canceled

Loss Transactions			
Policy	Accident Date	Payment Date	Loss Payment ($)
A	October 1, 2016	October 15, 2016	500
A	January 1, 2017	January 15, 2017	200
B	October 1, 2017	January 15, 2018	500
C	January 1, 2018	January 15, 2018	750

- Each claim is closed on the payment date.

a. (0.75 point)

Calculate the 2017 calendar year earned premium.

b. (1.25 points)

Calculate the 2017 policy year loss ratio evaluated at December 31, 2018.

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3. (1.75 points)

Given the following:

Effective Date	Overall Average Rate Change	Rate Per Exposure ($)	Class Factor X	Class Factor Y	Class Factor Z	Expense Fee ($)
January 1, 2016	0.0%	1,000	1.20	0.85	1.00	120
July 1, 2017	10.0%	1,112	1.20	0.85	1.00	120
October 1, 2017	0.0%	1,175	1.10	0.75	1.00	120
April 1, 2018	1.0%	1,175	1.10	0.75	1.00	132

- All policies are semi-annual.
- Exposures are written uniformly throughout the year.
- Expense fee is a per exposure fee that is added in the last step of the rate calculation.

a. (0.75 point)

Calculate the on-level factor for calendar year 2017 earned premium using the parallelogram method.

b. (0.5 point)

Calculate the on-level factor for a policy effective on April 1, 2017 within Class Y using the extension of exposure method.

c. (0.5 point)

Assess the appropriateness of using the parallelogram method to calculate indicated class factors using the loss ratio method.

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4. (1.5 points)

Given the following information:

Report Year	Loss Costs by Report Year Lag ($) 0	1	2
2015	500	300	200
2016	525	330	210
2017	550	365	220

a. (0.25 point)

Calculate the report year 2015 loss costs for a claims-made policy.

b. (0.25 point)

Calculate the accident year 2015 loss costs for an occurrence policy.

c. (0.5 point)

Compare the effect of an unexpected increase in underlying trend on the accuracy of the pricing for a claims-made policy and an occurrence policy. Briefly explain why one of the policies is impacted more than the other.

d. (0.25 point)

Briefly explain why the risk of reserve inadequacy is reduced for a claims-made policy relative to an occurrence policy.

e. (0.25 point)

Briefly describe why the investment income earned from claims-made policies is less than under occurrence policies.

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5. (2 points)

Given the following:

Accident Year	Incurred Loss and ALAE as of December 31, 2017 ($000s)
2015	$15,000
2016	$8,000
2017	$2,000

Year Ending Quarter	Frequency	Severity ($)	Pure Premium ($)
March 31, 2014	0.055	18,200	1,001
June 30, 2014	0.054	18,000	972
September 30, 2014	0.056	18,100	1,014
December 31, 2014	0.058	18,300	1,061
March 31, 2015	0.058	18,500	1,073
June 30, 2015	0.059	19,000	1,121
September 30, 2015	0.062	19,200	1,190
December 31, 2015	0.063	19,500	1,229
March 31, 2016	0.065	19,750	1,284
June 30, 2016	0.066	19,885	1,312
September 30, 2016	0.066	20,000	1,320
December 31, 2016	0.068	20,250	1,377
March 31, 2017	0.069	20,445	1,411
June 30, 2017	0.070	20,882	1,462
September 30, 2017	0.069	21,000	1,449
December 31, 2017	0.065	21,250	1,381

Annual Exponential Trends			
# of Points	Frequency	Severity	Pure Premium
16	7%	5%	12%
12	6%	5%	11%
8	2%	4%	7%
6	0%	5%	5%
4	-7%	5%	-3%

- All policies are semi-annual.
- Rates are to be in effect for 2 years.
- There is no development after 36 months.
- An underwriting change went into effect on July 1, 2017, materially changing the composition of the book of business.
- A planned rate change will go into effect on January 1, 2019.

Calculate the projected 2015 accident year loss and ALAE to be used in the rate change analysis. Justify any trend selections.

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6. (1.5 points)

Two methods of deriving expense provisions in ratemaking include the premium-based projection method and the exposure-based projection method.

a. (1 point)

For each method, briefly describe how both fixed and variable expenses are treated.

b. (0.5 point)

Briefly describe one shortcoming (or distortion) of each method.

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7. (5.75 points)

Given the following information as of December 31, 2017:

Cumulative Reported Claim Counts as of (months)			
Accident Year	12	24	36
2015	480	456	447
2016	560	532	
2017	590		

Cumulative Reported Loss + ALAE ($) as of (months)			
Accident Year	12	24	36
2015	7,200,000	8,208,000	8,850,600
2016	8,120,000	9,256,800	
2017	9,145,000		

$98,000	Expected reinsurance recoveries
$318,000	Cost of reinsurance (expected ceded premium)
3%	Expected annual exposure increase

Calendar Year	Earned Exposures
2015	14,000
2016	15,000
2017	17,000

5%	ULAE provision as a percent of loss and ALAE
3%	Annual pure premium trend
$21	Projected fixed expenses per exposure
15%	Variable expense ratio
10%	Profit provision
2%	Contingency provision
$950	On-leveled and projected earned premium per exposure

- Exposures are written evenly throughout each year.
- All policies are annual.
- There is no loss development or claim count development beyond 36 months.
- The reinsurance contract has a 12 month term length and an effective date of January 1, 2019.
- Rates are to be in effect for one year.
- Rate revision is planned to be effective April 1, 2019.

a. (1 point)

Calculate the projected net reinsurance cost per exposure using a 12-month term for the reinsurance contract.

b. (2 points)

Calculate the ultimate losses and ALAE for each accident year using an appropriate frequency-severity technique.

c. (1.75 points)

Calculate the projected pure premium per exposure using even weights across the three accident years.

d. (1 point)

Calculate the indicated rate change.

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8. (2.25 points)

Given the following information:

$500	Current average premium
$600	Indicated average premium
$510	All competitors' average premium

a. (0.5 point)

List two likely consequences of the company implementing the indicated rate.

b. (0.5 point)

Briefly describe two factors that affect an insured's propensity to renew.

c. (0.75 point)

The company has decided to not implement the indicated rate. List three non-pricing solutions the company could implement to ensure profitability does not deteriorate.

d. (0.5 point)

Identify an issue with comparing one company's premium to another and briefly propose a solution to this issue.

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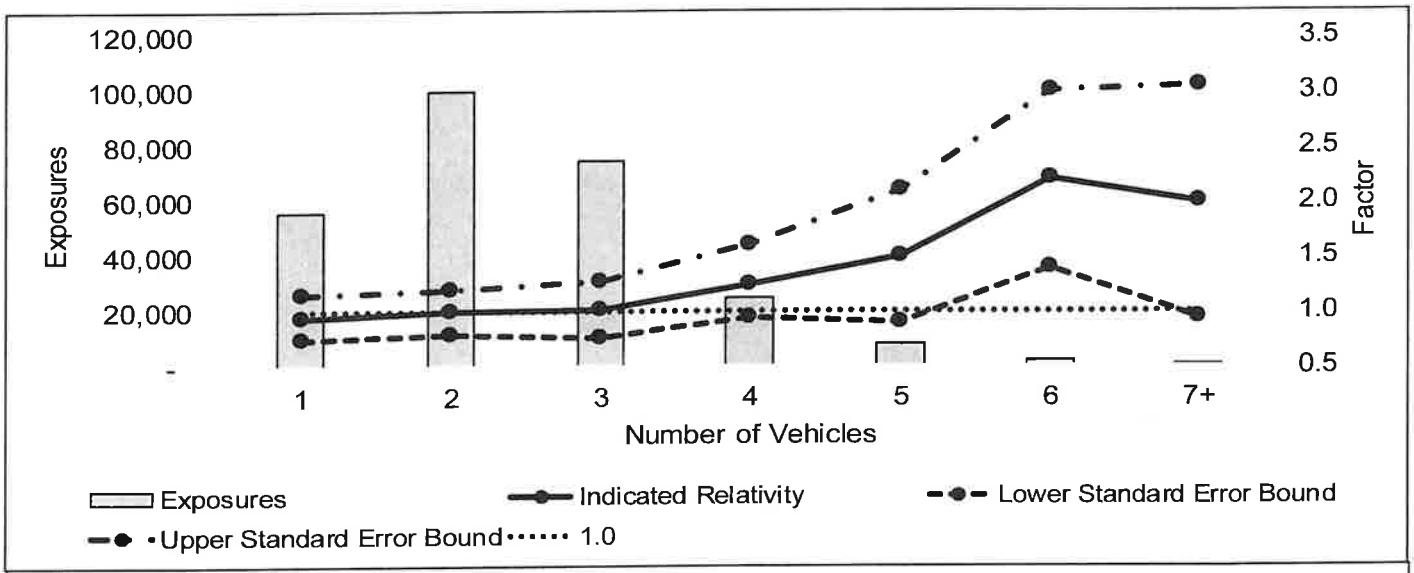
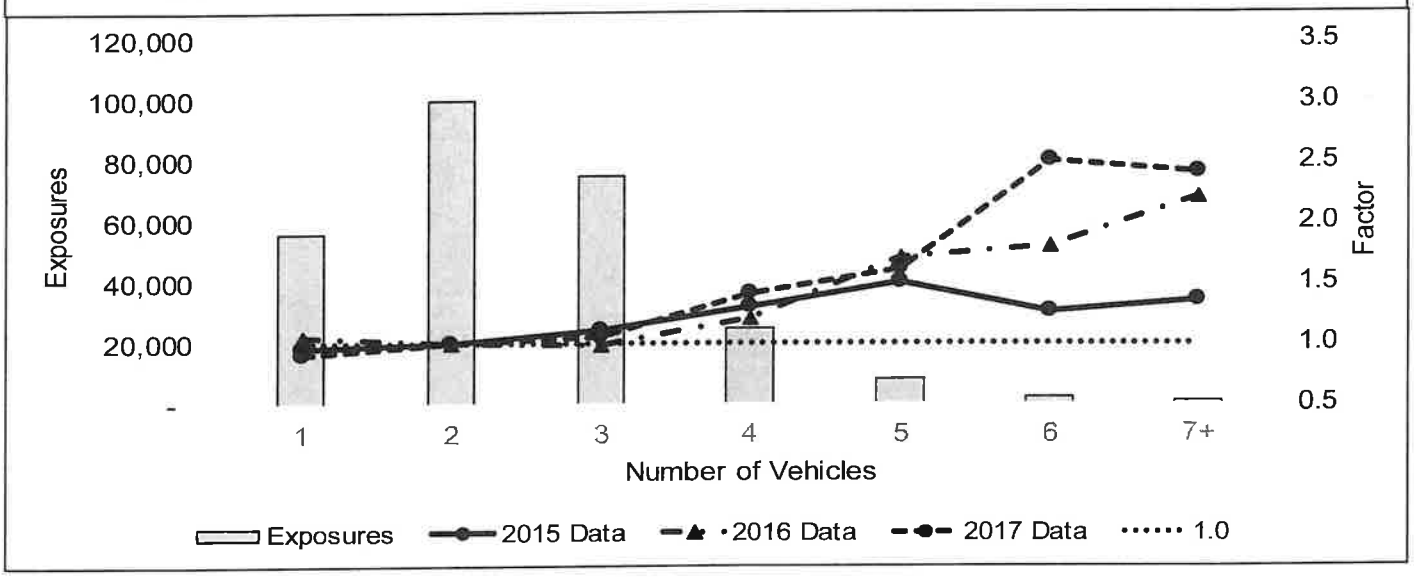
9. (2 points)

An auto insurer is evaluating the variable "number of vehicles" for inclusion in a rating plan. Given the following Generalized Linear Model (GLM) output:





- Number of vehicles chi-square percentage: 10%

a. (1 point)

Fully justify whether number of vehicles should be included in the rating plan.

b. (0.75 point)

Briefly discuss three challenges associated with performing GLM analysis on loss ratio data.

c. (0.25 point)

GLM analysis is widely accepted in classification ratemaking. Briefly discuss one reason that univariate analysis may be more appropriate than GLM analysis.

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10. (2.5 points)

A company writes homeowners insurance in a large state divided in half by a mountain range. The company currently uses two geographic rating territories, one on either side of the mountains, as the range has an effect on weather patterns. Each territory has sufficient exposures for its loss experience to be considered fully credible.

a. (0.5 point)

Briefly discuss two disadvantages of the company's current territorial rating approach.

b. (2 points)

Discuss the process by which an actuary would develop new rating territory definitions for this state. Briefly explain a consideration for each step in the process.

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11. (1.75 points)

Given the following for a large deductible commercial general liability policy:

$500,000	Per occurrence deductible
90.0%	Loss elimination ratio for a $500,000 deductible
10.0%	ALAE/ground up loss ratio
$2,000,000	Ground up loss estimate
$100,000	Fixed expenses
12.0%	Variable expenses as % of premium
4.0%	Underwriting profit as % of premium
3.0%	Deductible processing cost as a % of losses below the deductible
1.0%	Credit risk as a % of losses below the deductible
7.0%	Additional risk margin as a % of excess losses

- The insurer will handle all claims, including those that fall below the deductible.
- The insurer will make the payments on all claims and will seek reimbursement for amounts below the deductible from the insured.
- The deductible is for loss only.
- All ALAE is paid by the insurer.

Calculate the premium for the large deductible policy.

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12. (2.5 points)

Given the following for an insurance company:

Premium = (Base Rate) × (Rating Factor 1) × (Rating Factor 2)

Variable 1 Segment	Rating Factor 1
A	0.90
B	2.00
C	1.00

Variable 2 Segment	Rating Factor 2
X	0.75
Y	0.95
Z	1.00

Earned Exposures			
	Variable 1		
Variable 2	A	B	C
X	800	1,500	600
Y	300	750	500
Z	500	500	1,500

Reported Loss & ALAE ($)			
	Variable 1		
Variable 2	A	B	C
X	320,000	2,100,000	400,000
Y	170,000	1,535,000	500,000
Z	305,000	1,100,000	1,600,000

- The base rate is $1,000.
- The base classification for Variable 1 is C.
- The proposed overall rate level change is 0%.

a. (1.5 points)

Calculate the indicated relativities for Variable 1 using the adjusted pure premium method.

b. (0.5 point)

Calculate the proposed base rate assuming the company selects half of the indicated relativity change for each segment of Variable 1.

c. (0.5 point)

Briefly describe two social criteria for evaluating the appropriateness of rating variables.

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13. (2.75 points)

Given the following information about a home's propensity for loss:

Size of Loss			Loss Distribution
	$X \leq$	\$400,000	50.0%
\$400,000	$< X \leq$	\$550,000	25.0%
\$550,000	$< X \leq$	\$700,000	10.0%
\$700,000	$< X \leq$	\$850,000	10.0%
\$850,000	$< X \leq$	\$1,000,000	2.5%
\$1,000,000	$< X \leq$	\$1,500,000	2.5%
Total:			100.0%

- Expected claim frequency is 2%.
- Expected losses are uniformly distributed within each layer of loss.
- The home is valued at \$1,500,000.

a. (1.25 points)

Calculate the rate per \$1,000 of coverage for the home at the following amounts of insurance:

i. \$1,500,000
ii. \$800,000

b. (0.5 point)

Briefly discuss a problem associated with underinsurance from the following perspectives:

i. Insured
ii. Insurer

c. (1 point)

The home is insured for \$1,000,000 with a coinsurance requirement of 80%. Calculate the indemnity payments and coinsurance penalties for the following losses:

i. \$800,000
ii. \$1,200,000

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14. (1.5 points)

For each of the following stakeholders, describe the importance of having accurate unpaid claim estimates:

i. Internal Management
ii. Investors
iii. Regulators

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15. (2.75 points)

Given the following:

Claim ID	Accident Date	Transaction Date	Gross Amount Paid on Transaction Date ($)	Gross Ending Case Outstanding ($)
A	May 30, 2015	December 24, 2015	1,000	550
		August 1, 2016	500	225
		June 1, 2017	725	0
B	August 28, 2015	August 29, 2015	300	1,050
		February 6, 2016	600	375
		June 14, 2016	450	150
C	April 21, 2016	April 25, 2016	1,200	575
		March 3, 2017	700	250
		December 1, 2017	200	0
D	October 11, 2016	October 12, 2016	400	900
		May 17, 2017	800	625

60%	Quota share ceded percentage for reinsurance that applies to claims occurring in 2015.
$1,500	Per claim excess of loss retention for reinsurance that applies to claims occurring in 2016.

a. (0.25 point)

Calculate calendar year 2015 reported claims, gross of reinsurance.

b. (0.75 point)

Calculate calendar year 2016 paid claims, net of reinsurance.

c. (0.75 point)

Calculate calendar year 2016 reported claims, gross of reinsurance.

d. (1 point)

Calculate calendar year 2017 reported claims, net of reinsurance.

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16. (2 points)

An insurance company with a book of business (Book A) has recently acquired a smaller book of business (Book B) in the same state and line of business. Given the following as of December 31, 2017:

Book A

Accident Year	Reported Claims ($000) as of (months) 12	24	36	48
2014	55,000	92,000	112,500	123,700
2015	54,800	92,600	111,100	
2016	57,000	94,400		
2017	62,600			

Calendar Year	Earned Premium ($000)
2014	175,200
2015	179,400
2016	182,800
2017	184,200

75%	Book A expected claims ratio
1.06	48 to ultimate reported claim development factor

Book B

Accident Year	Reported Claims ($000) as of (months) 12	24	36	48
2014	2,600	5,900	6,700	7,500
2015	3,500	4,300	6,000	
2016	2,600	2,700		
2017	4,400			

Calendar Year	Earned Premium ($000)
2014	8,700
2015	9,700
2016	11,000
2017	13,900

a. (0.75 point)

Calculate the Book A ultimate claims for accident year 2015 using the reported development technique.

b. (0.5 point)

Calculate the Book A ultimate claims for accident year 2016 using the Bornhuetter-Ferguson technique.

c. (0.25 point)

Calculate the Book A ultimate claims for accident year 2017 using the expected claims technique.

d. (0.5 point)

Recommend an approach for estimating ultimate claims for Book B in accident year 2015 without performing any calculations. Justify all assumptions.

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17. (3.5 points)

Given the following information as of December 31, 2017:

Calendar Year	Earned Premium ($000)	On-Level Adjustment
2014	127,500	0.710
2015	117,600	0.660
2016	64,300	0.850
2017	58,900	1.000

Accident Year	Ultimate Claim Counts	Ultimate Severity ($)
2014	2,200	32,600
2015	1,970	35,300

-1.3%	Annual claim count trend
6.0%	Annual severity trend
15%	Estimated savings on claims occurring after January 1, 2017 due to legislative change

a. (3 points)

Estimate the ultimate claims for accident years 2016 and 2017 using an appropriate frequency-severity technique.

b. (0.5 point)

Briefly describe two key assumptions of frequency-severity techniques.

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18. (1.75 points)

Given the following data as of December 31, 2017:

Accident Year	Cumulative Reported Claims ($000) as of (months) 12	24	36	48
2014	500	1,100	1,800	2,500
2015	900	1,700	2,300	
2016	1,000	1,900		
2017	1,100			

Calendar Year	Earned Premium ($000)
2014	5,300
2015	7,200
2016	7,800
2017	8,500

1.3	48 to ultimate reported claim development factor

- In 2015 the company started writing a new class of insureds within this line of business.
- Both existing and new classes of insureds are priced accurately.

a. (1.25 points)

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

b. (0.5 point)

Discuss the effect the new class of insureds has on the reported Cape Cod technique for accident year 2017.

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19. (1.5 points)

One year ago, an automobile insurer implemented a mobile claims reporting platform. The company anticipated that this would lead to shorter reporting patterns.

Since the mobile platform was implemented, the company has identified a shift in mix of business towards younger drivers, with younger drivers having a higher loss cost than older drivers.

Evaluate the effect on the IBNR estimated using each of the following techniques if no adjustments are made:

i. Development Technique
ii. Expected Claims Technique
iii. Cape Cod Technique

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20. (2.25 points)

Given the following data as of December 31, 2017:

Accident Year	Case Outstanding ($000) as of (months) 12	24	36	48
2014	50,400	51,150	35,100	9,600
2015	45,900	64,500	36,000	
2016	60,300	68,400		
2017	62,100			

Accident Year	Cumulative Paid Claims ($000) as of (months) 12	24	36	48
2014	10,800	21,600	129,600	276,000
2015	9,800	19,000	125,000	
2016	10,350	20,000		
2017	10,500			

Accident Year	Open Claim Counts as of (months) 12	24	36	48
2014	360	465	270	80
2015	340	430	250	
2016	335	450		
2017	345			

7.5%	Selected annual severity trend
1.05	48 to ultimate reported claim development factor

a. (0.5 point)

Evaluate whether there has been a change in the adequacy of case outstanding over the experience period.

b. (1.25 points)

Estimate the ultimate claims for accident year 2017 using the Berquist-Sherman adjustment.

c. (0.25 point)

Briefly explain the effect of the Berquist-Sherman adjustment in part b. above when compared to the result using unadjusted data.

d. (0.25 point)

Briefly describe a potential limitation to the Berquist-Sherman adjustment in part b. above.

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21. (1.5 points)

Given the following as of December 31, 2017:

Accident Year	Cumulative Received Salvage and Subrogation (S&S) ($000) as of (months)			
	12	24	36	48
2014	4,700	7,000	7,200	7,300
2015	4,300	6,600	6,800	
2016	4,300	6,800		
2017	4,900			

Accident Year	Cumulative Paid Claims Gross of S&S ($000) as of (months)			
	12	24	36	48
2014	13,500	16,800	16,800	16,800
2015	13,300	16,900	16,900	
2016	13,200	16,800		
2017	12,900			

Accident Year	Selected Ultimate Claims Gross of S&S ($000)
2014	16,800
2015	16,900
2016	16,800
2017	16,400

- There is no development beyond 48 months.

Estimate ultimate salvage and subrogation for accident year 2017 using a ratio approach.

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22. (1.75 points)

Given the following information as of December 31, 2017:

Calendar Year	Paid Claims ($)	Paid ULAE ($)
2014	21,300	1,030
2015	20,900	1,040
2016	20,800	1,040
2017	21,200	1,090

Accident Year	Paid Claims ($)	Reported Claim Counts	Closed Claim Counts	Ultimate Claim Counts	Ultimate Claims ($)
2014	20,800	335	335	335	20,800
2015	18,000	300	270	330	21,400
2016	12,000	275	190	330	21,500
2017	5,000	200	80	335	21,800

60%	Percent of unallocated work that occurs when a claim is opened
40%	Percent of unallocated work that occurs when a claim is closed

- Claims are fully settled and paid by 48 months.

a. (0.75 point)

Estimate the provision for claims incurred but not yet reported (IBNYR) for all accident years as of December 31, 2017.

b. (1 point)

Estimate unpaid ULAE as of December 31, 2017.

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23. (2.25 points)

Given the following information as of December 31, 2017:

Accident Year	Cumulative Paid Claims Only ($) as of (months) 12	24	36
2014	172,000	464,400	626,900
2015	168,000	453,600	
2016	170,000		

Accident Year	Calendar Year 2017 Paid Claims Only ($)
2014	75,200
2015	158,800
2016	289,000
2017	172,000

Accident Year	Cumulative Paid ALAE ($) as of (months) 12	24	36	48
2014	5,500	27,000	40,000	55,000
2015	5,600	26,000	39,000	
2016	5,700	26,000		
2017	5,600			

- There is no development beyond 48 months.

a. (0.25 point)
Calculate the last diagonal of the Cumulative Paid Claims Only triangle as of December 31, 2017.

b. (1.75 points)
Estimate ultimate ALAE for Accident Year 2017 using an additive ratio approach.

c. (0.25 point)
Identify one disadvantage of using a ratio technique to estimate ALAE.

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24. (3.5 points)

The following information is available for an insurance company:

Age (Month)	Cumulative Paid Development Factors to Ultimate	Cumulative Reported Development Factors to Ultimate
12	2.44	1.69
15	2.00	1.46
18	1.65	1.38
21	1.49	1.30
24	1.38	1.22

Accident year 2017 as of March 31, 2018:

2,400	Reported claims ($)
1,820	Paid claims ($)
3,300	Selected ultimate claims ($)

Accident year 2017 as of May 31, 2018:

2,750	Reported claims ($)
2,050	Paid claims ($)

- Loss emergence between evaluation points is linear.

a. (1.25 points)

Considering the data through March 31, 2018, compare the cumulative expected reported claims to the actual reported claims as of May 31, 2018 for accident year 2017.

b. (1.25 points)

Considering the data through March 31, 2018, compare the cumulative expected paid claims to the actual paid claims as of May 31, 2018 for accident year 2017.

c. (0.5 point)

Describe a situation in which the actuary ***would*** revise the March 31, 2018 estimate of ultimate claims given the results calculated in parts a. and b. above.

d. (0.5 point)

Describe a situation in which the actuary ***would not*** revise the March 31, 2018 estimate of ultimate claims given the results calculated in parts a. and b. above.

END OF EXAMINATION

Exam 5
Basic Techniques for Ratemaking and Estimating Claim Liabilities

22-Oct-18

POINT VALUE OF QUESTIONS

QUESTION	VALUE OF QUESTON	SUB-PART OF QUESTION (a)	(b)	(c)	(d)	(e)	(f)	(g)
1	2.50	2.50						
2	2.00	0.75	1.25					
3	1.75	0.75	0.50	0.50				
4	1.50	0.25	0.25	0.50	0.25	0.25		
5	2.00	2.00						
6	1.50	1.00	0.50					
7	5.75	1.00	2.00	1.75	1.00			
8	2.25	0.50	0.50	0.75	0.50			
9	2.00	1.00	0.75	0.25				
10	2.50	0.50	2.00					
11	1.75	1.75						
12	2.50	1.50	0.50	0.50				
13	2.75	1.25	0.50	1.00				
14	1.50	1.50						
15	2.75	0.25	0.75	0.75	1.00			
16	2.00	0.75	0.50	0.25	0.50			
17	3.50	3.00	0.50					
18	1.75	1.25	0.50					
19	1.50	1.50						
20	2.25	0.50	1.25	0.25	0.25			
21	1.50	1.50						
22	1.75	0.75	1.00					
23	2.25	0.25	1.75	0.25				
24	3.50	1.25	1.25	0.50	0.50			
TOTAL	55.00							

EXAM 5 FALL 2018 SAMPLE ANSWERS AND EXAMINER'S REPORT

FALL 2018 EXAM 5 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: 600
- Available Points: 55.0
- Passing Score: 36.5
- Number of Passing Candidates: 187
- Raw Pass Ratio: 31.2%
- Effective Pass Ratio: 33.8%

The Syllabus and Examination Committee understands the pass ratio for this exam is lower than recent prior sittings, and as a result spent additional time analyzing the results prior to selecting the pass mark. In determining the final pass score the committee examined the performance of first time exam takers and repeat exam takers and compared these groups with similar groups from prior sittings.

The recent spring exam sitting gave many candidates two attempts to pass exam 5, as a make-up exam was offered due to technology issues associated with the original exam. The extra attempt resulted in a larger than normal number of candidates passing. This directly resulted in the fall exam being taken by disproportionately fewer repeat exam takers. Repeat exam takers have historically performed better than first time exam takers. In this sitting there was a noticeable drop in performance by the group of repeat takers, while the first-time exam takers performed right in line with prior sittings.

Based on the consistent performance of first time takers, the Syllabus and Examination Committee is satisfied that the selected passing score is reasonably consistent with the standard that candidates have been held to in the past.

EXAM 5 FALL 2018 SAMPLE ANSWERS AND EXAMINER'S REPORT

We understand this explanation is of little comfort to those candidates who did not achieve the passing score. We hope that the details by question provided throughout this Examiner's Report will be helpful to those candidates and future candidates.

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.

EXAM 5 FALL 2018 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 1	
TOTAL POINT VALUE: 2.5	**LEARNING OBJECTIVE(S): A1**

SAMPLE ANSWERS

Sample 1

i. Liability Coverage
   a. Proportional to Expected Loss: Value of the boat is not proportional to the damages it causes to others
   b. Practical: It is not easy to obtain and verify the value of the boat. If we take the insured's word for the value, it is subject to manipulation. Also, it is not objective as to what we define as the value of the boat: is it the price in the market today or the original sale price?
   c. Considerate of Historical Precedence: It could be costly for the insurer to change the exposure base both from an IT standpoint and modification of the data. It could also result in large premium swings for the insured.

ii. Physical Damage Coverage:
   a. Proportional: Yes, there is a logical relationship between the severity of claims and the value of the boat.
   b. Practical: same as liability
   c. Historical Precedence: same as liability

I would recommend continuing to use boat-years because:

1. It is proportional to expected loss (more boats = more claims)
2. Objective, easy to verify and obtain
3. No change needed, so no cost to implement new exposure base

Sample 2

1. Practical – Insured value of the boat can be clearly defined and measured and would be a value already on-record by the insurance company
2. Proportional to Loss – IV is proportional to loss for physical damage, because a higher value boat will cost more to the insurer to fix or replace. However, the value of the boat is not proportional to liability coverage because injuries to people not on the boat is not dependent on how expensive the boat is and damages to another boat will not vary based on the insured's own boat value
3. Considerate of Historical Precedence – Changing the exposure base is both expensive for the insurer due to the changes in reporting/systems required and disruptive to the insured due to premium swings from the change in how the policy is rated.

I would recommend sticking with boat-years as the preferred exposure base due to the disruption that changing the base would cause and the limited benefit, since insured value is not proportional to liability loss.

EXAMINER'S REPORT

Candidates were expected to:

- List and define the 3 criteria of a good exposure base
- Justify how insured value meets each of these criteria for both Liability and Property damage coverages
- Recommend and justify an appropriate exposure base that meets these criteria

Common mistakes include:

- Not accurately listing or defining 3 criteria of a good exposure base
- Not evaluating the differences between Liability and Property Damages Coverages
- Not recommending an exposure base or recommending a base that was not supported by the justification

QUESTION 2

TOTAL POINT VALUE: 2 | **LEARNING OBJECTIVE(S): A2, A3, A5**

SAMPLE ANSWERS

Part a: 0.75 point

Sample 1

800 x 1/2 + 400 x 3/12 + 1000 x 9/12 + 500 x 3/12 = 1375

Sample 2

CY 2017 EP = 800 x 3/12 + 1200 x 3/12 + 1000 x 9/12 + 500 x 3/12
(1/1 to 3/31) (4/1 to 6/30) (4/1 to 12/31) (10/1 to 12/31)

= 200+300+750+125 = 1375

Part b: 1.25 points

Sample 1

$$\frac{500 + 750}{1000 + 500 \times 6/12} = 100\%$$

Sample 2

Policy	PY 17 EP	Loss
A	0	0
B	1000	500
C	500 (.5) = 250	750

Loss Ratio = (500 + 750) / (1000 + 250) = 1.00

EXAMINER'S REPORT

Candidates were expected to determine which premium transactions pertained to calendar year (CY) 2017, which premium and loss transactions pertained to policy year (PY) 2017, earn the CY premium, prorate the premium for the endorsement and cancellation where applicable, and calculate a PY loss ratio.

Part a

Candidates were expected to earn the Policy A, B and C premium transactions for CY 2017 based on their effective and expiration dates, prorating the full-term Policy A endorsement premium for the partial year that the endorsement was in effect, excluding the Policy C cancellation that was effective after CY 2017, and summing the earned premium from all policies for the total premium.

Candidates did not receive credit for stating an assumption that the Policy A endorsement premium was already prorated, as the premium was identified in the question as "Full-Term Premium".

Common mistakes include:

- Not prorating the full-term endorsement premium for Policy A
- Earning the Policy A premium and endorsement premium over the same time period

Part b

Candidates were expected to determine that only Policy B and C pertained to PY 2017, sum the premium and loss transactions for those policies, adjust the Policy C premium for the mid-year cancellation, and calculate the loss ratio.

Common mistakes include:

- Not recognizing the policy cancellation for Policy C
- Calculation more resembling calendar year than policy year

EXAM 5 FALL 2018 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 3

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

SAMPLE ANSWERS

Part a: 0.75 point

2017 Weight	0.75	0.25	0
Rate Level	1	1.1	1.1x1.01

0.75x1+0.25x1.1+0x1.111=1.025
1.1x1.01=1.111
1.111/1.025=1.0839

Part b: 0.5 point

Written premium on 04/01/2017:
1000x0.85+120=970
Current level premium:
1175x0.75+132=1013.25

1013.25/970=1.0446

Part c: 0.5 point

Sample 1

The parallelogram method is inappropriate because it is applied at the aggregate level using overall average rate change. It would not account for different class factor changing on 10/1/2017.

Sample 2

If the parallelogram method is applied at the class level using each class rate impact then it is appropriate. Otherwise this method would not account for the changing class factor on 10/1/2017.

EXAMINER'S REPORT

Candidates were expected to understand both parallelogram and extension of exposure methods, their underlying assumptions, and how to apply those methods to calculate on-level factors.

Part a

Candidates were expected to identify each rate level at different points in time and weight them to calculate the on-level factor.

A common mistake was miscalculating weights (portion of year) to apply to each rate level.

Part b

Candidates were expected to calculate written premium on different effective dates for a class, then calculate the on-level factor.

Common mistakes include:

- Using wrong point in time (row in table) or class factors
- Not including expense fee

Part c

Candidates were expected to understand that the parallelogram method is applied at the aggregate level using the average rate change.

Common mistakes include:

- Not identifying the different class factor changes
- Not realizing the parallelogram method uses overall average rate change

QUESTION 4	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE(S): A3**
SAMPLE ANSWERS	
Part a: 0.25 point	
Sample 1 Report year 2015 loss costs for a claims-made policy = 500 + 300 + 200 = 1000 *Sample 2* Assuming this is a first-year claims-made policy Report year 2015 loss costs = 500	
Part b: 0.25 point	
Accident year 2015 loss costs for an occurrence policy = 500 + 330 + 220 = 1050	
Part c: 0.5 point	
Sample 1 A change in underlying trend will have little to no impact for a claims-made policy relative to an occurrence policy. The occurrence policy will be impacted more because occurrence policies are susceptible to both report and settlement lag, while claims-made policies only have settlement lag. As a result, occurrence policies remain open longer and are thus more susceptible to trends. *Sample 2* An unexpected increase in underlying trend will distort the accuracy of the occurrence policy more than the claims-made policy. Whereas claims-made are all reported within one report year/term, occurrence losses could be reported over several years, and all of those losses would be subject to trends, at varying trend periods. *Sample 3* This unexpected increase has less impact on the accuracy of claims-made policy pricing as claims-made policy has no pure IBNR. All claims are reported within the year. The change only impacts IBNER and has short term development period. It has bigger impact on occurrence policy as there are IBNR and IBNER and it has longer development period.	
Part d: 0.25 point	
Sample 1 Because claims-made policies do not have report lag, there is no risk of IBNR and thus reserve adequacy risk is greatly reduced. They only have IBNER, i.e. settlement lag. *Sample 2* Because claims-made policies only cover the lag from reported date to settlement date. However, occurrence policies need to cover the lag from occurrence date to report date as well. So occurrence policies have higher reserve risks.	
Part e: 0.25 point	
Sample 1	

Relative to the occurrence policy, the claims-made policy shortens the period of time between collection of premium and payment of claim; consequently, funds invested for a shorter time horizon result in less investment income.

EXAMINER'S REPORT

Candidates were expected to understand how a claims-made policy works and know the main differences between an occurrence policy and a claims-made policy.

Part a

Candidates were expected to know that all loss costs reported during the year 2015 would be covered by a claims-made policy, regardless of when the losses occurred.

A common mistake was to assume that the claims-made policy only covered loss costs reported and occurred in 2015 without stating any assumptions (i.e. $500).

Part b

Candidates were expected to know that all loss costs that occurred during the year 2015 would be covered by an occurrence policy, accounting for various lags in reporting.

A common mistake was to assume an occurrence policy covered claims reported in 2015

Part c

Candidates were expected to understand that an occurrence policy has a longer development period than a claims-made policy because claims can still be reported further into the future for an occurrence policy. They were expected to recognize that these claims would be more impacted by a change in future trend.

A common mistake was simply stating that claims-made policies are shorter tailed than occurrence policies, without explaining why they were shorter tailed or why it matters.

Part d

Candidates were expected to know that the IBNR includes two components: pure IBNR or IBNYR for losses incurred but not yet reported, and IBNER for losses incurred but not enough reported. Candidates were expected to know that a claims-made policy only has IBNER, while an occurrence policy has both pure IBNR an IBNER.

A common mistake was to mention that claims-made policies had no IBNR, without elaborating why this is meaningful to the question being asked.

Part e

Candidates were expected to understand that the investment period is shorter for a claims-made policy since there is less time between the collection of premium and the claim payment, thus resulting in less investment income.

A common mistake was stating that claims-made policies have a longer time lapse between the claim occurrence and the claim payment, instead of between the premium collection (or beginning of coverage) and the claim payment.

QUESTION 5	
TOTAL POINT VALUE: 2	**LEARNING OBJECTIVE(S): A3**

SAMPLE ANSWERS

Sample 1

The severity trend is stable, so I will select 5%. There is a major change that occurs on July 1, 2017, so a two-step trend for frequency is best. I will select a 6% trend up until July 1, 2017, and then I will choose the -7% trend from July 1, 2017 and onward.

Rates are in effect for 2 years on 1/1/2019., so 1/1/2019 – 1/1/2021.
Avg written = 1/1/2020
Avg earned = 4/1/2020

7/1/2015 – 7/1/2017 = 2.0 years
7/1/2017 – 4/1/2020 = 2.75 years

$15{,}000 \times (1.06 \times 1.05)^2 \times (0.93 \times 1.05)^{2.75} = \$17{,}405.25$

Sample 2

- Two-step trending for frequency, because of UW change
  - Step 1: 7/1/15 – 7/1/17, using long term trend, 16 points
  - Step 2: 7/1/17 – 4/1/20, using short term trend, 4 points
- One-step for severity, since trend is stable
  - 7/1/15 – 4/1/20
- $15{,}000\ (1.07)^2(.93)^{2.75}(1.05)^{4.75} = 17{,}735$
  freq sev

Sample 3

Due to change at 7/1/17, I will select a two-step pure premium trend.
1st proj from 7/1/15 to 7/1/17 2 yrs
2nd proj from 7/1/17 to 4/1/20 (avg loss date) 2.75 yrs

For the 1st trend, I will use the all points avg.
For the 2nd trend, due to the impact of underwriting change, I will select the 4 pt trend to better reflect this change.

Proj 2015 loss + ALAE = $15{,}000\ (1.12)^2\ (0.97)^{2.75} = 17{,}304$

EXAMINER'S REPORT

Candidates were expected to perform a two-step trend, choosing appropriate trends (either frequency and severity or pure premium) and calculating appropriate trend periods, in order to calculate projected losses.

Common mistakes include:

- Performing a one-step trend, instead of a two-step trend, which doesn't reflect the UW change

- Choosing inappropriate trends based on the data provided
- Failing to provide justification for trend selections
- Incorrect projection date for trending
- Calculating the trend periods incorrectly

Question 6	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE: A4**
SAMPLE ANSWERS	

Part a: 1 point

Sample 1

Premium-Based Projection = Fixed expense is separated and divided by premium to get the fixed expense ratio. Variable expense is separated and is divided by premium (either WP or EP) depending on whether the expense incurred at the beginning or throughout the policy period. Exposure-Based Projection = Fixed expense is divided by earned exposure (or policy count) to get a fixed expense per exposure. Variable is also divided by premium, like the Premium-Based Method.

Sample 2

For Premium-based projection method

WP => Written Premium

EP => Earned Premium

Fixed: (the total expenses x percentage of fixed expenses)/(WP or EP)

Variable: (the total expenses x percentage of variable expenses)/(WP or EP)

For Exposure-based projection method

For variable is the same as premium-based projection method.

Fixed: (the total expenses x percentage of fixed expenses)/(Written Exposure or Earned Exposure)

Sample 3

In the premium-based projection method, fixed and variable expenses are separated, and each are divided by either written or earned premium to produce separate fixed and variable expense ratios to premium. If the premium and fixed expenses are trending at different rates, a trend can be applied to the fixed expense rate to adjust for the difference. In the exposure-based projection method, fixed and variable expenses are separated. Variable expenses are divided by either written or earned premium to produce a variable expense ratio. Fixed expenses are divided by either written or earned exposures to produce an average fixed expense per exposure. A fixed expense trend can be applied to the fixed expense per exposure to project the average future level.

Sample 4

For both methods, the expense categories are assigned fixed and variable percentages.

The variable provision is calculated the same for both methods. The variable percent of each expense category is divided by the appropriate premium – written if incurred when a policy is written, earned if incurred over the policy period. This is done for all historical years in the analysis and a selection representative of future expense levels is made. The result is an expense %.

For fixed expenses under the premium-based method, the approach is the same as above except with fixed percent of each expense category.

For fixed expenses under the exposure-based method, fixed expenses are divided by exposures – earned if expenses incurred over the policy period or written if incurred at time policy is written. The result is a dollar amount of expense per exposure. Done for all relevant years, and a selection for future expense levels is made. One consideration for fixed expenses under this method is that the fixed expense provision may need to be trended.

Another consideration for both methods is whether to use state-specific or countrywide expenses and premiums. Generally, commission and taxes, licenses and fees use state and General and other acquisition use countrywide as state-specific allocations of these expenses might be impossible or difficult to do.

Part b: 0.5 point

Sample Premium Based Shortcomings (distortions)

- A shortcoming with the premium-based projection method is rate changes during or after the experience period can distort the historical fixed expense ratios.
- Premium-Based Projection Method can be problematic if expenses are calculated at the countrywide level and allocated to state. The allocation between countrywide and state can cause distortions.
- Premium-based projection method: fixed expenses might trend at a different rate than premium.
- Premium-based projection Method can be distorted based on the split between the fixed and variable expenses. Need to find more accurate way to split the expenses into fixed and variable components.
- In the premium-based method, since fixed costs are a percentage of premium, high premium policyholders would be paying significantly higher fixed costs than low premium policyholders. This would not be appropriate as some cost are truly fixed.

Sample Exposure Based Shortcomings (distortions)

- A shortcoming with the exposure-based projection method is the existence of the economies of scale in a changing book may lead to increasing or decreasing projected average fixed expenses.
- Exposure-Based Projection Method can be distorted based on the split between the fixed and variable expenses. Need to find more accurate way to split the expenses into fixed and variable components.
- Exposure based projection method: Some fixed expense actually vary by risk characteristics. For example, new and renewal business tend to have different fixed expense. Allocation of fixed expense to different classes are therefore distorted to the extent to which these risk characteristics vary between classes.
- Exposure based method may be distorted if exposures are trending at a different rate than expenses.

EXAMINER'S REPORT

Candidates were expected to distinguish fixed and variable expenses from total expenses, as well as the differences between and details of both expense provision approaches.

EXAM 5 FALL 2018 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part a

Candidates were expected to explain how fixed and variable expenses are treated in the 2 common methodologies.

Common mistakes include:

- No mention of separating total expense into fixed and variable buckets.
- Not identifying the use of exposure or policy count for the fixed expense portion of the exposure-based method.

Part b

Candidates were expected to understand and describe a potential shortcoming/distortion of each method.

Common mistakes include:

Premium-based method

- Stating a need for on-level premium without any explanation for why.

Exposure-based method

- Stating simply that exposures must be clearly defined or aren't readily available.
- Stating that exposures are difficult to estimate or subject to change.

QUESTION 7

TOTAL POINT VALUE: 5.75 | **LEARNING OBJECTIVE(S): A3, A5, B3**

SAMPLE ANSWERS

Part a: 1 point

Expected net reinsurance cost = 318,000 – 98,000 = $220,000
Trend from 7/1/2017 to 7/1/2019, trend period is 2 yr.
Projected earned exposure in CY 2019 = (1 + 0.03)^2 * 17,000 = 18,035
Projected net reinsurance cost per exposure = 220,000 / 18,035 = $12.2

Part b: 2 points

Sample 1

Cumulative Severity Triangle

AY	12	24	36
2015	15,000	18,000	19,800
2016	14,500	17,400	
2017	15,500		

Sev. LDF

AY	12-24	24-36	36-ult
2015	1.2	1.1	1
2016	1.2		
Selected	1.2	1.1	1
CDF to ult	1.32	1.1	1

Claim Count LDF

AY	12-24	24-36	36-ult
2015	0.95	0.98	1
2016	0.95		
Selected	0.95	0.98	1
CDF to ult	0.931	0.98	1

Ultimate loss and ALAE:
AY
2015: 8,850,600 * 1 * 1 = 8,850,600
2016: 9,256,800 * 1.1 * 0.98 = 9,978,830
2017: 9,145,000 * 1.32 * 0.931 = 11,238,473

Sample 2

LDFs for Reported Claim Count

AY	12-24	24-36	36-Ult
2015	456/480 = 0.95	447/456 = .98	
2016	532/560 = .95		
average = selected	0.95	0.95	
Age to Ult	0.98 * 0.95 = 0.931	0.98	1.00

Reported Severity = Reported Claims / Reported Count

AY	12	24	36
2015	15,000	18,000	8,850,600 / 447 = 19,800
2016	14,500	17,400	
2017	15,500		

LDFs Reported Severity

AY	12-24	24-36	36-Ult
2015	18,000 / 15,000 = 1.20	1.10	
2016	1.20		
average = selected	1.20	1.10	
Age to Ult	1.32	1.10	1.00

AY	(1) Reported Claim Count	(2) Count CDF	(3) = (1)*(2) Ultimate Count	(4) Reported Severity	(5) Severity CDF	(6) = (4)*(5) Ultimate Severity
2015	447	1.00	447	19,800	1.00	19,800
2016	532	0.98	521	17,400	1.10	19,140
2017	590	0.931	549	15,500	1.32	20,460

AY	Ultimate Loss & ALAE (7) = (3) * (6)
2015	447 * 19,800 = 8,850,600
2016	9,971,940
2017	11,232,540

Sample 3

AY	12	24	36
2015	0.034	0.033	0.032
2016	0.037	0.035	
2017	0.035		

Sev

AY	12	24	36
2015	15,000	18,000	19,800
2016	14,500	17,400	
2017	15,500		

LDFs Sev.

AY	12	24	36
2015	1.2	1.1	
2016	1.2		
Sel	1.2		
CDF	1.32	1.1	1.0

LDF Freq.

AY	12	24	36
2015	0.971	0.97	
2016	0.946		
Sel	0.9585	0.97	1.0
CDF	0.9297	0.97	1.0

AY	Ult Count	Ult Sev	Ult Claims
2015	447	19,800	8,850,600
2016	516	19,140	9,876,240
2017	549	20,460	11,232,540

Part c: 1.75 points

Year	(1) Earned Exposure	(2) Loss	(3) Pure Premium Trend	(2) / (1) * (3) Pure Prem per Exposure
2015	14,000	8,850,600	1.03 ^ 4.75	727
2016	15,000	9,978,830	1.03 ^ 3.75	743
2017	17,000	11,238,473	1.03 ^ 2.75	717
			Average	729

Trend from 7/1 of 2015, 2016 and 2017 to 4/1/2020
Projected pure prem per exposure = 1/3 * (727 + 743 + 717) = 729

Part d: 1 point

Sample 1

LR = 729 / 950
Fixed expense ratio = 21 / 950
Net reinsurance ratio = 12.2 / 950

Indicated rate change = [(729/950) * (1.05) + 21/950 + 12.2/950] / (1 – 15% - 10% - 2%) – 1
= 15.16%

Sample 2

Ind rate = (765.73 + 21 + 12.20) / (1 – 15% - 10% - 2%) = 1,094

Ind rate chg = 1,094 / 950 – 1 = 15.2%

EXAMINER'S REPORT

This question required candidates to understand indication loss adjustments, including trend and loss development, and calculation of the overall indication. Candidates were expected to demonstrate knowledge of a frequency-severity loss development technique and understand basic reinsurance concepts.

Part a

Candidates were expected to calculate the net cost of reinsurance and project the latest year's exposures forward to the period covered by the reinsurance contract in order to determine the projected net reinsurance cost per exposure.

Common mistakes include:

- Incorrectly calculating the projection period for which to apply the exposure trend
- Not including the expected reinsurance recoveries in the net reinsurance cost calculation
- Using the sum of exposures over multiple accident years rather than the exposures from the latest accident year to determine projected exposures

Part b

Candidates were expected to use a frequency-severity technique to develop claim counts and severities to ultimate levels for each accident year and use those results to determine the ultimate losses and ALAE for each accident year.

Common mistakes include:

- Using the chain ladder method rather than a frequency-severity technique to determine ultimate losses
- Using a frequency-severity technique that involved trending, but not applying the appropriate trend for all components of the technique

Part c

Candidates were expected to calculate the loss trend period for each accident year, trend losses, apply the ULAE factor, and determine the projected pure premium. Credit was given to candidates that omitted ULAE from the response to this part of the question if it was correctly included in the response to part d.

Common mistakes included:

- Calculating the pure premium using losses and exposures summed across accident years rather than applying equal weights to each year's pure premium
- Trending the exposures used to calculate pure premium

Part d

Candidates were expected to calculate the indicated premium and indicated rate level change.

Common mistakes included:

- Omitting the net reinsurance cost per exposure from the calculation of the indicated premium
- Omitting or incorrectly including the contingency provision when calculating the indicated premium

QUESTION 8	
TOTAL POINT VALUE: 2.25	**LEARNING OBJECTIVE(S): A6, A9**
SAMPLE ANSWERS	

Part a: 0.5 point

- Policyholders will not renew, will switch to competitors
- Retention rate will go down
- Company starts to lose market share as new insureds will also choose competitor
- The company may be subject to filing objections from the regulators
- The competitor might also raise their rates
- Close/hit/conversion rate will go down
- Loss ratio will improve/decrease
- Profitability of the company should increase
- Profit per risk will increase

Part b: 0.5 point

- Price: if other factors are the same, insureds will choose an insurance policy with lower premium
- Level of service/customer satisfaction: insureds prefer insurance companies with better services
- Brand Loyalty: Loyal insureds/Insureds that have been with the company longer will more likely renew with the company than new customers
- Overall price of product: if the product is expensive in general, customers tend to shop around more
- Competitor Price: customers might choose to non-renew if they can find a cheaper policy from competitors
- Rate Change: A big rate increase will trigger customers to shop around
- Renewal rates offered by current insurer: If the renewal rates offered are relatively similar to previous rates, client is likely to stay
- Younger insureds tend to shop around more than older insureds
- Claim handling service quality, if the policyholder has filed a claim
- The need for the coverage: if the coverage is not mandatory, clients may not renew if the coverage is no longer needed (e.g. sell property)

Part c: 0.75 point

- Reduce expenses by laying off staff/ reducing marketing expenses
- Reduce fixed expenses/variable expenses/commissions
- Modify underwriting rules to write less risky policies/ to target more profitable risks
- Decrease benefits by rising deductibles/ lowering limits
- Target favorable risks to market to
- Non-renew high risk exposures
- Hire experienced claim adjusters to control claims paid/ avoid claim leakage
- Change mix of business by tightening UW guidelines to write better risks
- Introduce loss mitigating programs to insureds to help reduce claims

Part d: 0.5 point

Sample Responses for identifying an issue

- Companies do not always have the same types of policyholders, so a lower rate could mean a company only writes low risk policies and a different company writes high risk but are both profitable.
- Companies can have different mix of business/ underwriting guidelines/ growth strategies/ targeted markets/ coverage levels/ products

Sample Responses for proposing a solution

- Instead, company should compare premium by segment
- We should find a competitor with similar mix of business to compare
- We can pick risks that share the same coverage level to compare
- Company can choose a risk profile and get a quote for it from competitor to compare
- Can re-rate our book of business using information found in competitor's rate manuals and filings and then compare
- We can compare average premiums of a segment and relativities of the segment

EXAMINER'S REPORT

Candidates were expected to understand the impact of rate changes and elements contributing to customer renewal decisions. They were also expected to know non-pricing solutions to increase profitability.

Part a

Candidates were expected to provide two different consequences to the given scenario (both positive and negative consequences were accepted).

Common mistakes include:

- Company is subject to adverse selection
- Company's LR will deteriorate
- Company should not implement the indicated premium (not a consequence)

Part b

Candidates were expected to briefly describe two factors affecting the insureds' propensity to renew.

Common mistakes include:

- Listing "Price" without any description as to why this affects renewal
- Other listed items without description

Part c

Candidates were expected to list three non-pricing solutions to maintain profitability.

Common mistakes include:

- Better segment risks by changing relativities but don't change overall rate

- Change mix of business (need more verbiage as to shifting to a better performing mix)
- Change coverage (a direction needs to be given)
- Increase investment income
- Purchase reinsurance

Part d

Candidates were expected to show understanding of conditions required for a fair premium comparison between companies.

Some candidates did not answer this part in conjunction with the information provided in the questions, or provided solutions to another issue rather than the one identified.

Common mistakes for issues include:

- Premiums are not comparable due to different expense assumptions
- Premiums are not comparable due to different profit provisions

Common mistakes for solutions include:

- We can look at pure premium instead
- Adjust for bias and then compare (too vague)

QUESTION 9

TOTAL POINT VALUE: 2	**LEARNING OBJECTIVE: A8**

SAMPLE ANSWERS

Part a: 1 point

Based on GLM output would NOT implement because:

- Chi-square > 0.05
- Nearly all of the levels are not statistically significant from 1.00, as 1.00 is contained in the error range
- Consistency over time is poor outside of the first few buckets

Part b: 0.75 point

- Premiums need to be on-leveled for the model
- No default distribution to model loss ratios
- Actuaries don't have a priori expectation for loss ratio
- Loss ratio model will become obsolete when rate changes
- Loss ratios do not present clear trend factors like frequency and severity trends

Part c: 0.25 point

- Univariate analysis is easier to compute than GLM
- Univariate analysis can be quickly understood and accepted by people, but GLM can't
- If there is not enough data for a GLM to be run on, then a univariate analysis may be more appropriate
- The law/regulator in some states may require univariate analysis
- Univariate analysis may be more appropriate if a company does not have the computing power to perform and set up a GLM
- Univariate is more transparent
- Simple rating algorithm, does not require higher complexity/cost GLM analysis

EXAMINER'S REPORT

Candidates were expected to understand how to analyze GLM output, recognize challenges of loss ratio data within a GLM, and specify when univariate methods are more appropriate than multivariate methods.

Part a

Candidates were expected to demonstrate knowledge and proper application of tests used to analyze the predictive quality of a variable based on GLM output: Main Effect Test, Consistency Test, Statistical Test, and Judgment. Candidates were also expected to demonstrate a clear decision on whether the variable should or should not be included based on the test results.

Candidates did not receive credit if they incorrectly stated/implied the variable passed the main effect test or the consistency test. Further, candidates did not receive credit for simply stating a recommendation on exclusion/inclusion of variable with no justification.

Common mistakes include:

- Did not clearly indicate whether the variable passed or failed each test
- Did not clearly state whether variable should or should not be used

Part b
Candidates were expected to list three challenges of using GLM on loss ratio data. A common mistake was to list general challenges of GLM without any reference to the specific issues of using loss ratio data.
Part c
Candidates were expected to discuss one reason why univariate analysis could be more appropriate than multivariate analysis. A common mistake was to describe a difficulty but not specify whether that was a difficulty for multivariate or an univariate approach so credit could not be awarded.

QUESTION 10	
TOTAL POINT VALUE: 2.5	**LEARNING OBJECTIVE: A8**

SAMPLE ANSWERS

Part a: 0.5 point

Sample 1

- The company's current approach doesn't take into account differences between rural & urban areas since there are only two relativities (not enough territories)
- The company's current approach doesn't have homogeneous risks in the territories since it's only based on one variable

Sample 2

- First, this is a large state but only contains two territories. That means we are only accounting for the mountain range and ignoring all other factors
- Second, these groups are not homogeneous, which will lead to adverse selection on the basis of territory

Sample 3

- Other companies may deviate greater and have more than two territories. You could gain competitive advantage if you added more territories
- Homeowner claims come from many other perils besides weather (ie theft, liability, fire, water) so breaking the territories by just the weather pattern might not be as accurate as you could be

Part b: 2 points

Sample 1

Step #1: Divide the state in geographic units, such as zip codes or counties.

- Consider: zip code definitions are subject to change

Step #2: Estimate the geo-demographic and geo-physical relativities of each unit using a GLM

- Consider: geographic units are highly correlated with other rating variables, so need to distinguish signal from noise

Step #3: Calculate a residual geographic factor not explained in step #2 and smooth across units using spatial smoothing, for example

- Consider: use either adjacency or spatial smoothing depending on risk in policy (ex: use adjacency for theft)

Step #4: group geographic units into territories using clustering methods, for example

- Consider: figure out if you want an equal number of units in each territory to create balance

Sample 2

First, the actuary should define the basic geographical unit, usually a zip code or county. A consideration might be balancing granularity (zip code) or a constant unit definition (county). Second the actuary should quantify each basic unit's geographic systematic risk. Preferably using a GLM. This will remove the effect of exposure correlation in the analysis & ensure the geographic rating variable is just for territory. If that's not a consideration, a consideration might be in choosing the link function. Third, the actuary should use spatial smoothing to allocate the residual geographic risk (which should also be given by a GLM). A consideration might be the optical weight for smoothing, like using distance or adjacency bases. Fourth, the actuary should

consider if they want to group the basic units into larger territories. Considerations for this step include choosing the clustering method, such as quantile or similarity method

EXAMINER'S REPORT

Candidates were expected to understand the importance of sufficiently granular rating territories and how these rating territory definitions are created

Part a

Candidates were expected to understand why company would not want to use overly broad territorial definitions.

Common mistakes included:

- Providing only one disadvantage
- Providing advantages of the companies territorial rating approach

Part b

Candidates were expected to understand the steps involved in developing new rating territories.

Common mistakes included:

- Simply listing each step, and not providing any consideration for each step
- Neglecting to cluster geographic units into final rating territories
- Describing criteria for evaluating rating variables

EXAM 5 FALL 2018 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 11	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE: A11**

SAMPLE ANSWERS

Sample 1

Losses below ded = 1,800,000 = 2M x 0.9
Losses above ded = 200,000 = 2M x 0.1
ALAE = 200,000 = 2M x 10%
Fixed Expense = 100,000
Var Expense = 0.12
Profit = 0.04
Ded processing cost = 54,000 = 0.03 x 1,800,000
Credit risk = 18,000 = 0.01 x 1,800,000
Add'l risk margin = 14,000 = 0.07 x 200,000

(200,000 + 200,000 + 100,000 + 54,000 + 18,000 + 14,000) / (1 - .12 - .04) = 697,619

Sample 2

{2,000,000 x [10% + (1 – 90%) x 1.07 + 90% x (3% + 1%)] +100,000} / (1 – 12% - 4%) = 679,619

EXAMINER'S REPORT

Candidates were expected to calculate the premium for a large deductible policy by correctly applying the loss elimination ratio then further including the appropriate costs and expenses.

Common mistakes include:

- Forgetting to include Fixed Expense, ALAE, or Excess Loss in the final calculation
- Calculating the Excess Deductible Loss as (Ground Up Loss x LER) or (Ground Up Loss – 0.5M per occurrence deductible) instead of (Ground Up Loss x (1-LER))
- Using incorrect loss amount for the Credit Risk and Deductible Processing Fee calculation
- Including one or several of the following: Credit Risk, Deducible Processing Fee, and Risk Margin, in the denominator
- Including losses below the deductible in the final premium calculation instead of losses above the deductible
- Only including ALAE related to the Excess Deductible Loss amount, while the problem clearly states that all ALAE is paid by the insurer

QUESTION: 12

TOTAL POINT VALUE: 2 | **LEARNING OBJECTIVES: A7, A8**

SAMPLE ANSWERS

Part a: 1.5 points

Sample 1

	Adjusted Exposures	Loss	Adjusted Pure Prem	Relativity to "C"
A	1,385	795,000	574	0.56
B	2,338	4,735,000	2,026	1.96
C	2,425	2,500,000	1,031	1.00

Sample 2

	Adjusted Exposures	Reported Loss/ALAE	Indicated Adjusted Pure Prem	Indicated Relativity	Indicated Relativity @ Base
A	1,385	795,000	574.01	0.4394	0.5568
B	2,338	4,735,000	2025.67	1.5508	1.9649
C	2,425	2,500,000	1030.93	0.7892	1.0000
Total	6,148	8,030,000	1306.22	1.0000	

Part b: 0.5 point

Sample 1

Adj EE	Current	Indicated	Selected
1,385	0.90	0.5600	0.73
2,338	2.00	1.9600	1.98
2,425	1.00	1.0000	1.00
6,148	1.36		1.31
		Ofb	1.035
		New Rate	1,035

Sample 2

Adj EE	Current	Indicated	Change	1/2 Chg	Premium	Change
1,385	0.90	0.5600	-38%	-19%	1,246,500	-19%
2,338	2.00	1.9600	-2%	-1%	4,675,000	-1%
2,425	1.00	1.0000	0%	0%	2,425,000	0%
					8,346,500	-3.4%
						1.035
					New C rate	1035.0

Part c: 0.5 point

- Affordability - insurance should be affordable for everyone
- Controllability - should be able to change the class you are in to get a lower rate
- Privacy - should not infringe on someone's privacy
- Causality/Logical/Intuitive - causal relationship to loss makes sense

EXAMINER'S REPORT

Candidates were expected to calculate class relativities using the adjusted pure premium method, off-balance a final base rate given constraints, and recognize social criteria of rating variables.

Part a

Candidates were expected to understand the adjusted pure premium methodology and how to calculate class relativities.

Common mistakes include:

- Using unadjusted exposures
- Not using the base class to rebase indicated relativities

Part b

Candidates were expected to understand how to calculate a proposed base rate given a premium change goal and a constraint on the change in class relativities.

Common mistakes include:

- Using exposures rather than adjusted exposures as the weights for total relativity change
- Using indicated relativities rather than selected relativities

Part c

Candidates were expected to understand social criteria of rating variables.

Common mistakes include:

- Using legal criteria
- Using operational criteria

QUESTION 13	
TOTAL POINT VALUE: 2.75	**LEARNING OBJECTIVE: A10**

SAMPLE ANSWERS

Part a: 1.25 points

i)
Avg Severity = .5(200K) + .25(475K) + .1(625K) + .1(775K) + .025(925K) + .025(1250K) = $413.125K
Rate per $1K AOI = $413.125K (.02)/(1500K/1K) = $5.51

ii)
Sample 1
Avg Severity = .5(200K) + .25(475K) + .1(625K) + .1(766.667K) + (.025 + .025)(800K) = $397.917K
Where 766.667K from above is calculated: 750K*(2/3)+800K(1/3)
Rate per $1K AOI = $397.917K (.02)/(800K/1K) = $9.95

Sample 2
Avg Severity = .5(200K) + .25(475K) + .1(625K) + .1(750K)(2/3) + (.1*(1/3)+.025 + .025)(800K) = $397.917K
Rate per $1K AOI = $397.917K (.02)/(800K/1K) = $9.95

Part b: 0.5 point

i.)

- Insureds will not have total losses or near total losses fully covered.
- Insured will suffer coinsurance penalties for losses below the coinsurance requirement.
- If the insured is underinsured, then in the case of a total loss, they will not get enough money to rebuild their home and they would need to come up with the difference.

ii.)

- If rates are calculated assuming all policies are fully insured-to-value then policies that are under-insured will be underpriced.
- Insurer will assume all policies a fully insured to replacement cost, which will make the rate for under-insured policies be inadequate.
- If insurer assumes all homes are insured to value they will not be collecting enough premium to cover expected losses. They may adjust by raising rates, but then the insureds at full value will be subsidizing those under-insured and rates will be inequitable.
- Insurer assumes homes are fully covered to their replacement cost when calculating rates, but premium charged for underinsured homes is not adequate to cover losses. Thus, rates are not equitable.

Part c: 1 point

i)
Coinsurance Apportionment Ratio:
a = min(1M/(1.5M*.8),1) = .8333
I = min(800K*.8333,1M) = $666.667K
e = 800K – 666.667K = 133.333K

ii)
Sample 1
I = min(1.2M*.8333,1M) = $1M
e = min(1.2M,1M) – 1M = $0

Sample 2
I = min(1.2M*.8333,1M) = $1M
Penalty = $0 because they have hit their limit

EXAMINER'S REPORT

Candidate were expected to calculate the rates per $1000 AOI given frequency and severity distribution, recognize issues for both insureds and insurers when insureds are underinsured, calculate indemnity payments and coinsurance penalties

Part a

i)
Candidates were expected to calculate the rate per Amount of Insurance (AOI) by calculating the average severity using the midpoint of the range and supplied loss distribution then using this to get a pure premium for this level of coverage and divide by the AOI (in $000s).

Common mistakes include:

- Using the upper or lower bound of the range instead of the midpoint
- Not multiplying by frequency
- Not dividing by AOI

ii)
Candidates were expected to properly cap losses at $800K and adjust the loss distribution for the layer in which an $800K loss fell in addition to the elements for part (i.)

Common mistakes include:

- Incorrectly accounting for the capping of coverage at $800K by not using the correct average severity for the range 700K-850K
- Omitting all layers above 800K
- Using the upper or lower bound of the range instead of the midpoint
- Not multiplying by frequency
- Not dividing by AOI

Part b

i.)
Candidates were expected to demonstrate an issue with underinsurance from the insureds' perspective.

Common mistakes include:

- Simply stating that the insured would not receive the full loss payment as the explanation would need to specify that it was a total or near-total loss

- Stating an issue of the insurer rather than the insured, such as the insured would not be charged adequate premium

ii.)
Candidates were expected to demonstrate an issue with underinsurance from the insurers' perspective.
Common mistakes include:

- Stating that the insurers' profitability would be impacted without directional justification
- Stating that rates would be inaccurate without specifying they would be inadequate
- Stating that rates would be skewed without specifying how they were skewed

Part c

Candidates were expected to calculate the appropriate apportionment ratio and apply it to the loss to determine the indemnity payment and coinsurance penalty.

Common mistakes include:

- Using an incorrect apportionment ratio calculation
- Including the loss amount in excess of the coverage in the coinsurance penalty

EXAM 5 FALL 2018 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 14	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE: B1**

SAMPLE ANSWERS

Part a: 0.5 point

- The estimates are used to make business decisions in pricing, underwriting, and strategy
- Low reserve estimates could lead to management increasing prices until it is too late.
- Inaccurately high estimates could lead to decisions such as raising rates or tightening underwriting guidelines
- Accurate reserve estimates help make appropriate reinsurance decisions

Part b: 0.5 point

- Inaccurate reserve estimates could distort the financial reports that are relied on by investors.
- Inaccurate reserve could lead investors to believe that the company is stronger or weaker than it really is
- An accurate reserve is needed to form an accurate estimate of the dividend that will be paid

Part c: 0.5 point

- If the reserves are understated, the regulator may not get involved until too late to prevent the insurer from entering insolvency
- Accurate reserve estimates are important for assessing the insolvency risk by regulator.
- Accurate reserve estimates help to assess rate level.

EXAMINER'S REPORT

Candidates were expected to know the importance of accurate estimates of unpaid claims and how under-reserving or over-reserving could impact different aspects of a company.

In some cases, candidates did not receive full credit based upon the amount of description provided. Full credit was awarded for situation where two briefly describe items were provided.

Part a

Candidates were expected to know how under-reserving or over-reserving could impact internal management.

Common mistakes include:

- Providing one brief point when the question prompt specified describe

Part b

Candidates were expected to know how under-reserving or over-reserving could impact investors.

A common mistake was providing one brief point when the question prompt specified describe.

Part c

Candidates were expected to know how under-reserving or over-reserving could impact regulators.

Common mistakes include:

- Providing one brief point when the question prompt specified describe
- Specifying that regulators would use the information to determine the appropriate reserve level

QUESTION 15

TOTAL POINT VALUE: 2.75 | **LEARNING OBJECTIVE: B1, B4**

SAMPLE ANSWERS

Part a: 0.25 point

Sample 1

Claim A: 1,000 + 550 = 1,550
Claim B: 300 + 1,050 = 1,350
Total = 2,900

Sample 2

Payments: 1,000 + 300 = 1,300
Change in Case Reserves: (550 – 0) + (1,050-0) = 1,600
Total = 2,900

Part b: 0.75 point

Sample 1

CY 2016 Net Paid = 500 * 0.4 + 1,050 * 0.4 + 1200 + 400 = 2,220

Sample 2

Claim	Gross Paid	Reinsurance	Paid in CY16 Net
A	500	500 * 0.6 = 300	500 – 300 = 200
B	600 + 450 = 1,050	1,050 * 0.6 = 630	1.050 – 630 = 420
C	1,200	0	1,200
D	400	0	400
Total			2,220

Sample 3

CY 2016 Net Paid = (1-0.6) * [500+600+450] + min(1,200 , 1,500) + min(400 , 1,500) = 2,220

Part c: 0.75 point

Sample 1

A: (500 + 225 – 550) = 175
B: (600 + 450 + 150 – 1050) = 150
C: (1200 + 575) = 1775
D: (400 + 900) = 1300

Total = 3,400

Sample 2

CY 2016 Paid Claims = (500 + 600 + 450 + 1200 + 400) = 3,150

CY 2016 Change in Case Reserves:

A = 225 – 550 = -325

B = 150 – 1050 = -900

C = 575

D = 900

Total CY 2016 Change in Case Reserves = -325 – 900 + 575 + 900 = 250

Total CY 2016 Reported Claims = CY 2016 Paid + CY 2016 Change in Case Reserves
= 3,150 + 250 = 3,400

Part d: 1 point

Sample 1

A: 0.4*(725 - 225) = 200

B: No incurred claims in CY 2017. 0

C: Retention limit reached in CY 2016. 0

D: 1300 incurred at start of CY 2017.

Gross incurred at end of CY 2017 = 1300 + 800 + (625 – 900) = 1,825

Since Excess of Loss limit reached, net incurred = 1500 – 1300 = 200

Total = 200 + 0 + 0 + 200 = 400

Sample 2

Claim	CY 2017 Gross Reported	CY 2017 Reinsurance Ceded	CY 2017 Net Reported
A	725 + (0 – 225) = 500	0.6 * (725 – 225) = 300	500 – 300 = 200
B	0	0	0
C	700 + 200 + (0 – 575) = 325	*(1200 + 700 + 200 – 1500 – (1200 + 575 – 1500)) = 325	325 – 325 = 0
D	800 + (625 – 900) = 525	400 + 800 + 625 – 1500 = 325	525 – 325 = 200
Total			400

*CY 2017 Reinsurance Ceded for Claim C = Total Ceded – CY 2016 Ceded = CY 2017 Ceded

EXAMINER'S REPORT

Candidates were expected to understand the basic mechanics of case outstanding, paid claims, reported claims in relation to both Accident Year and Calendar Year. The candidate was also expected to demonstrate basic knowledge of reinsurance.

Part a

Candidates were expected to understand how to derive total reported claims for a specific Calendar Year when given a list of paid and case outstanding claim data.

Common mistakes include:

- Calculation errors when summing paid and change in case
- Incorporating reinsurance calculations into the final answer

Part b

Candidates were expected to understand how to derive total gross paid claims for a specific Calendar Year and then apply both quota share and excess of loss reinsurance where appropriate.

Common mistakes include:

- Calculation errors when summing net paid claims
- Forgetting to incorporate reinsurance and only calculating gross paid claims
- Multiplying gross paid claims by 0.6 rather than 0.4

Part c

Candidates were expected to understand how to calculate reported claims for a specific Calendar Year. Candidates did not receive full credit if they did not take into account change in case reserves for claims A and B.

Common mistakes include:

- Not including change in case reserves when calculating reported amounts for claims A and B.
- Unnecessarily applying reinsurance to paid or reported claims.
- Calculation errors in summing up total reported for claims A or B when taking case reserves into account.

Part d

Candidates were expected to understand how to calculate total reported claims in a given Calendar Year net of both Quota Share as well as Excess of Loss reinsurance.

Common mistakes include:

- Not applying or applying the wrong Quota Share to claim A.
- Not capping claims C and D at the 1,500 excess of loss limit.
- Incorrectly applying the 1,500 excess of loss limit on an aggregate claim basis.

QUESTION 16

TOTAL POINT VALUE: 2 | **LEARNING OBJECTIVES: B1, B3**

SAMPLE ANSWERS

Part a: 0.75 point

Sample 1

LDF 36-48 = 123,700 / 112,500 = 1.1
CDF 36-Ult = 1.1 x 1.06 = 1.166
AY 2015 Ult Claims = 1.166 x 111,100 = 129,543

Sample 2

AY	12-24	24-36	36-48	48-Ult
2014	1.673	1.223	1.100	
2015	1.690	1.200		
2016	1.656			
Avg	1.673	1.211	1.100	1.06
CDF	2.362	1.412	1.166	1.06

Book A Ult Claims for AY 2015 = 111,100K x 1.166 = 129,495,490

Part b: 0.50 point

Sample 1

LDF	24-36
2014	1.2230
2015	1.1998
Avg	1.2114

CDF 24-Ult = 1.2114 x 1.166 = 1.412
% Unreported = 1 – 1/1.412 = 29.2%
AY 2016 Ult Claims = 94,400 + [182,800 x 0.75 x .292)] = 134,388

Sample 2

Book A Ult Claims for AY 2016 = 94,400,000 + [182,800,000 x 0.75 x (1 – 1/1.412)] = 134,394,206

Part c: 0.25 point

AY 2017 Ult Claims = 0.75 x 184,200 = 138,150

Part d: 0.50 point

Sample 1

Since B is in the same state and LOB as A, we can use the CDF in Book A to estimate ult claims for B in AY 2015, assuming the loss development pattern is the same.

Sample 2

B is small but given it's the same coverage/state as A, it makes sense to combine the data. A & B together would provide more credibility. With more data to make estimates more stable, I suggest the development technique, so it will be responsive to changes.

Sample 3

Given this is a small book of business and perhaps very correlated with book A (same state and same LOB), I think a B-F technique would work well, using the same ECR and CDF as book A.

Sample 4

Since it is a smaller company with same line and same state, we can directly use the expected claim ratio for book A to calculate book B.

EXAMINER'S REPORT

Candidates were expected to demonstrate the mechanics of the development technique, Bornhuetter-Ferguson technique, and expected claims technique. Candidates were expected to recognize the challenges of loss development with a small and volatile book of business and recommend and justify an appropriate technique in this situation.

Part a

Candidates were expected to calculate Book A ultimate losses for accident year 2015 using the reported development technique, including calculation of age-to-age and cumulative development factors.

Common mistakes include:

- Calculating ultimate losses for an accident year other than 2015
- Omitting the 48-ultimate reported development factor
- Using nonadjacent columns of the loss development triangle to calculate age-to-age factors

Part b

Candidates were expected to calculate ultimate losses for accident year 2016 using the Bornhuetter-Ferguson technique, including calculation of the % unreported and expected losses.

Common mistakes include:

- Using an age-to-age factor to calculate the % unreported instead of the cumulative development factor
- Calculating ultimate losses for an accident year other than 2016
- Using the % reported instead of the % unreported
- Calculating an expected claim ratio instead of using the given ECR

Part c

Candidates were expected to calculate ultimate losses using the expected claims technique.

A common error was calculating an expected claim ratio instead of using the given ECR.

Part d

Candidates were expected to recognize that Book B is small and volatile, so any development technique that relies on Book B's historical development pattern is inappropriate. Candidates were expected to recommend and justify a specific alternative approach. For recommended techniques using Book A, candidates were expected to state the Book A is appropriate to use since A and B operate in the same state and line of business.

Common mistakes include:

- Recommending a technique using Book B's historical development pattern
- Providing a recommendation with no justification
- Recommending a technique using Book A without stating why A is appropriate to use
- Recommending use of an "appropriate" expected claims ratio for Book B without making a recommendation for how to select one (e.g. using industry data)
- Attempting to diagnose a change in case reserve adequacy and recommending a Berquist-Sherman adjustment

QUESTION 17

TOTAL POINT VALUE: 3.5 | **LEARNING OBJECTIVE(S): B3, B5**

SAMPLE ANSWERS

Part a: 3 points

AY	Ult Claim Counts	Trend to 2017	Trended Ult Counts	Earned Premium	On-Level Adjustment	On-Level Premium	Trended Ult Freq
2014	2200	0.962	2115	127,500	0.71	90,525	2.34%
2015	1,970	0.974	1919	117,600	0.66	77,616	2.47%
Average							2.4%
Selected							2.4%
Estimated 2016 (adjusted for OLEP and detrended)					0.024 / (0.987 * .85) = 2.07%		

Projection of Ult. Severity

AY	Ult Severity	Trend to 2017	On-Level Adjustment	Trended Ult Freq
2014	32,600	1.19	0.85	33,003
2015	35,300	1.12	0.85	33,714
Average				33,358
Selected				33,358
Estimated 2016 Severity (reverse tort factor adj and detrend)			33,358 / (1.06 * 0.85) = 37,024	

AY	Earned Premium	Selected Freq	Ultimate Claims	Selected Severity	Ult. Claims
2016	64,300	2.07%	1332	37024	49,300
2017	58,900	2.40%	1416	33358	47,247

Addtional

Graders also gave full credit to severity selections equal to 2015 or 2014 instead of the average or to algebraically equivalent answers including selecting values trended to 2016 and trending the selection to 2017 instead of selecting values trended to 2017 and detrending to 2016.

Part b: 0.5 point

Any two of the following:

- Claim counts develop similarly in future
- Claim counts consistent over time
- Mix by claim type consistent / homogeneous
- Consistent definition of exposures
- Stable settlement pattern

- Stable case reserve adequacy
- Frequency/severity consistent in future

EXAMINER'S REPORT

Candidates were expected to calculate ultimate claims using the frequency / severity technique incorporating trend and discuss assumptions of frequency / severity techniques.

Part a

Candidates were expected to use the frequency /severity technique incorporating trend to calculate ultimate claims. Candidates were expected to trend the data from different accident years consistently, separately for frequency and severity. Then, provided a new exposure base for years 2016 and 2017, candidate were expected to estimate the total ultimate claims for each. Candidates were expected to apply frequency trend, severity trend, adjust for a change in premium per exposure, and apply an adjustment for a change in the tort environment.

Candidates were expected to calculate frequency by adjusting for the change in on-level premium. Next, candidates were expected to apply trend separately to the frequency and severities, individually for each accident year. Frequencies and severities could be trended to either 2016 or 2017 values. Selected frequency and severity were then detrended to 2016 (or trended to 2017 if selections were made at 2016 levels). The candidates were expected to apply the tort factor for the 2017 losses only. Lastly, candidates were expected to multiply selected frequency by premiums, resulting in ultimate claims counts and multiply these ultimate claim counts by selected ultimate severity to arrive at the ultimate claims estimate.

Common mistakes include:

- Failing to convert claim counts to frequency
- Incorrectly applying the on-level factors or applying them inconsistently
- Not applying the tort factor, applying it to both years, or applying it to 2016 only.
- Multiplying the calculated frequency and severity together, but not multiplying by premium (exposure).
- Attempting to calculate a loss ratio
- Averaging the 2014 and 2015 data without individually trending them

Part b

Candidates were expected to describe two key assumptions of the frequency / severity technique.

Common mistakes include:

- Providing a generic answer regarding the availability or accuracy of data.
- Providing a specific required definition of claim count. The assumption of the frequency / severity technique is that the definition of a claim count is *consistent*, but there are alternate valid ways to define claim counts.

QUESTION 18	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): B3, B4**
SAMPLE ANSWERS	

Part a: 1.25 points

Sample 1

	12-24	24-36	36-48	48-60
LDF	1.9963	1.4932	1.3889	1.3
CDF	5.3822	2.6961	1.8056	1.3

AY	Claims	EP	% Rept	Used up Prem
2014	2500	5300	.7692	5300(.7692) = 4076.76
2015	2300	7200	.5538	3987.65
2016	1900	7800	.3709	2890.10
2017	1100	8500	.1858	1579.81
	7800			12536.8

2017 ECR = 7800/12536.8 = .622168

2017 Ult = 1100 + 8500(.6222)(1 - .1858) = 5405.84

Sample 2

	12-24	24-36	36-48	48-60
LDF	1.9	1.353	1.389	1.3
CDF	4.642	2.443	1.806	1.3

Using selected LDFs based on the latest diagonal to reflect changes to book due to new class of insureds. Assumes there are no one-time changes that EP needs to be adjusted for.

AY	EP	CDF	Used up Prem
2014	5300	1.3	4077
2015	7200	1.806	3987
2016	7800	2.443	3193
2017	8500	4.642	1831
			13088

ECR = (1100 + 1900+2300+2500)/13088 = .596

AY 2017 Ult = 1100 + .596(8500)(1 – 1/4.642) = 5074

Additional

Graders also gave full credit to alternate loss development factor selections such as weighted averages or excluding the 2014 development factors due to the new class of business.

Part b: 0.5 point

- Since the new class of insured is priced accurately, they should have no effect on the ultimate claims ratio. However, looking at the development factors from part (a), there looks to have been a speedup in reporting after the new class was introduced. This would lead to our LDFs being overstated and our "used up" premium being understated, resulting in an overstatement of the ECR and thusly the AY 2017 ultimate claims.
- Pre – 2015, the development factors were higher, meaning ultimate claims were higher. Since the CC method uses these development factors, it is overestimating the ultimate claims in 2017.
- Since the development technique shows a change in development patterns in 2015, I reduced the influence of 2014 by not including that factor into my selection. The 36-48 is based on the 2014 AY, so it might be higher than what it should be, and as a result, ultimate might be slightly overstated using the CC method due to a higher % unreported and slightly higher ECR.

EXAMINER'S REPORT

Candidates were expected to calculate the estimated ultimate loss using the Cape Cod technique, and explain how the change in the mix of business impacted the Cape Cod ultimate claims for Accident Year 2017.

Part a

Candidates were expected to select claim development factors from a reported claims triangle and use these development factors to calculate used up premium. Candidates were expected to calculate the expected claims ratio as the ratio of reported losses to used up premium (as defined by the Cape Cod technique), and apply this expected claims ratio to get the estimated unreported claims, and subsequently, the ultimate claims.

Common mistakes include:

- Calculating the expected claims ratio as something other than total reported losses over total used up premium (e.g., straight average or total developed claims over total earned premium)
- Multiplying the expected claims ratio by the earned premium to get the ultimate claims

Part b

Candidates were expected to recognize the change in the development factors as a result of the change in the mix of business, and to discuss the impact of this change in development factors on the estimated ultimate claims.

Common mistakes include:

- Stating that the Cape Cod ultimate claims would be impacted without detailing how.
- Stating that the new mix of business would have no impact on Cape Cod ultimate claims.
- Confusion regarding the loss ratio as the source of the effect to the Cape Cod technique rather than the change in reported development.
- Stating that the new mix of business would lower the estimated ultimate claims.

QUESTION 19	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE(S): B4**
SAMPLE ANSWERS	

i. Development technique:

Sample 1:
IBNR would be overestimated as the mobile platform has a shorter reporting pattern and thus requires the selection of lower LDFs for the latest AY.

Sample 2:
Overstates IBNR. Development technique will apply higher loss development factors based on historical data (prior to implementing mobile reporting platform), to higher reported claims based upon latest mix shift to higher loss cost drivers if the change in reporting pattern is not considered.

Sample 3:
Assume that it is true that reporting patterns are shorter and loss costs higher, but no adjustments are made for these changes. IBNR will be overstated since it is based on old, higher LDFs than should be selected under the new, shorter reporting patters. With higher loss cost due to mix shift, the impact is further amplified.

ii. Expected claims technique:

Sample 1:
No effect on IBNR if the premium paid for both young and old drivers are adequate and accurate; expected claim technique not affected by any changes in reporting pattern

Sample 2:
The change in reporting pattern does not affect expected claims technique. If young and old drivers are correctly priced it should not change the ECR, so this method is accurate (losses higher for younger drivers, but so is associated premium).

Sample 3:
Accurate – assuming premium charged for both loss cost levels is adequate, this method should not be impacted by mix shift. If that is not the case, and premium charged for youthful drivers is inadequate, this method has the potential to understate actual IBNR due to the shift towards higher loss cost drivers.

iii. Cape Cod technique:

Sample 1:

Overstates IBNR, but the effect is less than the development technique; overstatement is due to higher % unreported from development technique without considering the change (speed up) in reporting pattern.

Sample 2:
This method will be affected by the LDFs which are too high without adjustment for the new reporting pattern, but to a lesser extent than the dev method. If policies are correctly priced, then premium component of this method will be unaffected and ECR not impacted. In total – the method will overstate IBNR because the LDFs which are too high, will lead to a % unreported which is too high.

Sample 3:
CDF's will be too high, which leads to lower used up earned premium, which leads to a higher ECR for the latest AY and in total across AYs. Higher ECR -> Higher expected claims -> Higher expected unreported claims as both % unreported is higher from inflated cdf's and expected claims are higher -> overstated IBNR

EXAMINER'S REPORT

The candidate was expected to demonstrate knowledge with respect to the following:

- Assessing the influence of operating changes and distributional shifts in mix of business on the estimation of unpaid claims
- When the development technique works/does not work as well as how the technique is implemented
- When the expected claims technique works/does not as well as how the technique is implemented
- When the Cape Cod technique works/does not as well as how the technique is implemented

Candidates were expected to recognize that there are two changes taking place - a change in reporting pattern and a shift in mix of business - and to then to address the impact on IBNR if no adjustments are made to account for these changes. This means addressing impacts for each of the three techniques in question, and providing directional impact or lack thereof for each of the techniques accompanied by support for the stated impacts.

Common mistakes include:

- Simply stating a directional impact without providing any support
- Failure to identify correct directional impact from the changes
- Simply stating IBNR would be impacted or generalizing that a method would not account for changes appropriately
- Focusing on a single change and ignoring the fact that two changes are taking place

Common mistakes for part ii. Include:

- Failure to differentiate between *loss cost* impact and *loss ratio* impact, ignoring the premium component of this technique.

Common mistakes for part iii. Include:

- Simply stating that this method is a weighted average of the development technique and expected claims technique, without demonstrating real knowledge of the method, stating directional impact to IBNR or providing support for that impact.

QUESTION 20

TOTAL POINT VALUE: 2.25 | **LEARNING OBJECTIVE(S): B2, B5**

SAMPLE ANSWERS

Part a: 0.5 point

Sample 1

	Unadjusted Average Case Outstanding (000s)			
Accident Year	12	24	36	48
2014	140	110	130	120
2015	135	150	144	
2016	180	152		
2017	180			

Yes. There has been a change in the adequacy of case outstanding since the avg case O/S has increased down the column, suggesting strengthening in case O/S adequacy level.

Sample 2

	Unadjusted Average Case Outstanding (000s)			
Accident Year	12	24	36	48
2014	140	110	130	120
2015	135	150	144	
2016	180	152		
2017	180			

Change in average case

12	24	36	48
-3.6%	36.4%	10.8%	
33.3%	1.3%		
0.0%			

Trend is different than severity trend of 7.5%. Assume that difference in trend is due to a change in case adequacy over the experience period.

Part b: 1.25 points

Sample 1

Adj Avg Case				
Accident Year	12	24	36	48

2014	144,893	131,531	133,953	120,000
2015	155,760	141,395	144,000	
2016	167,442	152,000		
2017	180,000			

Adj Reported				
Accident Year	12	24	36	48
2014	62,961,480	82,761,915	165,767,310	285,600,000
2015	62,758,400	79,799,850	161,000,000	
2016	66,443,070	88,400,000		
2017	72,600,000			

LDF				
Accident Year	12	24	36	48
2014	1.314	2.003	1.723	
2015	1.272	2.018		
2016	1.33			
2017				
Avg	1.305	2.0105	1.723	1.05
Cum	4.747	3.637	1.809	1.050

BS Adj Ultimate for AY 2017 = 72,600,000 x 1.305 x 2.0105 x 1.723 x 1.05 = 344,608,342

Sample 2

Adj Avg Case				
Accident Year	12	24	36	48
2014	145	132	134	120
2015	156	141	144	
2016	167	152		
2017	180			

Adj Case O/S				
Accident Year	12	24	36	48
2014	52,200	61,380	36,180	9,600
2015	53,040	60,630	36,000	

2016	55,945	68,400		
2017	62,100			

Adj Reported				
Accident Year	12	24	36	48
2014	63,000	82,980	1658,780	285,600
2015	62,840	79,630	161,000	
2016	66,295	88,400		
2017	72,600			

	12-24	24-36	36-48	48-Ult
LDF	1.31	2.01	1.72	1.05
Cum	4.755			

Ultimate claims AY 17 = 72,600 x 4.755 = 345,240

Additional
Graders also gave full credit to alternative development factor selections such as weighted average.

Part c: 0.25 point

Sample 1:
With the B-S adjustment, the ultimate claims estimate for AY2017 is not overestimated as compared to the unadjusted data.

Sample 2:
Case OS increased in recent years because of adequacy changes. Based on prior LDFs calculated from unadjusted data, applied to higher reported loss in year would have overestimated the ultimate.

Sample 3:
Results in b is lower compared to unadjusted data because not overestimated.

Part d: 0.25 point

Sample 1:
The Berquist-Sherman adjustment used in part (b) assumes that claim settlement rates have been consistent.

Sample 2:
The selection of the underlying trend in severity for this method required much care due to the sensitivity of reserve estimate & need for judgmental selection. If this trend is incorrect reserve estimates may be off by a lot.

Sample 3:
A limitation would be if our loss trend unexpectedly changes throughout the historical period.

Sample 4:
It highly depends on selected severity trend.

Sample 5:
Assumes that change in case outstanding severity is due to case adequacy change and not due to other factors like change in prioritization between large and small claims.

EXAMINER'S REPORT

Candidates were expected to apply the Berquist-Sherman case outstanding adjustment to adjust for changes in the adequacy of case outstanding. Candidates were also expect to know the limitations of the technique and understand how it impacts the calculated ultimate as compared to unadjusted techniques.

Part a

The candidate was expected to calculate the average case outstanding triangle and evaluate the triangle to identify that there has been a change (increase) in the adequacy of case outstanding over time.

Common mistakes included:

- Concluding the case reserve adequacy was decreasing.
- Examine only a single period (for example: 12 month average case per open claim). A change in the average case outstanding per open claim at a single evaluation does not provide sufficient evidence of case reserve adequacy changes.

Part b

The candidate was expected to apply the Berquist Sherman case outstanding adjustment to the data given. They were also expected to use the adjusted data to calculate the ultimate loss for AY 2017.

Common mistakes included

- Restating only the 2016 and prior average case outstanding diagonals using the 2016 diagonal as a basis and not restating the 2017 diagonal as well.
- Failure to apply the tail factor provided
- Applying the trend factor incorrectly (e.g., multiplied by trend factor or used 7% instead of 7.5%)

Part c

The candidates were expected to identify that the unadjusted loss development method would overstate ultimate loss when case reserve adequacy increases.

Common mistakes include:

- Concluding that the unadjusted loss development method would understate the ultimate loss.

- Describing the mechanics of the adjustment but not providing a comparison to the unadjusted result.

Part d

The candidates were expected to understand the limitations of the Berquist-Sherman case outstanding adjustment.

Common msitakes include:

- Identifying assumptions of the adjustment that could be violated instead of a limitation of the adjustment.
- Identifying when the technique is not appropriate.

QUESTION 21	
TOTAL POINT VALUE: 1.50	**LEARNING OBJECTIVE(S): B6**

SAMPLE ANSWERS

Sample 1

Ratio of Salvage & Subrogation to Paid Claims

Accident Year	12	24	36	48
2014	0.348	0.417	0.429	0.435
2015	0.323	0.391	0.402	
2016	0.326	0.405		
2017	0.380			

Link Ratio

Accident Year	12-24	24-36	36-48	48-Ult
2014	1.198	1.029	1.014	
2015	1.211	1.028		
2016	1.242			

Assume all ratios are random fluctuations. We take the average of the ratios.

	12-24	24-36	36-48	48-Ult
Selected LDF	1.217	1.0285	1.014	1.000
CDF	1.2692	1.0429	1.014	1.000

Accident Year	Estimated Ultimate Ratio
2014	0.435
2015	0.402*1.014 = 0.408
2016	0.4224
2017	0.4823

The accident year 2017 ultimate ratio is relatively too high compared to other years. We select the average of the prior 3 years of the ultimate ratio.

Selected Ultimate Ratio for Accident Year 2017 = $\frac{0.435+0.408+0.4224}{3} = 0.421$

Ultimate Salvage & Subrogation for AY 2017 = $0.4218 * 16{,}400{,}00 = \$6{,}917{,}520$

Sample 2

Ratio for Rec. Sub Sal to Paid Claims (Gross)

	12	24	36	48	Ult Est (latest diag times CDF)
14	0.348	0.4166	0.428	0.4345	0.4345
15	0.3233	0.3905	0.402		0.408
16	0.3259	0.4047			0.422
17	0.3798				0.4853

	12-24	24-36	36-48	48-Ult
14	1.197	1.0273	1.015	
15	1.207	1.029		
16	1.2425			
17				
Sel	1.22475*	1.028	1.015	1.0
CDF	1.2779	1.0432	1.015	1.0

* Select avg of past 2 yrs since there appears to be increasing trend

Keep .4853 selection as we notice increasing trend

.4853 * 16,400 = 7958.92

EXAMINER'S REPORT

Candidates were expected to know how to apply the ratio approach to estimate ultimate salvage and subrogation. This involves calculating the appropriate ratios, calculating the development factors for these ratios, making an actuarially sound selection of an ultimate ratio, and using that ratio to estimate the ultimate salvage and subrogation dollars.

Common mistakes included:

- Failure to calculate and/or consider ultimate S&S ratios for years 2014-2016.
- Confusing the ratio approach for S&S with ALAE estimate methods.
- Calculating S&S ratios using ultimate gross claims instead of cumulative paid claims in the denominator.

QUESTION 22	
TOTAL POINT VALUE: 1.75	**LEARNING OBJECTIVE(S): B3, B7**
SAMPLE ANSWERS	
Part a: 0.75 point	

Sample 1

AY	(1) IBNYR Claim Counts	(2) Implied Ult Severity	(3) IBNYR Claims
14	0	-	0
15	30	64.85	1,945
16	55	65.15	3,583
17	135	65.07	8,785
			14,313

(1) = Ult Counts – Reported Counts
(2) = Ultimate Claims / Ultimate Counts
(3) = (1) x (2)

Sample 2

$\frac{Ultimate\ Claim - Paid\ Claim}{Ultimate\ Claim\ Count - Closed\ Claim\ Count}$ x [Ultimate Claim Count – Reported Claim Count] = IBNYR

AY	
14	0
15	$\frac{21{,}400 - 18{,}000}{330 - 270}$ x [330 - 300] = 1,700
16	3,732
17	8,894

Sample 3

AY	(1) IBNR	(2) Open Counts	(3) Unreported Counts	(4) IBNYR %	(5) = (1) x (4) IBNYR
14	0	0	0	0	0
15	3400	30	30	50%	1700
16	9500	85	55	39.3%	3734
17	16,800	120	135	52.9%	8887

Sample 4

AY	Paid on Closed Severity	IBNYR
14	62.09	0
15	66.67	(330-300) x 66.67 = 2000
16	63.16	(330 – 275) x 63.16 = 3473.8
17	62.5	(335 – 200) x 62.5 = 8437.5

Sample 5

Ultimate Claims x [1 – (Reported claim counts/ Ultimate Claim Counts)] = IBNYR

AY 2014 = (20,800) (1 – 335/335) = 0

AY2015 = (21,400) (1 – 300/330) = 1,945
AY2016 = (21,500) (1 – 275/330) = 3,583
AY2017 = (21,800) (1 – 200 / 335) = 8,785

Part b: 1 point

Sample 1

CY	Paid ULAE/Paid Claim
14	0.048
15	0.05
16	0.05
17	0.05

Select 0.05 as the ULAE Ratio

AY	Unpaid -IBNYR	IBNYR
14	0	0
15	1,700	1,700
16	5,768	3,732
17	7,906	8,894
Total	15,374	14,326

Unpaid ULAE = (15,374 x 0.05 x 40%) + (14,326 x 0.05) = 1,024

Sample 2

AY	(1) IBNYR Claim Counts	(2) Open Counts	(3) Unpaid ULAE %	(4) Ult ULAE	(5) = (2) x (4) Unpaid ULAE
14	0	0	0%		
15	30	30	12.73%	1065.72	135.64
16	55	85	26.97%	1070.7	288.76
17	135	120	54.62%	1085.64	593.05
					1017.45

(3) = [(1) + 40% x (2)] / Ult Counts
(4) = Ult Claims x .0498

Sample 3

Unpaid ULAE = (15,379 x 0.05 x 40%) + (14,321 x 0.05 x 1) = 1,024

Unpaid ULAE = w* x [IBNYR + 40% (Case + IBNER)]

EXAMINER'S REPORT

Candidates were expected to estimate incurred but not yet reported (IBNYR) claims and use this information to estimate unpaid ULAE.

Common mistakes include:

- Not correctly identify the relationship between case reserves, incurred but not enough reported (IBNER), and incurred but not yet reported (IBNYR).
- Using the incorrect technique to estimate unpaid ULAE.

Part a

Candidates were expected to calculate the incurred but not yet reported claim provision for all accident years.

Common mistakes include:

- Calculating the unpaid claim amount (ultimate claims – paid claims) instead of the IBNYR provision.
- Calculating incurred but not yet reported claim counts instead of claims, or not knowing how to proceed after calculating IBNYR claim counts
- Incorrectly calculating IBNYR and/or open claim counts
- Estimating case outstanding and IBNER provision instead of the IBNYR provision
- Attempting to estimate IBNYR by taking the sum of the accident year ultimate or paid less CY paid

Part b

Candidates were expected to calculate the unpaid ULAE estimate using the data presented and appropriate assumptions.

Common mistakes include:

- Using an invalid ULAE estimation method based on the data presented.
- Using the wrong denominator in the ratio of calendar year paid ULAE to calendar year paid claims.
- Using incorrect weights to apply to different claim provisions (eg, 50%/50% weighting, 60% to case outstanding + IBNER, etc.).
- Taking 100% of the pure IBNR and then 40% of the total unpaid losses (without subtracting pure IBNR), resulting in 140% weight to pure IBNR.
- Incorrectly calculating case outstanding + IBNER.
- Applying the ratio of calendar year paid ULAE to calendar year paid claims to total unpaid claims.
- Calculating unpaid ULAE for only one accident year
- Incorrectly mixing calendar and accident year data

QUESTION 23

TOTAL POINT VALUE: 2.25 | **LEARNING OBJECTIVE(S): B7**

SAMPLE ANSWERS

Part a: 0.25 point

2014 702,100
2015 612,400
2016 459,000
2017 172,000

Part b: 1.75 points

ALAE to Paid

AY	12	24	36	48
14	.032	.058	.064	.078
15	.033	.057	.064	
16	.034	.057		
17	.033			

Additive LDFs

AY	12-24	24-36	36-48	
14	.026	.006	.014	
15	.024	.007		
16	.023			
Sel Avg	.024	.007	.014	
Age to Ult	.045	.021	.014	

Ult ALAE to Paid Ratio = .033 + .045 = .078

Paid LDFs

AY	12-24	24-36	36-48	
14	2.7	1.35	1.12	
15	2.7	1.35		
16	2.7			
Sel Avg	2.7	1.35	1.12	
Age to Ult	4.0824	1.512	1.12	

Ult Paid = 172,000(4.0824) = 702172.8
AY 2017 Ult ALAE = 702172.8*(.078) = 54,769.48

Part c: 0.25 point

Sample 1:
A disadvantage is that if you incorrectly estimate claims you will then incorrectly estimate ALAE
Sample 2:

It will be distorted when some claims are closed without payment but with significant amount of ALAE

EXAMINER'S REPORT

The candidate was expected to demonstrate knowledge of the additive ratio method of estimating unpaid ALAE

Part a

The candidate was expected to calculate the December 31, 2017 paid loss diagonal using the prior diagonal and calendar year 2017 loss payments.

A common mistake was adding the calendar year payments to the incorrect year in the prior diagonal

Part b

The candidate was expected to estimate ultimate ALAE using the additive ratio approach. This consists of constructing a triangle of paid alae to paid claims, calculating development factors of this triangle using addition, cumulating selected development factors, and applying the 12-ult factor to the 2017 estimate of ultimate loss, which can be determined using the development method on the cumulative paid claims triangle.

Common mistakes include:

- Only providing the ALAE ratio instead of an ultimate ALAE estimate
- Applying the ALAE ratio to 2017 paid loss instead of to the 2017 ultimate loss estimate
- Using the ALAE development method to calculate ultimate ALAE.

Part c

The candidate was expected to describe a disadvantage of the additive ratio approach.

Common mistakes include:

- Describing an advantage of the approach
- Describing an assumption of the approach.

QUESTION 24	
TOTAL POINT VALUE: 3.5	**LEARNING OBJECTIVE(S): B3, B8**

SAMPLE ANSWERS

Part a: 1.25 points

Sample 1

cumul exp rep to actual
AY 2017 btw 15 & 17
losses occur uniformly – will use linear interpolation

% rep at 15 = 1/1.46 = 68.49%
% rep at 18 = 1/1.38 = 72.46%
% rep at 17 = 68.49% + (2/3)(72.46% - 68.49%) = 71.14%

AY 2017 exp rep emergence = (3300 - 2400)(71.14% - 68.49%)/(1 – 68.49%) = 75.66
cumul exp = 2400 + 75.66 = 2475.66
actual rep = 2750
actual is 274 higher

Sample 2

Cum actual rept claim = 2750
% rept at 15 = 1/1.46 = 0.685
% rept at 18 = 1/1.38 = .725
incremental expt rept claim from 15 to 17 = (3300 – 2400) x (.725 - .685)/(1 - .685) x 2/3 = 75.6
cum exp rept at 5/31/2018 = 2400 + 75.6 = 2475
cum expected rept claim is lower than cum actual rept claim

Part b: 1.25 point(s)

Sample 1

cumul paid btw 15 & 17

% paid at 15 = 1/2 = 50%
% paid at 18 = 1/1.65 = 60.6%
% paid at 17 = 50% + (2/3)(60.6% - 50%) = 57.07%

AY 2017 exp rep emergence = (3300 - 1820)(57.07% - 50%)/(1 – 50%) = 209.3
cumul exp = 1820 + 209.3 = 2029.3
actual paid = 2050
actual is only 21 greater. Quite close.

Sample 2

% paid at 15 = 1/2 = 0.5
% paid at 18 = 1/1.65 = .606
Incremental expt paid claim from 15 to 17 = (3300 – 1820) x (.606 - 0.5)/(1 – 0.5) x 2/3 = 209.293
cum expected paid at 5/31/2018 = 1820 + 209.293 = 2029.293

cum actual paid claim = 2050
cum expected paid claim is lower than actual paid claim, but it's still quite close

Part c: 0.5 point

Sample 1

You would revise ultimate claims in part a and b if caused by a large claim/cat which you expect to develop beyond current IBNR provisions

Sample 2

Paid is close so no comment. Actual rep is higher than expected. If this was due to a large unpaid claim, I would increase the est of ult claims.

Part d: 0.5 point

Sample 1

If the difference btw actual rep & expected reported was due to a recent increase in case reserve adequacy, I would not revise est of ult claims.

Sample 2

Increase case reserve adequacy. Because the cumulative paid claim is pretty close to the expected value, but the actual rept claim is much larger than the expected claim. If the case reserve adequacy increases, the ult claim will not change

EXAMINER'S REPORT

Candidates were expected to assess the estimate of ultimate claims by utilizing reporting and payment patterns to derive expected claim emergence and compare this expectation to actual claim emergence.

Areas where candidates struggled included recognizing the need to interpolate between quarters and performing the associated calculations.

-notes on failure to calc incremental/cumulative amount

Additionally, many candidates failed to draw appropriate conclusions or provide adequate detail for situations that would justify changing (or not changing) the estimate of ultimate claims based on the actual vs expected.

Part a

Candidates were expected to calculate expected cumulative reported claims for the given accident year and compare to actual cumulative reported claims. This required calculating

expected incremental reported emergence over a two month period based on an interpolated reporting pattern. Candidates were expected to derive the cumulative expected amount by adding the expected incremental amount to the latest inception to date reported amount. Candidates were expected to compare the actual and expected amounts.

Common mistakes include:

- Failing to recognize the need to interpolate between quarters
- Interpolating the cumulative LDFs rather than the percent reported
- Calculating the expected incremental emergence by multiplying expected emergence percentage by the selected ultimate instead of the unreported amount
- Leaving the expected amount as incremental, and not deriving the associated cumulative amount
- Failing to provide adequate comparison between the actual and expected amount

Part b

Candidates were expected to calculate expected cumulative paid claims for the given accident year and compare to actual cumulative paid claims. This required calculating expected incremental paid emergence over a two month period based on an interpolated payment pattern. Candidates were expected to derive the cumulative expected amount by adding the expected incremental amount to the latest inception to date paid amount. Candidates were expected to compare the actual and expected amounts.

Common mistakes include:

- Failing to recognize the need to interpolate between quarters
- Interpolating the cumulative LDFs rather than the percent paid
- Calculating the expected incremental emergence by multiplying expected emergence percentage by the selected ultimate instead of the un paid amount
- Leaving the expected amount as incremental, and not deriving the associated cumulative amount
- Failing to provide adequate comparison between the actual and expected amount

Part c

Candidates were expected to provide a situation in which the actuary would revise the estimate of ultimate claims given the results in parts a & b.

Common mistakes include:
Stating that the actual emergence being worse than expected is due to organizational changes such as case reserve strengthening or speed up in payment patterns is grounds for increasing the ultimate. If the driver of the actual vs expected amounts was due to organizational changes, this would only impact the timing of case revisions and payments, but would not necessarily change the ultimate claims.

Part d

Candidates were expected to provide a situation in which the actuary would not revise the estimate of ultimate claims given the results in parts a & b.

Common mistakes include:
Stating that the actual emergence being worse than expected is due to a large loss would not require an increase to the estimate of ultimate. If there is a one-time shock loss that is not expected to happen again, it may be appropriate to exclude this from estimates of ultimates for future accident years. However, the question being asked is in regard to the selected ultimate for accident year 2017, and so the impact of the large loss should be reflected through an increase to the selected ultimate.