

Exam 5



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Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 57.75 point examination consists of 25 problem and essay questions.
2. For the problem and essay questions, the number of points for each full question and part of a question is indicated at the beginning of the question or part. Answer these questions on the lined sheets provided in your Examination Envelope. Use dark pencil or ink. Do not use multiple colors or correction fluid/tape.
 - Write your Candidate ID number and the examination number, 5, at the top of each answer sheet. For your Candidate ID number, four boxes are provided corresponding to one box for each digit in your Candidate ID number. If your Candidate ID number is fewer than 4 digits, begin in the first box and do not include leading zeroes. Your name, or any other identifying mark, must not appear.
 - Do not answer more than one question on a single sheet of paper. Write only on the front lined side of the paper – DO NOT WRITE ON THE BACK OF THE PAPER. Be careful to give the number of the question you are answering on each sheet. If your response cannot be confined to one page, please use additional sheets of paper as necessary. Clearly mark the question number on each page of the response in addition to using a label such as “Page 1 of 2” on the first sheet of paper and then “Page 2 of 2” on the second sheet of paper.
 - The answer should be concise and confined to the question as posed. When a specified number of items are requested, do not offer more items than requested. For example, if you are requested to provide three items, only the first three responses will be graded.
 - In order to receive full credit or to maximize partial credit on mathematical and computational questions, you must clearly outline your approach in either verbal or mathematical form, showing calculations where necessary. Also, you must clearly specify any additional assumptions you have made to answer the question.
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

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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 May 23, 2016.

END OF INSTRUCTIONS

EXAM 5, SPRING 2016

1. (2.5 points)

Given the following information for an insurance company:

Accident Year	Earned Premium (\$000)	Ultimate Losses (\$000)
2013	1,500	800
2014	1,600	800
2015	1,800	1,200

- A benefit level change increased losses by 10% for policies written after April 1, 2013.
- A second benefit level change decreased losses by 5% for accidents occurring after January 1, 2014.
- A rate change of +5% was effective October 1, 2013.
- Annual loss cost trend is +2%.
- All policies have a term of one year.
- The company writes policies uniformly throughout the year and files rates only one time per year.
- Planned rate revision to be effective January 1, 2017.

Calculate the on-level loss ratio for accident year 2013 for the planned rate revision.

EXAM 5, SPRING 2016

2. (2.5 points)

An insurance company writes both 6-month and 12-month automobile policies. Given the following information:

Policy	Original Effective Date	Original Expiration Date	Transaction Effective Date	Territory	Full-Term Written Premium	Notes
A	January 1, 2015	December 31, 2015	January 1, 2015	1	\$1,000	Start of New Policy
A	January 1, 2015	December 31, 2015	July 1, 2015	1	N/A	Policy Canceled
B	July 1, 2015	June 30, 2016	July 1, 2015	1	\$500	Start of New Policy
B	July 1, 2015	June 30, 2016	September 30, 2015	2	\$400	Relocated to Territory 2
C	October 1, 2015	March 31, 2016	October 1, 2015	2	\$1,000	Start of New Policy

- Full-term written premium represents the policy premium if policy characteristics shown were in place from original effective date to original expiration date.
 - a. (0.75 point)
Calculate the 2015 calendar year written premium as of December 31, 2015.
 - b. (0.75 point)
Calculate the 2015 calendar year earned premium as of December 31, 2015.
 - c. (0.5 point)
Calculate the in-force premium as of October 1, 2015.
 - d. (0.5 point)
Calculate the 2015 calendar year earned exposures separately for Territory 1 and Territory 2 as of December 31, 2015.

3. (2.25 points)

A personal automobile insurance company is considering changing its exposure base from car-years to hours driven.

a. (1.5 points)

Evaluate hours driven using three criteria of a good exposure base.

b. (0.75 point)

The company is also considering keeping its current exposure base as car-years but including hours driven in its risk classification system. Briefly discuss the appropriateness of adding this risk characteristic to the company's risk classification system using three considerations from the Actuarial Standard of Practice No. 12: Risk Classification (for All Practice Areas).

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4. (2.25 points)

Given the following information:

Claim	Policy Effective Date	Accident Date	Report Date	Transaction Date	Claim Status	Loss Payment	Case Reserve Change
1	October 1, 2013	December 15, 2013	January 5, 2014	January 7, 2014	Open	-	+\$5,000
				March 1, 2014	Open	\$4,000	-\$4,000
				January 5, 2015	Closed	\$500	-\$1,000
2	November 1, 2013	February 1, 2014	February 10, 2014	March 1, 2014	Open	-	+\$6,000
				March 15, 2014	Closed	\$6,000	-\$6,000
3	January 1, 2014	June 1, 2014	June 5, 2014	June 10, 2014	Open	-	+\$10,000
				September 1, 2014	Open	\$1,000	+\$10,000
				January 3, 2015	Open	\$4,000	-\$5,000
4	June 1, 2014	August 15, 2014	July 15, 2015	July 20, 2015	Open	\$500	+\$5,000
				March 1, 2016	Open	-	+\$5,000
				June 1, 2016	Open	\$5,000	+\$7,000

- Calendar year 2014 earned premium = \$50,000.
- Calendar year 2015 earned premium = \$60,000.

a. (0.5 point)

Calculate the 2015 calendar year case incurred losses.

b. (0.5 point)

Calculate the 2014 policy year case incurred losses, evaluated at December 31, 2014.

c. (0.75 point)

Calculate the 2014 accident year case incurred loss ratio, evaluated at December 31, 2015.

d. (0.5 point)

Provide one advantage and one disadvantage of using policy year data in ratemaking analyses.

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5. (1.5 points)

An insured had a mature claims-made policy with Insurer A in 2011 and 2012 before switching to an occurrence policy with Insurer B in 2013 and 2014. Below are the losses incurred over a 5-year period:

Accident Date	Report Date	Claim Amount
July 1, 2010	October 1, 2012	\$1,000
August 1, 2010	November 1, 2011	\$2,000
January 1, 2011	March 1, 2014	\$2,000
April 1, 2011	May 1, 2011	\$3,000
June 1, 2012	December 1, 2012	\$4,000
March 1, 2013	February 1, 2015	\$5,000
April 1, 2013	June 1, 2014	\$3,000
April 1, 2014	August 1, 2014	\$2,000

- Policies are effective on January 1 of each year.
- All policies are annual.

a. (0.5 point)

Determine the loss amount each insurer pays.

b. (0.5 point)

Briefly discuss two reasons why occurrence policy ultimate loss estimates are more volatile than claims-made policy ultimate loss estimates.

c. (0.5 point)

Discuss whether an occurrence policy or a claims-made policy is likely to earn more investment income, assuming a stable interest rate environment.

6. (2.25 points)

Given the following for an individual state:

Selected Loss and ALAE Ratio	105.5%
Expense and ULAE Ratio	30.7%
Profit and Contingency Provision	-5.0%
Number of Reported Claims	109
Claims Required for Full Credibility Standard	683
Countrywide Indicated Rate Change	8.5%

- Partial credibility is determined using the square root rule.

a. (1 point)

Calculate the credibility-weighted indicated rate change for this state.

b. (0.25 point)

Briefly describe a situation where the given profit and contingency provision may be appropriate.

c. (1 point)

Discuss two situations where the pure premium method is preferable to the loss ratio method for calculating an indicated rate change.

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7. (2.25 points)

Given the following information:

Expense Ratios	Calendar Year			% Fixed
	2013	2014	2015	
General Expenses	4.2%	5.1%	5.9%	70%
Other Acquisition	9.9%	10.6%	11.5%	80%
Taxes, Licenses and Fees	1.5%	1.4%	1.5%	30%
Commission and Brokerage	11.1%	10.4%	11.0%	0%

- Projected ultimate pure premium, including LAE = \$600.
- Underwriting profit provision = 12%.
- Projected average premium per exposure = \$1,000.

a. (1.75 points)

Calculate the indicated average rate using the premium-based projection method for determining expense provisions. Justify all selections.

b. (0.5 point)

Management would like to achieve its targeted underwriting profit without changing rates. Discuss whether this is a reasonable expectation based on the information above.

8. (4.75 points)

Given the following information for a book of business as of December 31, 2015:

Rate Change History	
Effective Date	Change
October 1, 2013	+4.5%
April 1, 2015	+2.5%

Calendar Year	2013	2014	2015
Earned Premium	\$1,870,000	\$2,228,000	\$2,404,000
Earned Exposures	1,420	1,530	1,610

Cumulative Reported Loss + ALAE (\$)
as of (months)

<u>Accident Year</u>	<u>12</u>	<u>24</u>	<u>36</u>
2013	2,150,000	2,395,000	2,495,000
2014	925,000	1,085,000	
2015	1,250,000		

Cumulative Reported Loss + ALAE excluding Catastrophes (\$)
as of (months)

<u>Accident Year</u>	<u>12</u>	<u>24</u>	<u>36</u>
2013	750,000	895,000	975,000
2014	825,000	975,000	
2015	900,000		

- All policies are semi-annual.
- Exposures are written evenly throughout each calendar year.
- Annual severity trend = 5%.
- Annual frequency trend = -1%.
- Annual premium trend = 2%.
- Fixed expense ratio = 5%.
- Variable expense ratio = 22%.
- Profit and contingencies provision = 6%.
- ULAE provision = 7% of loss and ALAE.
- Projected catastrophe load including ALAE = \$235 per exposure.
- There is no loss development beyond 36 months.
- Rates are to be in effect for one year.

Calculate the indicated rate change for policies effective January 1, 2017 using the latest three accident years of experience and assuming full credibility.

9. (2 points)

The following are considerations for pricing a large deductible policy:

- Deductible = \$750,000 per occurrence.
- Expected total ground-up losses = \$1,500,000.
- ALAE = 12% of total ground-up losses.
- Fixed expenses = \$75,000.
- Variable expenses = 15% of premium.
- Underwriting profit provision = 3%.
- Risk margin = 10% of excess losses.
- Cost of processing losses below the deductible = 5% of losses below the deductible.
- Credit risk = 1.5% of expected deductible payments.
- Deductible applies to losses only and does not reduce ALAE.
- Loss elimination ratios (LER) and excess ratios are:

Loss Limit (\$000)	LER	Excess Ratio
\$500	85%	15%
\$750	90%	10%
\$1,000	95%	5%

Calculate the large deductible premium.

10. (2.5 points)

Given the following:

<u>Class</u>	<u>Premium at Current Rate Level</u>	<u>Reported Loss and ALAE</u>	<u>Number of Claims</u>	<u>Current Relativity</u>
A	\$1,257,600	\$964,200	924	1.00
B	\$879,500	\$632,800	623	1.10
C	\$254,900	\$201,400	185	1.80

- Full credibility standard is 800 claims.
- Partial credibility is determined based on the square root rule.

a. (2 points)

Calculate the indicated rate change for each class to achieve a revenue-neutral overall change.

b. (0.5 point)

Briefly discuss two benefits of multivariate classification ratemaking.

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11. (1.75 points)

Given the following loss distribution for accident year 2015 by policy limit:

Size of Loss	\$100,000 Limit		\$250,000 Limit		\$500,000 Limit	
	Claims	Losses (\$000)	Claims	Losses (\$000)	Claims	Losses (\$000)
$X \leq \$100,000$	210	14,000	40	3,000	50	3,000
$\$100,000 < X \leq \$250,000$			50	9,000	40	7,000
$\$250,000 < X \leq \$500,000$					10	4,000
Total	210	14,000	90	12,000	100	14,000

a. (1 point)

Calculate the increased limits factor for \$250,000 assuming a basic limit of \$100,000.

b. (0.25 point)

Assume a ground-up annual severity trend of 10% applies to the data above. Briefly discuss how the increased limits factor estimate would change for future accident years without performing any additional calculations.

c. (0.5 point)

Calculate the complement of credibility for the excess layer between \$250,000 and \$500,000 using the industry increased limits factors below.

Limit of Liability	Increased Limits Factor
\$100,000	1.00
\$250,000	1.50
\$500,000	1.90
\$750,000	2.25
\$1,000,000	2.50

12. (2.5 points)

An insurer is proposing the following changes in order to address inadequate rates:

Building Type	Rating Factor		Exposures
	Current	Proposed	
Commercial	1.00	1.00	300
Large Industrial	1.15	1.15	500
Small Industrial	1.20	1.40	100

Years Since Claim	Discount		Exposures
	Current	Proposed	
0	0%	0%	50
1	10%	5%	150
2+	15%	10%	700

- Additive expense factor (after applying rating factors and discounts) = \$20.
- Base premium = \$100.

a. (1.75 points)

Estimate the change to average premiums.

b. (0.25 point)

Briefly explain a shortcoming with the calculation performed in part a. above.

c. (0.5 point)

Briefly describe two non-pricing solutions that can address inadequate rates.

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13. (3 points)

An insurance company sells workers compensation insurance, which includes both indemnity and medical loss types. In preparation for its next rate filing, effective January 1, 2017, the company uses the following information about its book of business for accident year 2015, evaluated as of December 31, 2015:

Territory	Exposures	Indemnity Loss & ALAE	Medical Loss & ALAE	Workers Compensation Total Current Relativity
A	2,500	\$2,000,000	\$2,000,000	1.20
B	3,500	\$3,000,000	\$500,000	0.90
C	4,500	\$4,000,000	\$1,000,000	1.00

- Indemnity development factor to ultimate = 2.50.
- Medical development factor to ultimate = 1.50.
- Indemnity annual loss and ALAE trend = 3%.
- Medical annual loss and ALAE trend = 6%.
- Accidents are evenly distributed throughout the experience period.
- All policies are annual.
- Rates are in effect for one year.
- The base territory remains the same.

a. (2.25 points)

Calculate the indicated territorial relativities to the base territory.

b. (0.75 point)

Determine the percent change by territory, assuming the indicated relativities are to be adopted and no overall premium change is desired.

14. (1.75 points)

Given the following data evaluated as of December 31, 2015:

Company Data				
Accident Year	Cumulative Paid Claims (\$000) as of (months)			
	12	24	36	48
2012	850	950	1,950	2,450
2013	700	2,200	3,300	
2014	900	1,600		
2015	1,000			

Industry Data			
Accident Year	Paid Claims Age-to-Age Factors		
	12-24	24-36	36-48
2012	1.97	1.24	1.10
2013	2.03	1.27	
2014	2.03		

- There is no development after 48 months.

a. (0.75 point)

Calculate the company's accident year 2015 ultimate claims using the paid claim development technique and the company's historical paid claim activity.

b. (0.5 point)

Calculate the company's accident year 2015 ultimate claims using the paid claim development technique and the industry claim development factors.

c. (0.5 point)

Recommend and briefly justify an estimate of the company's accident year 2015 ultimate claims.

15. (1.5 points)

Given the following information:

Accident	<u>Personal Auto: Cumulative Reported Claims</u> <u>(\$000) as of (months)</u>		
	<u>12</u>	<u>24</u>	<u>36</u>
Year			
2013	10,000	12,500	13,750
2014	10,500	13,120	
2015	11,000		

Accident	<u>Commercial Auto: Cumulative Reported Claims</u> <u>(\$000) as of (months)</u>		
	<u>12</u>	<u>24</u>	<u>36</u>
Year			
2013	2,000	4,000	5,000
2014	4,000	8,000	
2015	5,000		

- The insurer began operating January 1, 2013.

a. (0.5 point)

Calculate personal auto reported claims for each of the calendar years 2013, 2014, and 2015.

b. (0.25 point)

Briefly discuss the appropriateness of using calendar year aggregation in estimating unpaid claims.

c. (0.25 point)

Briefly discuss the appropriateness of using accident year aggregation in estimating unpaid claims.

d. (0.5 point)

Evaluate the appropriateness of combining the two lines of business above when estimating unpaid claims for this insurer.

16. (2.25 points)

Given the following as of December 31, 2015:

Accident Year	Cumulative Paid Claims	Paid Development Technique Ultimate Claims	Paid Development Technique Age-to-Ultimate Factor
2012	\$600	\$720	Not Provided
2013	\$500	\$625	Not Provided
2014	Not Provided	Not Provided	2.00
2015	\$150	Not Provided	3.75

- Accident year 2015 reported claims = \$350.
- Expected claim ratio = 65.0%.
- Calendar year 2015 earned premium = \$700.

a. (0.75 point)

Calculate the following for accident year 2015:

- i. Case outstanding
- ii. IBNR using the expected claims technique
- iii. Total unpaid claim estimate using the expected claims technique

b. (1 point)

Upon review, the 36-48 age-to-age claims development factor was corrected to be 1.4. Calculate the revised accident year 2015 ultimate claims using the correct factor and the paid development technique.

c. (0.5 point)

Calculate the accident year 2015 ultimate claims using the paid Bornhuetter-Ferguson technique and the corrected age-to-age claims development factor in part b. above.

17. (2 points)

Given the following as of December 31, 2015:

Accident Year	Reported Claims (\$000)	Paid Claims (\$000)	Reported Claim Count Development Factor to Ultimate
2013	15,000	15,000	1.0
2014	12,000	10,000	1.1
2015	7,000	3,000	2.0

Selected Ratios:

Age (months)	Case Outstanding to Previous Case <u>Outstanding</u>	Incremental Paid Claims to Previous Case <u>Outstanding</u>
48	0	0
36	0	3.5
24	0.5	2.0

a. (1.5 points)

Estimate the accident year 2015 unpaid claims using the case outstanding development technique.

b. (0.5 point)

Assess whether the case outstanding development technique is appropriate for accident year 2015.

18. (2 points)

An actuary is considering whether to use the Cape Cod technique or the Bornhuetter-Ferguson technique.

a. (0.5 point)

Briefly describe one similarity and one difference between the Cape Cod and Bornhuetter-Ferguson techniques.

b. (0.5 point)

Identify two adjustments to reported claims that may be needed before applying either technique.

c. (0.5 point)

Identify two adjustments to earned premium that may be needed before applying either technique.

d. (0.5 point)

A court decision in 2014 resulted in larger payments to be paid to claimants. Justify which technique would be more appropriate for estimating the accident year 2015 IBNR.

19. (2 points)

Discuss whether a frequency-severity technique is appropriate to estimate ultimate claims for the following:

a. (0.5 point)

A very long-tailed line of business.

b. (0.5 point)

A line of business with a significant proportion of reopened claims.

c. (0.5 point)

A line of business with a recent increase in high severity claims during the experience period.

d. (0.5 point)

A line of business that has experienced changes in case reserving philosophy during the experience period.

20. (2.5 points)

Given the following information:

Accident Year	Cumulative Closed Claim Counts as of (months)				Estimated Ultimate Claim Count
	12	24	36	48	
2012	3,314	4,260	4,340	4,380	4,380
2013	3,390	4,404	4,550		4,596
2014	3,342	4,365			4,454
2015	3,607				4,509

Selected Disposal Rate:	Months			
	12	24	36	48
	0.800	0.980	0.990	1.000

Accident Year	Cumulative Paid Claims (\$) as of (months)			
	12	24	36	48
2012	7,760	13,664	15,515	16,484
2013	8,797	13,543	16,824	
2014	7,821	13,928		
2015	9,113			

Accident Year	Parameter ("a"; "b") for Two-Point Exponential Fit as of (months)			
	12	24	36	48
2012		(1,069 ; 0.00060)	(16 ; 0.00159)	(22 ; 0.00151)
2013		(2,080 ; 0.00043)	(19 ; 0.00149)	
2014		(1,187 ; 0.00056)		

- The relationship between the cumulative number of closed claims ("X") and cumulative paid claims ("Y") is:
 $Y = ae^{bx}$.
- The adjusted paid claims for calendar year 2015 are the same as the unadjusted paid claims.
- There is no development after 48 months.
- An all-year volume weighted average is used to calculate claim development factors.

Calculate ultimate claims for accident year 2015 using the Berquist-Sherman paid claim development adjustment.

21. (1.75 points)

Given the following information:

Accident Year	<u>Cumulative Paid Claims (\$) as of (months)</u>		
	<u>12</u>	<u>24</u>	<u>36</u>
2013	5,500	5,800	6,000
2014	4,800	5,500	
2015	3,600		

Accident Year	<u>Cumulative Reported Claims (\$) as of (months)</u>		
	<u>12</u>	<u>24</u>	<u>36</u>
2013	6,000	6,300	6,000
2014	5,400	6,200	
2015	4,150		

Accident Year	<u>Open Claim Counts as of (months)</u>		
	<u>12</u>	<u>24</u>	<u>36</u>
2013	25	15	15
2014	30	15	
2015	15		

a. (1.25 points)

Create two diagnostic triangles and discuss whether there have been any changes in case reserve adequacy.

b. (0.5 point)

Recommend and briefly justify an appropriate technique to determine ultimate claims based on the conclusion in part a. above.

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22. (2.25 points)

Given the following information:

Accident Year	Cumulative Paid Claims (\$) as of (months)					Accident Year	Cumulative Paid ALAE (\$) as of (months)				
	12	24	36	48	60		12	24	36	48	60
2011	10,000	20,000	25,000	27,000	27,000	2011	500	1,500	2,250	2,700	2,700
2012	10,000	20,000	25,000	27,000		2012	500	1,500	2,250	2,475	
2013	10,000	20,000	25,000			2013	500	1,500	1,875		
2014	10,000	20,000				2014	500	1,000			
2015	10,000					2015	250				

Accident Year	Paid Claims Development Factors				Accident Year	Paid ALAE Development Factors			
	12-24	24-36	36-48	48-60		12-24	24-36	36-48	48-60
2011	2.00	1.25	1.08	1.00	2011	3.00	1.50	1.20	1.00
2012	2.00	1.25	1.08		2012	3.00	1.50	1.10	
2013	2.00	1.25			2013	3.00	1.25		
2014	2.00				2014	2.00			

Calendar Year	Earned Premium (\$)	Paid Claims (\$)	Paid ALAE (\$)	Paid ULAE (\$)
2011	50,000	27,000	2,700	3,240
2012	50,000	27,000	2,700	3,240
2013	50,000	27,000	2,700	3,240
2014	50,000	27,000	2,700	3,240
2015	50,000	27,000	1,350	4,212

- Prior to 2015, the insurer operated in a steady state environment. Data prior to accident year 2011 exists but is not shown above.
- Claims and ALAE trend = 0%.
- Total case outstanding as of December 31, 2015 = \$21,000.
- Total IBNR as of December 31, 2015 = \$5,000.
- In 2015, the insurer began to use its own legal department on more claims in an effort to reduce legal expenses.
- Legal department salaries are not allocated to specific claims and thus are recorded as ULAE.
- The legal fees from outside attorneys are billed to specific claims and recorded as ALAE.
- The change in attorney expenses resulted in a 50% decline in ALAE and a 30% increase in ULAE; the new expense ratios are expected to persist through future calendar years.

<QUESTION 22 CONTINUED ON NEXT PAGE>

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22. (continued)

a. (1 point)

Estimate the total unpaid ALAE as of December 31, 2015 for all accident years.

b. (0.5 point)

Estimate the total unpaid ULAE as of December 31, 2015 using the classical technique.

c. (0.75 point)

Assume that prior to the change in 2015, half of ULAE was sustained when claims were reported. Fully assess the reasonableness of the estimate provided in part b. above.

EXAM 5, SPRING 2016

23. (2.75 points)

The following information is available as of June 30, 2015 for an insurance company:

Accident Year	Cumulative Paid Claims (\$000s) as of (months)			
	<u>6</u>	<u>18</u>	<u>30</u>	<u>42</u>
2012	3,450	4,313	4,528	4,573
2013	3,200	4,000	4,200	
2014	3,345	4,181		
2015	2,950			

Accident Year	Cumulative Paid ALAE (\$000s) as of (months)			
	<u>6</u>	<u>18</u>	<u>30</u>	<u>42</u>
2012	173	345	498	549
2013	160	320	462	
2014	167	335		
2015	148			

- There is no development beyond 42 months.

a. (2.25 points)

Estimate the total ultimate unpaid ALAE for all accident years using a paid ALAE-to-paid claims only development technique.

b. (0.5 point)

This insurance company expects a significant change in their mix of business that will impact accident years 2015 and later. Briefly describe one advantage and one disadvantage of using the paid ALAE-to-paid claim only technique during this change in mix of business.

24. (3 points)

Given the following information:

Accident Year	<u>Cumulative Reported Claims (\$) as of (months)</u>			
	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>
2011	450	650	730	750
2012	500	700	780	
2013	500	750		
2014	700			

Accident Year	<u>Selected</u>	<u>Reported Claims (\$) as</u>
	<u>Ultimate Claims (\$)</u>	<u>of December 31, 2015</u>
2011	750	750
2012	1,000	950
2013	1,050	900
2014	1,200	950

- There is no development after 48 months.

a. (1.5 points)

Compare actual reported claim emergence to expected reported claim emergence in calendar year 2015 for accident years 2011 through 2014.

b. (1.5 points)

When considering actual emergence compared to expected emergence, the actuary can react in one of three ways:

- i. Reduce the recommended unpaid claims
- ii. Leave the recommended unpaid claims at the same expected level
- iii. Increase the recommended unpaid claims

Identify and briefly justify a reserving technique that would generate each of the three potential reactions using the results of part a. above.

25. (2 points)

Given the following estimates of ultimate claims (\$000):

Accident Year	<u>Development Techniques</u>			<u>Bornhuetter-Ferguson Techniques</u>	
	<u>Paid</u>	<u>Reported</u>	<u>Case Outstanding</u>	<u>Paid</u>	<u>Reported</u>
2013	2,200	2,100	2,250	2,050	2,300
2014	3,300	3,400	2,700	2,500	2,400
2015	2,300	3,100	3,150	2,400	3,000

a. (1 point)

Identify one potential scenario that explains the differences between estimates resulting from the techniques above for accident year 2014. Select and briefly justify an ultimate claims estimate for accident year 2014 given this scenario.

b. (1 point)

Identify one potential scenario that explains the differences between estimates resulting from the techniques above for accident year 2015. Select and briefly justify an ultimate claims estimate for accident year 2015 given this scenario.

Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

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	2.50	0.75	0.75	0.50	0.50			
3	2.25	1.50	0.75					
4	2.25	0.50	0.50	0.75	0.50			
5	1.50	0.50	0.50	0.50				
6	2.25	1.00	0.25	1.00				
7	2.25	1.75	0.50					
8	4.75	4.75						
9	2.00	2.00						
10	2.50	2.00	0.50					
11	1.75	1.00	0.25	0.50				
12	2.50	1.75	0.25	0.50				
13	3.00	2.25	0.75					
14	1.75	0.75	0.50	0.50				
15	1.50	0.50	0.25	0.25	0.50			
16	2.25	0.75	1.00	0.50				
17	2.00	1.50	0.50					
18	2.00	0.50	0.50	0.50	0.50			
19	2.00	0.50	0.50	0.50	0.50			
20	2.50	2.50						
21	1.75	1.25	0.50					
22	2.25	1.00	0.50	0.75				
23	2.75	2.25	0.50					
24	3.00	1.50	1.50					
25	2.00	1.00	1.00					
TOTAL	<u>57.75</u>							

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

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).

EXAM STATISTICS:

- Number of Candidates: 838
- Available Points: 57.75
- Passing Score: 41.50
- Number of Passing Candidates: 392
- Raw Pass Ratio: 46.8%
- Effective Pass Ratio: 48.8%

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 1	
TOTAL POINT VALUE: 2.5	LEARNING OBJECTIVE(S): A2, A3
SAMPLE ANSWERS	
<p><u>Sample 1</u></p> <p>Benefit On-Level Factor Benefit Level 1.00: Weighting of 1-.28125 = .71875 Benefit Level 1.10: Weighting of (.75)(.75)(.5) = .28125</p> <p>Loss On-Level Factor = $1.045 / [(.28125)(1.1) + .71875] = 1.0164$</p> <p>Rate On-Level Factor Rate Level 1.00: Weighting of 1-.03125 = 0.96875 Rate Level 1.05: Weighting of (.25)(.25)(0.5) = 0.03125</p> <p>Rate On-Level Factor: $1.05 / [.96875 + (.03125)(1.05)] = 1.0484$</p> <p>2013 EP x On-Level Factor = $1500 \times 1.0484 = 1572.54 = \text{On-Level EP}$</p> <p>2013 Loss x On-Level Factor x Loss Trend = $800 \times 1.0164 \times (1.02)^{4.5} = 888.9$</p> <p>On-Level LR for AY 2013 = $888.9 / 1572.54 = 56.53\%$</p> <p><u>Sample 2</u></p> <p>Current Rate Level = 1.05</p> <p>On-Level rate level factor for 2013: $1.05 \times (0.5 \times 3/12 \times 3/12) + 1 \times (.96875) = 1.05/1.00156 = 1.048$</p> <p>On-Level EP = $1500 \times 1.048 = 1572$</p> <p>Assume premium trend is 0%</p> <p>On-Level factor for losses in 2013: $1.045 / [(9/12 \times 9/12 \times 0.5) \times 1.1 + (0.71875 \times 1.0)] = 1.045 / 1.028125 = 1.0164$</p> <p>Loss trend is 2%</p> <p>Trend period is 7/1/2013 to 1/1/2018 == > 4.5 years</p> <p>Ultimate Trended Losses for AY 2013: $800,000 \times 1.0164 \times (1.02)^{4.5} = 889K$</p> <p>On-level Loss Ratio = $889/1572 = 56.55\%$</p>	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

EXAMINER'S REPORT

Candidates were expected to know how to translate earned premium and incurred losses to current rate and benefit levels. This included calculating the "average rate" and "average benefit" levels associated with a specific accident year and translating these amounts to current levels. This question also involved incorporating trend into the on-leveling process.

This question was relatively straightforward, and candidates performed very well on this question.

Common mistakes included:

- Calculating the incorrect weighting for specific levels of rate or benefits
- Failing to translate either premiums or losses to current level properly (usually caused by a failure to correctly identify the current benefit level of $1.1 \times 0.95 = 1.045$ and/or the current rate level of 1.05)
- Failing to recognize the correct trend period of 4.5 years

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 2		
TOTAL POINT VALUE: 2.5	LEARNING OBJECTIVE(S): A1, A2	
SAMPLE ANSWERS		
Part a: 0.75 point		
<u>Sample 1</u>		
A $1000 - 500 = 500$		
B $0.25 * 500 + 0.75 * 400 = 425$		
C <u>1000</u>		
1925		
<u>Sample 2</u>		
A: $1000 - 500 = 500$ (cancels at midpoint)		
B: $500 - (\frac{3}{4}) * 500 + (\frac{3}{4}) * 400$ (equivalent to cancel 3/4 of the way in and rewriting in Terr 1 at cheaper rate)		
C: 1000		
Total = $500 + 425 + 1000 = 1925$		
Part b: 0.75 point		
<u>Sample 1</u>		
A 500		
B $0.25 * 500 + 0.25 * 400 = 225$		
C <u>500</u>		
1225		
<u>Sample 2</u>		
A: 500 (cancels before year is over so $\frac{1}{2}$ of the policy is fully earned in 2015)		
B: $500 * (\frac{1}{4}) + 400 * (\frac{1}{4}) = 225$ ($\frac{1}{4}$ of each portion in each terr is earned in 2015)		
C: $500 = 1000 * \frac{6}{12}$ 6 month policy, so $\frac{1}{2}$ is earned in 2015		
Total = $500 + 225 + 500 = 1225$		
Part c: 0.5 point		
A: not in force		
B: 400		
C: 1000		
Total = $400 + 1000 = 1400$		
Part d: 0.5 point		
Policy	Terr1 earned expo	Terr2 earned expo
A	0.5	0
B	0.25	0.25
C	0	<u>$0.25 = (0.5/2)$</u>
	0.75	0.5
EXAMINER'S REPORT		
This question required candidates to understand the differences between written, earned, and in-force premium and exposures. Two mid-term policy adjustments and a combination of 6- and 12-month policies were included to fully test these concepts. While some candidates were unsure how the different terms and adjustments impacted each calculation, the majority of		

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

candidates performed well on this question. The calculations were straightforward and did not pose a challenge for most candidates.

Candidates were expected to know:

- Aggregation of written premium, earned premium and in-force premium from a policy database
- Aggregation of earned exposure from a policy database

Part a

Candidates were expected to calculate the correct written premium for each policy.

Common mistakes included:

- Policy A: failing to correctly account for the mid-term cancellation, either by removing or including the entire original \$1,000 written premium.
- Policy B: misusing the \$400 new territory premium as additional new premium to the policy, and simply adding \$500 and \$400 together. Candidates should understand that \$400 was the full-term written premium (equivalent to 12 months for Policy B) and was in effect for 9 months. The \$500 full-term written premium was only in effect for 3 months.
- Policy C: assuming that the full-term written premium was an annual premium, including only \$500 in written premium for 2015. Candidates should understand that the full term of Policy C is 6 months, as indicated by the effective and expiration dates, so \$1,000 is written in 2015.

Part b

Candidates were expected to calculate the correct earned premium for each policy.

Common mistakes included:

- Policy A: failing to account for the mid-term cancellation.
- Policy C: failing to recognize that Policy C is a 6-month policy, such that 50% of the premium is earned in 2015
- Policy C: assuming that the full-term written premium was an annual premium, including only $50\% \times \$500 = \250 earned in 2015. Candidates should understand that the full term of Policy C is 6 months, as indicated by the effective and expiration dates, so \$500 is earned in 2015.

Part c

Candidates were expected to calculate the correct in-force premium for each policy.

Common mistakes included:

- Policy A: failing to account for the mid-term cancellation and therefore included Policy A as an in-force policy.
- Policy B: failing to use the written premium that was in-force on October 1, 2015 (\$400) and instead used some combination of \$500 and \$400.

Part d

Candidates were expected to calculate the correct earned exposure for each policy, and the correct allocation by territory.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Car-years is the most common exposure base for automobile policies, which almost every candidate used.

Common mistakes included:

- Failing to correctly allocate the exposures between territories, or altogether forgot to allocate by territory.
- Using earned premium as an exposure base, instead of car-years.
- Failing to account for the mid-term cancellation of policy A.
- Failing to recognize that policy C is a 6-month policy, representing 0.5 car-years for the full term, and earning 0.25 car years in 2015.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 3	
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVE(S): A1, A7
SAMPLE ANSWERS	
Part a: 1.5 points	
<u><i>Sample Responses for "Proportional to Expected Loss" Criteria</i></u>	
<ul style="list-style-type: none"> • Hours driven is proportional to expected loss. The more you drive the more likely you are to incur a loss • Hours driven is not proportional to expected loss, since some areas have more traffic than others, for example. For that reason, more hours driven does not translate to higher expected loss, necessarily. 	
<u><i>Sample Responses for "Practical" Criteria</i></u>	
<ul style="list-style-type: none"> • Is objective but would be very costly to verify and could be subject to manipulation if obtained by self-reporting • Car-years is very easy to determine, hours driven is not. It would require expensive telematics to verify • Hours driven is verifiable with telematics • Hours driven from an individual would be easy, inexpensive and objective to gain the information 	
<u><i>Sample Responses for "Historical Precedence" Criteria</i></u>	
<ul style="list-style-type: none"> • The current exposure base is car-years. If change to hours driven, it may cause large premium swings to insured • Since the insurer is changing the exposure base this can be very expensive and time consuming to modify the current rating structure • It would be very expensive and difficult to change exposure bases. Would have to restate historical data if analysis of past was ever performed • It is not a preexisting exposure base used within the industry. Thus, there may not be industry benchmark or other information 	
Part b: 0.75 point	
<i>[Examiner's note: many sample responses are provided below. Any 3 responses would receive credit, provided 3 considerations from ASOP 12 were covered. In other words, candidates would not receive full credit for providing two responses both discussing the "privacy" consideration.]</i>	
<ul style="list-style-type: none"> • The risk characteristic should have a relationship to expected losses. The hours driven is proportional to future cost since the more hours on the road, the higher likelihood of being involved in an accident. • Hours driven does not have a strong relationship to expected loss because people driving on the highway will travel further than someone driving the same amount of time in the city. • Objective: If hours driven is well defined and measured through a device (rather than self-reported) it may be a good rating variable and not subjective. • It is not easy to verify and the cost of collecting it will be expensive. • Hours driven may not be appropriate to use because it can be manipulated by drivers if self-reported. 	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

- Causality: Hours driven has a cause and effect relationship with losses. It is intuitive that more hours driven would result in more accidents & more losses, thus public acceptance would occur.
- Legal: This is probably a legal variable but would want to confirm before implementing.
- Regulators are likely to approve of this addition. No legal objections are likely.
- Hours driven hasn't been commonly used as a rating characteristic for personal auto insurance, thus it is less likely to be accepted by society.
- Using hours driven may help avoid adverse selection – risks that drive much more than average can be priced appropriately (rather than underpricing with the insurer attracting many such risks)
- Credibility: Classes can be made large enough to have enough drivers in them to provide reasonable credibility
- A risk characteristic should be statistically significant meaning different subsets of hours driven should have significantly different expected losses.
- The classes can be homogeneous if they are created so that the risks within them are similar with no clear subclasses.
- Homogeneity: Risks within some group should have similar expected loss. But hours driven is not directly proportional to expected loss. With different speed, car type and driving habits, same hours driven might show different expected loss.
- Affordability: Using hours driven might make insurance unaffordable for low income insureds with longer commutes.
- Hours driven is controllable by the insured. They can drive less hours to keep their premium down.
- Controllability: Insureds likely have little control over how much they drive, as many drive primarily to work. Not a desirable characteristic.
- Privacy: If devices are installed to track hours driven, could be seen as an invasion of personal privacy.
- Privacy: Hours driven is not private information so it's likely to be accepted by the public.

EXAMINER'S REPORT

Candidates were expected to know the three criteria of a good exposure base, and be familiar with the considerations of a risk characteristic from ASOP 12 to evaluate how the considerations apply to the exposures bases discussed in this question.

Candidates performed well on this question, which was not particularly challenging. The question represented the syllabus materials in a straightforward manner, so candidates were generally able to cover the concepts thoroughly in their responses.

Part a

Candidates were expected to know the three criteria of a good exposure base and evaluate a potential exposure base using each criteria: Proportional to Expected Loss, Practical, and Historical Precedence.

Candidates were expected to evaluate the proposed exposure base by explaining why they believed it met or did not meet each of the three criteria. Simply listing the criteria, or only stating that the proposed exposure base met or did not meet the criteria without any further explanation was not a sufficient response.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

- Proportional to expected loss: candidates needed to demonstrate that there was or wasn't a relationship between hours driven and expected loss
- Practical: candidates needed to demonstrate it would or wouldn't be practical based on whether it was or wasn't either objectively defined, easy/inexpensive to obtain, easy/inexpensive to verify, or subject to manipulation
- Historical Precedence: candidates needed to demonstrate whether or not this was met by explaining the change of base based on either impact to systems (IT costs), impact to policyholders (premium swings) or data (current data would be difficult to work with, there would be a lack of industry benchmarks, etc).

Common mistakes included:

- Proportional to Expected Loss: the most common mistakes were just listing the criteria, or only saying that it is more/less proportional than car-years. A small number of candidates interpreted hours driven to mean the hours of a single particular drive (e.g., in a single trip, with more hours driven the driver is more likely to get tired and fall asleep)
- Practical: common mistakes were evaluating miles driven instead of hours driven and incorrectly explaining a reason hours meets or does not meet criteria (e.g., it is subject to manipulation because the insured can drive as much or as little as they want)
- Historical Precedence: common mistakes included only stating that the current base is car-years, so hours driven doesn't meet historical precedence, and saying that hours driven doesn't meet historical precedence only because other companies/industry don't currently use hours driven (and not making the connection that there would be a lack of industry benchmarks).

Part b

Candidates were expected to evaluate hours driven as a risk classification variable based on three considerations from ASOP 12. There are approximately a dozen different considerations listed in the syllabus readings.

Candidates were expected to explain why they believed hours driven met or did not meet each consideration. Simply listing the considerations, or only stating that the base met or did not meet a consideration without any further explanation was not a sufficient response.

Differences in opinion on whether hours driven met or did not meet a certain criteria were not penalized. For example, some candidates thought privacy might be violated by this variable, while others did not. Both were awarded credit provided the candidate explained his or her reasoning.

Common mistakes included:

- Listing the considerations with no explanation
- Using the same consideration more than once
- Saying that hours driven meets or does not meet a certain consideration without any explanation

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 4	
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVE(S): A3
SAMPLE ANSWERS	
Part a: 0.5 point	
$500 - 1000 + 4000 - 5000 + 500 + 5000 = 4000$	
Part b: 0.5 point	
$10,000 + 1000 + 10000 = 21,000$	
Part c: 0.75 point	
$\frac{6000 + 6000 - 6000 + 10,000 + 1000 + 10000 + 4000 - 5000 + 5500}{50,000} = .63$	
Part d: 0.5 point	
<u>Sample Responses for "Advantage"</u>	
<ul style="list-style-type: none"> • Provides the best match of premium and losses • It provides a good match between exposures and losses • Can isolate changes in policy limits or underwriting guidelines 	
<u>Sample Responses for "Disadvantage"</u>	
<ul style="list-style-type: none"> • Takes longest to develop • PY is the least responsive with an extended time to become available for ratemaking analysis • Policy year premium and loss need to develop to ult 	
EXAMINER'S REPORT	
<p>Candidates were expected to calculate case incurred losses using the loss payment and case reserve change transactions provided. Candidates were also expected to calculate a loss ratio using the premium information provided. Finally, candidates were expected to provide an advantage and a disadvantage of using policy year data in ratemaking.</p> <p>This question was straightforward, and candidates did well on this question. The majority of candidates calculated the case incurred loss correctly for parts a., b. and c., as well as the loss ratio for part c. Most candidates were able to provide one each of the several advantages and disadvantages for using policy year data in ratemaking.</p>	
Part a	
<p>Candidates were expected to calculate the 2015 calendar year case incurred losses using the loss payment and case reserve change transactions provided for four claims, organized by policy effective, accident, report, and transaction dates.</p> <p>Candidates were expected to demonstrate the correct use of the loss payments and case reserve changes with a 2015 transaction date by summing the loss payments and case reserve changes to determine the correct total case incurred losses.</p> <p>Common mistakes included:</p> <ul style="list-style-type: none"> • Including transactions not belonging to calendar year 2015 • Calculating the change in case reserves but calling it the case incurred loss (i.e., ignoring the loss payments) 	
Part b	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Candidates were expected to calculate the 2014 policy year case incurred losses, evaluated at December 31, 2014, using the loss payment and case reserve change transactions provided for four claims, organized by policy effective, accident, report, and transaction dates.

Candidates were expected to demonstrate the correct use of the loss payments and case reserve changes for claims with policy effective dates in 2014 and transactions on or before December 31, 2014, by summing the loss payments and case reserve changes to determine the correct total case incurred losses. Note: only the first two transaction dates for claim 3 were required for this calculation.

Common mistakes included:

- Including claims not belonging to policy year 2014
- Including transactions beyond the December 31, 2014 evaluation date
- Calculating the change in case reserves but calling it the case incurred loss (i.e., ignoring the loss payments)

Part c

Candidates were expected to calculate the 2014 accident year case incurred losses, evaluated at December 31, 2015, using the loss payment and case reserve change transactions provided for four claims, organized by policy effective, accident, report, and transaction dates.

Candidates were expected to demonstrate the correct use of the loss payments and case reserve changes for claims with accident dates in 2014 & transactions on or before December 31, 2015, by summing the loss payments and case reserve changes to determine the correct total case incurred losses. In addition, candidates were expected to select the correct premium from the two provided premiums, and use the 2014 earned premium to calculate the case incurred loss ratio. Note: only the 2014 and 2015 transactions for claims 2, 3, and 4 are required for this calculation.

Common mistakes included:

- Including transactions beyond the December 31, 2015 evaluation date
- Calculating the change in case reserves but calling it the case incurred loss (i.e., ignoring the loss payments)
- Skipping the calculation of the loss ratio

Part d

Candidates were expected to know an advantage and a disadvantage of using policy year data in ratemaking.

Candidates were expected to briefly state one advantage and one disadvantage specific to the policy year aggregation method, with no detailed explanation or other supporting information required.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 5	
TOTAL POINT VALUE: 1.5	LEARNING OBJECTIVE(S): A3
SAMPLE ANSWERS	
Part a: 0.5 point	
<p><u>Sample 1</u> Insured A = 1000+2000+3000+4000=10,000 Insured B = 5000+3000+2000=10,000</p> <p><u>Sample 2</u> Assuming at the end of 2012 claims made policy, the insured bought tail coverage to cover reported losses after 12-31-12 for accidents which occurred during the mature claims made period, insurer A = 12,000 and insurer B = 10,000</p> <p><u>Sample 3</u> For claims made assume retroactive date of 1/1/2011. Insurer A = 3000+4000=7,000 Insurer B = 5000+3000+2000=10,000</p>	
Part b: 0.5 point	
<ul style="list-style-type: none"> • 1 - When there is a sudden shift in reporting pattern, claims made will be affected very little while occurrence will be affected a lot. 2 – When there is an unexpected loss trend change claims made will be less impacted and will not be significantly different compared to its estimate using the old trend. In comparison, occurrence will be affected much and will be very different from its estimate using the old trend. • One reason is that occurrence policies have pure IBNR, unlike claims-made policies, so there is a report lag that allows claims to develop further under occurrence policies. A second reason is that because occurrence policies have a report and settlement lag, there is significantly more time for claims to be influenced by loss trends, so there is greater volatility. • Reason 1 - Occurrence policy has longer development period than claims-made policy since claims-made policy does not have a report lag but the former one has. Reason 2 – If there is unexpected change in settlement rate or report 	
Part c: 0.5 point	
<ul style="list-style-type: none"> • Assuming a stable interest rate environment, an occurrence policy is likely to earn more investment income since ultimate losses are impacted by both report lag and settlement lag, whereas ultimate losses on claims-made policies are only impacted by settlement lag. Therefore, occurrence policies have more time for premium to be invested. • In case of occurrence policies, reserves will have more time to generate investment income. Also, occurrence policies have to set reserve for both IBNR and IBNER, so larger the amount available to invest, more will be the investment income. So occurrence policies will have more investment income as compared to claims made. 	
EXAMINER'S REPORT	
<p>Candidates were expected to understand both claims-made and occurrence coverage, how to apply those terms to claim data, and how each coverage responds in a stable interest rate environment.</p> <p>This question was relatively straightforward, and candidates performed very well on this question.</p>	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part a

Candidates were expected to know which claims were covered under a claims-made vs. occurrence policy given their accident and report dates.

If candidates stated an assumption regarding a retro date or the purchase of tail coverage that would have resulted in a different answer from the sample solutions, credit was awarded provided the assumption was applied properly.

Common mistakes included:

- Inclusion of the claim that would only be covered if tail coverage was covered but no assumption of tail coverage was stated.
- Candidates often did not include claims that occurred prior to 2011 but were reported under the claims made policy. Unless an assumed retro date of 1/1/11 was stated, these claims should have been included.

Part b

Candidates were expected to understand why occurrence policies are more volatile than claims made policies.

Common mistakes included:

- Listing only one reason
- Listing two reasons, where the second reason was just a restatement of the first reason
- Stating that claims made policies do not develop after 12 months
- Stating that claims made policies are not impacted by trend

Part c

Candidates were expected to demonstrate why occurrence policies earn more investment income.

Common mistakes included:

- Stating that occurrence policies earn more investment income, but not supporting the statement
- Stating that claims made policies are fully paid by 12 months
- Confusion in explaining settlement lag (the time from when a claim is reported to when it is closed) versus report lag (the time from when a claim occurs to when it is reported)

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 6	
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVE(S): A4, A5
SAMPLE ANSWERS	
Part a: 1 point	
<p><u>Sample 1</u> Credibility = $\sqrt{109/683} = 39.95\%$ Complement of credibility = 8.5% (countrywide indication) Rate Indication (*assume all expense variable): $105.5\% / (1 - 30.7\% + 5\%) - 1 = 41.99\%$ Credibility-weighted Indicated Rate Change: $41.99\% \times 39.95\% + (1 - 39.95\%) \times 8.5\% = 21.88\%$</p> <p><u>Sample 2</u> Cred = $z = \sqrt{109/683} = 39.9\%$ Ind Rate Chg = $(105.5\% + 30.7\%) / (1 - (-5\%)) - 1 = 29.7\%$ *assume expense/ulae ratio is fixed Cred-Wtd Ind Rate Chg = $(29.7\%)(39.9\%) + (8.5\%)(1 - 39.9\%) = 16.97\%$</p>	
Part b: 0.25 point	
<ul style="list-style-type: none"> • For a long-tailed line of business where there is a significant amount of investment income • Insurer has a negative profit target when they want to be competitive and gain new business hoping they will make profit in later years. • If the company is forced by regulation to set the profit at this amount 	
Part c: 1 point	
<ol style="list-style-type: none"> 1. When it is a new business, pure premium method is preferable to loss ratio method, since there is no existing rate. 2. When new rating variables are introduced and they are not available in historical dataset. Thus, it's impossible to on-level the premium. 	
EXAMINER'S REPORT	
<p>Candidates were expected to know how to calculate a basic rate level indication, as well as understand the differences between the loss ratio method and pure premium method.</p> <p>This question was straightforward, and most candidates performed well on this question.</p>	
Part a	
<p>Candidates were expected to know how to calculate a credibility weighted rate level indication using the loss ratio method.</p> <p>Common mistakes included:</p> <ul style="list-style-type: none"> • Assuming all expenses were fixed, but not stating the assumption. • Miscalculating credibility by forgetting to take the square root. 	
Part b	
<p>Candidates were expected to understand the purpose of the profit factor in the loss ratio method calculation, that the target profit is a choice made by the insurer, and why an insurer might choose to have a negative profit provision.</p>	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Some candidates made an assumption that profit was low for new business, because the losses and expenses will be high. This did not demonstrate understanding that the profit target is a choice made by the insurer.

Part c

Candidates were expected to know the differences between the pure premium method and the loss ratio method, and explain when it is appropriate to use each.

Common mistakes included:

- Stating that the pure premium method was preferable when exposures are readily available and well defined. While this is a requirement for using the pure premium method, it does not necessarily imply that the pure premium method would be better than the loss ratio method in that situation.
- Listing two reasons, where the second reason was just a restatement of the first reason, such as stating that new rating variables were not in the history and subsequently stating that new rating variables were not included in the existing rate.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 7	
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVE(S): A4, A6
SAMPLE ANSWERS	
Part a: 1.75 points	
<u>Sample 1</u>	
General expenses and other acquisitions are both increasing so the most recent data has been chosen.	
General expenses: .059	
Other Acquisitions: 0.115	
Taxes, Licenses + fees and commissions + Brokerage do not have any clear pattern and all year average was chosen	
Taxes Lisces + fees: $(.015+.014+.015)/3 = .014\bar{6}$	
Commissions + Brokerage: $(.111+.104+.11)/3 = .108\bar{3}$	
% fixed expenses	
$.059*(.7)+115(.8)+.014\bar{6}(.3)+.108\bar{3}(0) = .1377$	
% variable expenses	
$.059*(.3)+115(.2)+.014\bar{6}(.7)+.108\bar{3}(1) = .1593$	
Average fixed expenses per exposure = $(.1377)(1000)=137.7$	
$\frac{600 + 137.7}{1 - .12 - .1593} = 1023.59 = \text{Indicated average rate}$	
<u>Sample 2</u>	
	(1) (2)
<u>Exp</u>	<u>% Fixed</u> <u>Selected</u>
GE	70% 5.5%
OA	80% 11.05%
TLF	30% 1.5%
CB	0% 10.8%
Total = 28.85%	
FER = 13.13% <- sumprod[(1),(2)]	
VER = 15.72%	
Ind Avg Rate = $\frac{600+.1313(1000)}{1-.1572-.12} = 1011.76$	
<u>Sample 3</u>	
Since GE and OA expenses seem to be trending upwards, I will use 2015 expense ratios. For T,L,&F and commissions I will exclude CY2014 since those years seemed to have lower expenses. Since CY2015 & 2013 are similar, I will use 2015 for everything.	
2015	Fixed Variable
GE	$(.7)(5.9)=4.13\%$ $(.3)(5.9)=1.77\%$

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

OA	(.8)(11.5)=9.2%	(.2)(11.5)=2.3%
T,L,&F	(.3)(1.5) = .45%	(.7)(1.5)=1.05%
C&B	0%	11%
Total	13.78%	16.12%

Indicated avg Rate = $\frac{600+1000(.1378)}{1-.12-.1612} = 1026.43$

Sample 4

Used straight averages – assumed increases in GEN & OTHER are not indicative of trend, need more yrs to know that

Selected TOTAL GENERAL -> 5.067% x .7 -> 3.55% is fixed

“ TOTAL OTHER -> 10.067% x .8 -> 8.53% “ “

“ “ TL&F -> 1.467% x .3 -> 0.44% “ “

“ “ C&B -> 10.83% x 0 -> 0% is fixed

TOTAL FIXED EXPENSES = 3.55% + 8.53% + .44% = 12.52%

“ VARIABLE “ = 15.514% = 5.067% + 10.067% + 1.467% + 10.83% - 12.52%

$\frac{\text{TOTAL FIXED EXPENSES}}{\text{PREMIUM}} = 12.52\%$

AVG PREM / EXPOSURE = 1000

1000 x 12.52% = FIXED EXPENSE / EXPOSURE

$\frac{600+125.2}{1-.15514-.12} = 1000.5 \rightarrow$ INDICATED AVG RATE

Part b: 0.5 point

- This is not a reasonable expectation. The indicated rate is higher than the current rate. Additionally, if the fixed expenses continue to increase as they have been, this would make the indicated rate even higher, making the company even less likely to hit their target UW profit without changing rates.
- Using fundamental ins. Equation:
Premium = Loss & ALAE + Expenses + UW Profit
Management could achieve this by lowering expenses (more efficient processes), lowering losses (tighter claim settlement practices) or by marketing/underwriting to lower risk individuals/insureds.
- This could be reasonable if the insurer did other things such as reduce expenses, target profitable business to reduce expected losses, implement loss prevention/control programs through insureds, or layoffs (also ↓ expenses).
- They will be able to achieve the target profit without changing rates. In fact, price are actually too high so they will even make a better profit than the target one. Only, General Expenses and Other Acquisition are to follow because they continue going up. We will need to increase rates in the long run.

EXAMINER'S REPORT

Candidates were expected to determine the indicated rate after selecting reasonable expense ratios, split into fixed and variable components. Candidates were also expected to assess if the

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

target underwriting profit could be achieved without changing rates by evaluating the expense trends.

This question was relatively straightforward, and most candidates performed well, with many candidates making the expected observations on the expense trends, selecting expense ratios consistent with the trends and completing the calculation to determine the indicated rate without error.

Part a

Candidates were expected to select appropriate expense ratios, accounting for observed trends and volatilities. Candidates were further expected to be able to appropriately separate the expense ratios into fixed and variable components, and determine the indicated rate given the selections and the necessary pure premium and target profit provision information.

Common mistakes included:

- Some candidates took the following approach: splitting the annual expenses into fixed and variable parts. They then reviewed and made selections for each fixed and variable. A common inaccuracy made by candidates in this approach is allowing the volatility of the commission and brokerage expenses to hide the apparent trend in the general and other acquisition expenses, resulting in inconsistent treatment relative to the treatment of the fixed expenses portion of the general and other acquisition expenses.
- Applying the fixed expense ratio to the pure premium rather than the projected premium or the indicated premium.

Part b

Candidates were expected to draw a conclusion on the feasibility of achieving the target underwriting profit provision, taking into consideration expense trend observations and offering specific alternatives to changing rates.

Common mistakes included:

- Failing to discuss the expense trend observations
- Offering a proposed alternative approach without any support for the proposal

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 8					
TOTAL POINT VALUE: 4.75			LEARNING OBJECTIVE(S): A2, A3, A5		
SAMPLE ANSWERS					
<i>Sample 1 (Traditional Loss Ratio Approach)</i>					
Accident Year	Area A	Area B	Area C		
2013	0.9375	0.0625	0		
2014	0.0625	0.9375	0		
2015	0	0.5	0.5		
Rate	1	1.045	1.071		
Average Rate		On Level Factor			
1.002813		1.0681			
1.04219		1.0278			
1.05806		1.01235			
AY	EP	OLF	Trend	Trended OLEP	
2013	1,870,000	1.0681	1.02 ^{4.25}	2,172,722	
2014	2,228,000	1.0278	1.02 ^{3.25}	2,442,161	
2015	2,404,000	1.01235	1.02 ^{2.25}	2,544,577	
				7,159,468	
I will use the data for losses & ALAE excluding catastrophes, since we are given a separate catastrophe load.					
AY	12-24	24-36	36-Ult		
2013	1.193	1.0894			
2014	1.182				
Selected	1.1875	1.0894	1		
ATU	1.2937	1.0894	1		
AY	Loss	ATU	Trend	Trended Ult Loss	LR
2013	975,000	1	(0.99*1.05) ^{4.25}	1,149,499	52.91%
2014	975,000	1.0894	(0.99*1.05) ^{3.25}	1,204,680	49.33%
2015	900,000	1.2937	(0.99*1.05) ^{2.25}	1,270,373	49.92%
				3,624,552	50.63%
The loss ratios are pretty stable across the years. I'll select the weighted LR of 50.63%.					
Projected CAT load including ALAE = \$235/exposure. We can convert it to a ratio by dividing by average trended OLEP for 3 years					
CAT load ratio = 235 / (7,159,460 / (1420+1530+1610)) = 14.97%					
Indicated Rate change = [(50.63%+14.97%)*1.07+5%]/[1-22%-6%] - 1 = 4.433%.					

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Sample 2 (Loss Ratio using 2-step approach for premium trend)

2013 OLF = $1.045 * 1.025 / (15/16 + 1.045/16) = 1.0681$

2014 OLF = $1.071125 / (1/16 + 15/16 * 1.045) = 1.0278$

2015 OLF = $1.071125 / (0.5 * 1.045 + 0.5 * 1.071125) = 1.0123$

CY	OLF	Average on-level earned	Projected Premium – Calc	Projected Premium
2013	1.0681	$1,870,000/1420 * 1.0681 = 1406.6$	$1420 * 1511.5 * 1.02^{2.25}$	2,244,124
2014	1.0278	1496.7	$1530 * 1511.5 * 1.02^{2.25}$	2,417,965
2015	1.0123	1511.5	$1610 * 1511.5 * 1.02^{2.25}$	2,544,394
				7,206,483

I'll use a 2 step trending. I'll set the average written premium to the latest level of 1511.5 and then I'll trend Prem 7/1/15 to 10/1/17.

For losses I'll use ldfs from prem triangle that exclude catastrophe since we are using a catastrophe loading in the final rate change calculation. I'll use an all year average.

Maturities	12-24	24-36	36-48
Ldfs	1.187	1.089	1
CDF	1.2934	1.089	

AY	Non-cat reported	CDF	Trend	Projected non-cat
2013	975,000	1	$(0.99 * 1.05)^{4.25}$	1,149,499
2014	975,000	1.089	$(0.99 * 1.05)^{3.25}$	1,204,237
2015	900,000	1.2934	$(0.99 * 1.05)^{2.25}$	1,270,078
				3,023,814

I'll trend from 7/1/XX to 10/1/17.

Loss ratio = $[3,623,814 + 235 * (1420 + 1530 + 1610)] / 7,206,483 = 0.65155$

Indicated rate change = $(0.65155 * 1.07 + 0.05) / (1 - 0.22 - 0.06) = 3.77\%$

Sample 3 (Pure Premium Approach)

First Cal Prem

Ind Rate Chg = Ind Avg Prem / OL Trended Avg Prem

Ind Avg Prem = $(PP + Fixed Exp) / (1 - V - Q)$ V=22% Q=6%

CY (1)	Earned Prem (2)	OL Factor (3)	Trend (4)	Trended OL Prem (5) = (2)*(3)*(4)	Exposure (6)	OL Trended Avg Prem (7) = (5) / (6)
13	1870k	1.068	$1.02^{4.25}$	2,172,519	1420	1529.9
14	2280k	1.028	$1.02^{3.25}$	2,499,646	1530	1633.8

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

15	2404k	1.012	$1.02^{2.25}$	2,543,697	1610	1579.9
						Avg = 1581.21

$13 \text{ OLF} = (1.045 \cdot 1.025) / [(1/4 \cdot 1/2 \cdot 1/2) \cdot 1.045 + (1 - 1/4 \cdot 1/2 \cdot 1/2) \cdot 1] = 1.068$
 $14 \text{ OLF} = (1.045 \cdot 1.025) / [(1/4 \cdot 1/2 \cdot 1/2) \cdot 1 + (1 - 1/4 \cdot 1/2 \cdot 1/2) \cdot 1.045] = 1.028$
 $15 \text{ OLF} = 1.025 / (1/2 \cdot 1 + 1/2 \cdot 1.025) = 1.012$

Trend period earned premium (1.02)
 13: 7/11/13 – 10/1/17 Avg earned date → 4.25 yrs
 14: 3.25 yrs
 15: 2.25 yrs

Next Cal PP
 For non cat loses calculate LDF by using weighted avg
 12-24 = 1.187 24-36 = 1.089 36-ult = 1.0

AY (1)	Rep*CDF (2)	Exposure (3)	PP (4) = (2) / (3)	Trend (5) [[1+5%]*(1-1%)] same trend period as Earned Prem	Trended PP (6) = (4) * (5)
13	975,000	1420	686.62	1.179	809.5
14	975,000*1.089	1530	694	1.134	787.1
15	900,000*1.187*1.089	1610	723	1.091	788.85
					Avg =795.2

Total PP = (Non-Cat PP + Cat PP)*(ULAE% +1)
 = (795.2 + 235) * 1.07
 = 1102.3

Ind Avg Prem = (1102.3 + 5% * 1581.21) / (1 - V - Q)
 = 1618.3

So Ind Rate Change Factor = Ind Avg Prem / OL Trended Prem
 = 1618.3 / 1581.21
 = 1.0234

Ind Rate Change = 1.0234 – 1 = 2.34%

EXAMINER'S REPORT

Candidates were expected to demonstrate an understanding of and perform the calculation for a rate level indication.

Specifically, candidates were expected to demonstrate the following:

- Loss Development: calculate age-ultimate factors based on a non-cat loss development triangle.

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- Loss Trend: calculate the average loss date for each accident year and trend to the average accident date in the projection period.
- Total Losses: apply loss development and loss trend to the appropriate accident year reported losses to calculate trended and developed losses.
- Current Rate Level: calculate on-level factors for 3 years given two rate changes during those years, for semi-annual policies.
- Premium Trend: calculate the average earned date for each experience year and trend to the average earned date in the projection period.
- Total Premium: apply current rate level and premium trend to the appropriate experience year earned premiums to calculate the trended premium at current rate level.
- Catastrophe Load: calculate and apply a catastrophe load in the calculation of the overall indication.
- Indication: understand and calculate the formula for a rate level indication, given total losses, ULAE, cat load, total premium, expenses, and profit.

Although it contained many calculations, this question was straightforward, and candidates performed very well on this question.

Common mistakes relating to the calculation of the catastrophe load include:

- Failing to recognize the provision given was a pure premium
- Not expressing the catastrophe provision on the same basis as the non-catastrophe provision (e.g. as a loss ratio or as a pure premium)
- Not considering ULAE in the catastrophe calculation although the question stated that the given provision included only loss and ALAE

Another common mistake made was incorrectly calculating the factors to current level by assuming annual policies although the question stated that the policy term was semi-annual

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 9	
TOTAL POINT VALUE: 2	LEARNING OBJECTIVE(S): A8
SAMPLE ANSWERS	
<p><u>Sample 1</u> Expected Excess losses = 1,500,000 x 10% = 150,000 Expected deductible losses = 1,500,000 x 90% = 1,350,000 ALAE = 12% x 1,500,000 = 180,000 RM = 10% x 150,000 = 15,000 Cost of Processing deductible = 5% x 1,350,000 = 675,00 CR = 1.5% x 1,350,000 = 20,250 Premium = $\frac{150,000 + 180,000 + 75,000 + 15,000 + 67,500 + 20,250}{1 - 15\% - 3\%}$ = 619207</p>	
<p><u>Sample 2</u> Large ded premium Ind prem = $\frac{432,750 + 75,000}{1 - .15 - .03}$ = 619,207</p>	
<p><u>Sample 3</u> Legal = 1.5M (.12) = 180,000 Risk = 1.5M (.10)*(.10) = 15,000 proc < ded = 1.5(.9)(.05) = 67,500 1.5(.9)(.015) = 20,250 Losses itself = 1.5(.10) = 150,000 Z = 432,750 $\frac{1500000 [0.1 + 0.12 + 0.05 \times 0.90 + 0.015 \times 0.9 + 0.10 \times 0.10] + 75000}{1 - 0.03 - 0.15}$ = $\frac{507750}{1 - 0.18}$ = \$619207</p>	
<p><u>Sample 4</u> Deductible = \$750,000 LER = 0.90 Excess losses + includes risk margin ALAE cost of processing & credit risk Large deductible premium = $\frac{1500,000(.10)(1.10) + 1500000(.12) + 1500000(.9)(.065) + 75000}{1 - 0.03 - 0.15}$ = \$619,207.32</p>	
EXAMINER'S REPORT	
Candidates were expected to choose the correct loss elimination ratio from the table given and use it along with the other information given to calculate the large deductible premium.	

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Candidates performed very well on this question. The calculation was straightforward, and based on an example directly from the Werner & Modlin text.

Common mistakes included:

- Forgetting to include all components in the final formula, most commonly fixed expenses
- Not using the correct loss elimination ratio, or using some average of all the loss elimination ratios
- Assuming “deductible payments” referred to the per occurrence deductible of \$750,000
- Using the expected losses below the Loss Elimination Ratio in the final equation
- Applying the credit risk in the denominator

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 10								
TOTAL POINT VALUE: 2.5					LEARNING OBJECTIVE(S): A8			
SAMPLE ANSWERS								
Part a: 2 points								
<i>Sample 1</i>								
Class	Loss Ratio	Proposed Rel Change	Indicated Rel	Cred	Cred Wtd Ind Rel	Cred Wtd Ind Rel Rebased	Ind Change	Total Change
A	76.7%	1.020	1.0200	100.0%	1.020	1.000	0.0%	2.13%
B	71.9%	0.956	1.0516	88.2%	1.057	1.036	-5.8%	-3.80%
C	79.0%	1.051	1.8920	48.1%	1.844	1.808	0.4%	2.59%
Total	75.2%						-2.09%	
<i>Sample 2</i>								
Class	Loss Ratio	Loss Ratio Rel	Cred	Cred Wtd Rel	Adjusted Ind Rel	Cred Wtd Ind Rel Rebased	Indicated Rate Change	
A	76.7%	1.020	100.0%	1.020	1.020	1.021	2.1%	
B	71.9%	0.956	88.2%	0.961	1.057	0.962	-3.8%	
C	79.0%	1.051	48.1%	1.025	1.844	1.026	2.6%	
Total	75.2%				0.999			
<i>Sample 3</i>								
Class	Loss Ratio	Indicated Change	Z	Cred Wtd Change	New Rel	New Rel Rebased	Rel Change	Total Rate Change
A	76.7%	1.020	100.0%	1.020	1.020	1.000	1.000	1.021
B	71.9%	0.956	88.2%	0.961	1.057	1.036	0.942	0.962
C	79.0%	1.051	48.1%	1.025	1.845	1.809	1.005	1.026
Total	75.2%						0.979	
Off-Balance factor = $1/0.979 = 1.021$								
Part b: 0.5 point								
<ul style="list-style-type: none"> • To account for the exposure correlations between variables • To provide diagnostic statistics to evaluate the model and variables • Multivariate ratemaking provides the ability to investigate possible interactions between many different rating variables • Multivariate ratemaking attempts to focus on the “signal” of each variable and ignore the “noise” component • Considers all variables simultaneously and accounts for correlation among variables • It accounts for response correlation between rating variables 								

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EXAMINER'S REPORT

Candidates were expected to calculate a revenue-neutral rate change, followed by a discussion of the benefits of multivariate classification ratemaking.

This question was relatively straightforward, and candidates performed well.

Part a

Candidates were expected to calculate rating differentials for classification relativities using no change as the complement of credibility. Candidates needed to calculate an off-balance and apply that to the indicated relativity change to make the change revenue-neutral.

Common mistakes included:

- Credibility weighting the indicated change with the current relativity
- Calculating the normalized current relativity and credibility weighting with the non-normalized indicated relativity
- Rebasing the indicated change prior to credibility weighting
- Not applying the correct revenue-neutral off-balance factor

Part b

Candidates were expected to demonstrate an understanding of the benefits of multivariate methods.

The most common error made by candidates was providing a response regarding the reasons multivariate methods are adopted, which includes reductions in adverse selection and enhanced fairness within rating variables.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 11	
TOTAL POINT VALUE: 1.75	LEARNING OBJECTIVE(S): A8
SAMPLE ANSWERS	
Part a: 1 point	
<p><u>Sample 1</u></p> $\text{LAS}(100,000) = [14,000 + 3,000 + 3,000 + (50 + 40 + 10)(100)] * 1000 / (210 + 90 + 100) = 75,000$ $\text{LAS}(150,000 \text{ ex. } 100,000) = [9,000,000 + 7,000,000 - (50 + 40)(100,000) + 150,000(10)] / (50 + 40 + 10) = 85,000$ $\text{Pr}(X > 100,000) = (50 + 40 + 10) / (90 + 100) = .526$ $\text{LAS}(250,000) = 75,000 + .526(85,000) = 119,737$ $\text{ILF} = 119,737 / 75,000 = 1.60$	
<p><u>Sample 2</u></p> $(14,000,000 + 3,000,000 + 50 * 100,000 + 3,000,000 + 50 * 100,000) / (210 + 90 + 100) = 75,000$ $[9,000,000 - 50 * 100,000 + 7,000,000 - 40 * 100,000 + 10 * (250,000 - 100,000)] / 190 = 44,737$ $\text{ILF} = (75,000 + 44,737) / 75,000 = 1.5965$	
Part b: 0.25 point	
<ul style="list-style-type: none"> • The trend would have a greater impact in the excess layers because losses already at limit would get the full trend in the excess and those just under would be pushed into the excess layer. Since the excess would be increasing faster than the basic, the ILF would increase. • The factor given in part (A) will be too low because excess loss trend is greater than the trend for losses confined to the basic limit. • The increased limits factor would increase since the excess trend will be larger than the ground up trend. • The ILF estimate would increase in future years due to the leveraged effect of the severity trend on higher limit losses. • B/L Trend < Ground Up < XS Trend LAS(250K) will increase more than LAS(100K) due to the trend properties listed above and thus the ILF will increase. 	
Part c: 0.5 point	
<p><u>Sample 1</u></p> <p>Utilize lower limits analysis since we know the losses capped at 100,000 for all policies and it is the most stable given the small volume of data for all policies. It does however have a lower logical relationship to the losses between 250 and 500</p> $= \text{losses capped at } 100 * (1.9 - 1.5) / 1.00$ $= 30,000,000 * (1.9 - 1.5) / 1.00$ $= 12,000,000$	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Sample 2

Losses capped at 250,000 = $[3,000 + 9,000 + 3,000 + 7,000 + 10(250)] * 1,000 = 24,500,000$
 $24,500,000 [(1.9 - 1.5) / 1.5] = 6,533,333$

EXAMINER'S REPORT

Candidates were expected to calculate an increased limits factor using censored data, as well as demonstrate an understanding of how trend impacts excess layers and how to incorporate industry data.

Parts a. and b. of this question were relatively straightforward, while part c. was challenging. Some candidates performed well on this question, while others struggled to fully answer the question or complete the calculations.

Part a

Candidates were expected to calculate an increased limits factor using censored data. This included calculating limited average severities for \$100k and estimating the LAS for \$250k by calculating the average claim size within the \$100k to \$250k layer and adding to the calculated LAS(\$100k)

Common mistakes included:

- Using the shortcut for calculating the LAS (\$250k) and then applying the probability of a claim being greater than \$100k. This essentially double counted the probability.
- Using capped losses instead of Limited Average Severities
- Including claim counts from policies with \$100K policy limits when estimating the average size of claims in the \$100-\$250k layer.
- Calculating the LAS(\$250k) from all policy limits similar to the calculation for LAS(\$100k)

Part b

Candidates were required to understand the impact of trend on excess layers and explain that due to leveraged trend, ILF would increase over time.

Common mistakes included:

- Commenting on impact of trend, but failing to indicate how the ILF would change.
- Stating that the ILF would increase more than 10% (this is not true)
- Indicating there would be no change to the LAS(100K)
- Noting that the ILF would increase without discussing why.

Part c

Candidates were required to estimate a complement of credibility for the layer \$250k x/s \$250k. This involves generating a ratio from the industry ILFs for the layer and applying to capped losses from the experience.

The text states that for Increased Limits analysis, the actuary uses this "method when data is available for ground-up losses through the attachment point (i.e. losses have not been truncated at any point below the bottom of the excess layer being priced)." This would suggest that data from policy limits of \$250k and \$500k could be used for this method.

For Lower Limits analysis, data from all policy limits should be used for the above reasons.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

The question did not explicitly state the expected method to use, which proved challenging for candidates.

Common mistakes included:

- Calculation of the capped losses from experience
 - Using LAS instead of total capped losses.
 - Using \$100k policy limits experience for Increased Limits analysis to estimate capped losses at \$250k.
 - Using just the losses from the corresponding policy limit.
 - Using the size of the layer or attachment point (\$250k or \$100k)
- Attempting to use the Limits Analysis method of calculating the complement of credibility. There was not enough information given in the question to use this method.
- Attempting to estimate the ILF from the experience (similar to part a.).
- Estimating a Decreased Limits Factor (attachment point of \$500k). The question specifically asked for an ILF complement.
- Estimating the complement for the layer $\$250k \times /s \$500k$.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 12	
TOTAL POINT VALUE: 2.5	LEARNING OBJECTIVE(S): A9
SAMPLE ANSWERS	
Part a: 1.75 points	
<p><u>Sample 1</u> Current Average Building Type rating factor = $[(1)(300)+(1.15)(500)+(1.2)(100)]/900=1.1056$ Proposed Average Building Type rating factor = $[(1)300+(1.15)(500)+(1.4)100]/900=1.1278$ Current Average discount factor = $1 - [(0)(50)+(.1)(150)+(.15)(700)]/900=.8667$ Proposed Average discount factor = $1 - [(0)(50)+(.05)(150)+(.1)(700)]/900=.9139$ Current Average Premium = $100*1.1056*.8667 + 20 = \\115.82 Proposed Average Premium = $100*1.1278*.9134 + 20 = \\123.07 Change to Average Premium = $123.07/115.82 - 1 = .063$ 6.3% Increase</p> <p><u>Sample 2</u> Average Current Factor = $995/900 * 780/900 = 0.958$ Average Proposed Factor = $1015/900 * 822.5/900 = 1.031$ $1-[100*0.958+20]/[100*1.031+20] = 0.063$ 6.3% increase</p> <p><u>Sample 3</u> Building Overall Change = $[300(1)+500(1.15)+100(1.4)]/[300(1)+500(1.15)+100(1.2)] = 1.02$ Claim History Factor Overall Change = $[50(1)+150(.95)+700(.9)]/[50(1)+150(.9)+700(.85)] = 1.0545$ New = $100*1.0756 + 20 = \\$127.56$ Old = $100 + 20 = \\$120$ Change $\\$127.56/\\$120 = 1.063$ Increase 6.3%</p> <p><u>Sample 4</u> $100(300+1.15(500)+1.2(300))=99500$ Avg. discount = $50(0)+150(.1)+700(.15) = .133$ Current premium = $99500*(1-.133) = 86266.5$ $100(300+1.15(500)+1.4(300))=101500$ Avg. discount = $50(0)+150(.05)+700(.1) = .086$ Current premium = $99500*(1-.086) = 92771$ $[92771+20*900]/[86266.5+20*900] - 1 = .062$ 6.2% Increase</p>	
Part b: 0.25 point	
<ul style="list-style-type: none"> • The calculation above does not take into account the exposure correlation between the two variables. • A shortcoming is estimating the average relativity change for both variables – it wouldn't be as accurate as rerating each exposure and comparing new actual prem. vs. old prem. • Does not take into effect that client base may change as result of rate change. Distribution likely not identical for future. • Does not consider variable interaction • Assumes independence of building type and discount. • It doesn't account for distributional bias by variable. 	
Part c: 0.5 point	
<ul style="list-style-type: none"> • Lower Expenses (ex: lay off employees) 	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

- Market to risks with better loss experience
- Underwriting guidelines can be strengthened to limit exposure to worse performing segments
- Insurer could require insureds to fulfill certain loss mitigating practices such as safety seminars/training.
- Restrict coverage – i.e. require higher deductibles without changing rates.
- Adopt a more aggressive investment strategy to increase investment income.

EXAMINER'S REPORT

Candidates were expected to calculate the change in average premium given multiple inputs, and describe the shortcoming to this approach. Candidates were also expected to identify how to impact rates through two non-pricing solutions.

This question was relatively straightforward and candidates performed well.

Part a

Candidates were expected to calculate the current premium and proposed premium given two variables, a base rate and a fixed expense fee in order to calculate the change in average premium.

Common mistakes included:

- Missing the \$20 fixed expense fee, or subtracting it instead of adding it.
- Making the expense fee adjustment twice by calculating premiums for each rating plan
- Calculating discount separately without the consideration of the other rating plan.
- Using 0 weighting instead of 50 for the 1.0 claim discount factor.
- Using 1,000 as the denominator in the weighted average

Part b

Candidates were expected to know how using exposure weighted distribution of each variable to get average factor may lead to less than accurate result.

Many responses related to the two variables not being independent, that extension of exposures would be more accurate and that future distribution may not be identical to current.

Part c

Candidates were expected to name two non-pricing actions that would improve profitability and thus address inadequate rates.

Common mistakes included:

- Naming a pricing action
- Naming only one action
- Proposing that the insurer exit the entire market.
- Proposing that the insurer skim the cream (without briefly explaining what is meant by this)
- Naming a vague or incomplete solution such as "Adjust Marketing" or "Change U/W"

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 13

TOTAL POINT VALUE: 3

LEARNING OBJECTIVE(S): A8

SAMPLE ANSWERS

Part a: 2.25 points

Sample 1

Territory	Indemnity Loss	LDF	Trend	Trended Ult Indemnity
A	2,000,000	2.5	1.03 ^{2.5}	5,383,480
B	3,000,000	2.5	1.03 ^{2.5}	8,075,219
C	4,000,000	2.5	1.03 ^{2.5}	10,766,959

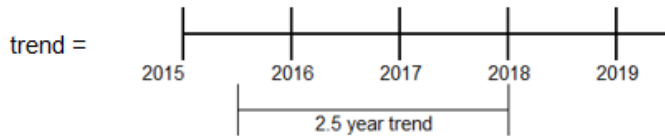
Trend from 7/1/2015 to 1/1/2018

Territory	Medical Loss	LDF	Trend	Trended Ult Indemnity
A	2,000,000	1.5	1.06 ^{2.5}	3,470,451
B	500,000	1.5	1.06 ^{2.5}	867,613
C	1,000,000	1.5	1.06 ^{2.5}	1,735,226

Territory	Total Losses	Exposures	PP	Ind Rel	Rebased
A	8,853,931	2500	3541.57	1.227	1.275
B	8,942,832	3500	2555.09	0.885	0.919
C	12,502,185	4500	2778.26	0.963	1.000
Total			2885.61		

Sample 2

A	2	2.5	1.03 ^{2.5}	2	1.5	1.06 ^{2.5}
B	3	2.5	1.03 ^{2.5}	0.5	1.5	1.06 ^{2.5}
C	4	2.5	1.03 ^{2.5}	1	1.5	1.06 ^{2.5}



	Ult Indemnity + Medical		Pure Prem
A	5.383 + 3.47	2500	3,541.2
B	8.075 + 0.868	3500	2,555.14
C	10.767 + 1.735	4500	2,778.22

Relativities (Rebased)	
A	1.275
B	0.920
C	1.000

Part b: 0.75 point

Sample 1

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Terr	Curr Rel	Ind Rel
A	1.2	1.275
B	0.9	0.919
C	1.0	1.0
	1.0143	1.0385

Exposure Weighted

Off-Balance Factor = $(1.0143 / 1.0385) = 0.977$

Terr	% Change
A	$(1.275 / 1.2) * .977 - 1.0 = .0377$
B	$(.919 / .9) * .977 - 1.0 = -.0024$
C	$(1.0 / 1.0) * .977 - 1.0 = -.023$

Sample 2

Terr	Exp	Curr Rel	Ind Rel
A	2500	1.2	1.275
B	3500	0.9	0.919
C	4500	1.0	1.0

Off Balance Factor = $\frac{1.275(2500) + .919(3500) + 1(4500)}{1.2(2500) + .9(3500) + 1(4500)} = \frac{10904}{10650} = 1.0238$

Terr	% Change
A	$(1.275 / 1.2) / 1.0238 - 1.0 = .0377$
B	$(.919 / .9) / 1.0238 - 1.0 = -.0024$
C	$(1.0 / 1.0) / 1.0238 - 1.0 = -.023$

Sample 3

Terr	Curr Rel	Normalized Current Rel	Ind Rel	Normalized Indicated Rel	% Change
A	1.2	1.183	1.275	1.228	$1.228 / 1.183 - 1.0 = .038$
B	0.9	0.887	0.919	0.885	$.885 / .887 - 1.0 = -.002$
C	1.0	0.986	1.0	0.963	$.963 / .986 - 1.0 = -.023$
	1.0143		1.0385		

Sample 4

Terr	Exposures	Current PP Relativity	Current Premium	Indicated PP Relativity	Indicated Premium
A	2,500	1.20	3,000	1.275	3,188
B	3,500	0.90	3,150	0.920	3,220
C	4,500	1.00	4,500	1.000	4,500
			10,650		10,908

Terr	Current Premium	Indicated Premium	Indicated Change	Rebalanced
A	3,000	3,188	6.3%	3.7%
B	3,150	3,220	2.2%	-0.2%
C	4,500	4,500	0.0%	-2.4%
	10650	10907.5	2.4%	0.0%

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Sample 5

Terr	Curr Rel	Ind Rel
A	1.2	1.275
B	0.9	0.919
C	1.0	1.0
	1.0143	1.0385

Exposure Weighted

Off-Balance Factor = $(1.0143 / 1.0385) = 0.977$

Terr	% Change
A	$(1.275 / 1.2) - 1.0 = .0625$
B	$(.919 / .9) - 1.0 = .0211$
C	$(1.0 / 1.0) - 1.0 = 0$

Base rate should be multiplied by 0.977 to result in no overall premium change

EXAMINER'S REPORT

Part a. of this question required candidates to calculate indicated relativities to the base territory given the empirical data as ratios of the trended ultimate pure premium for each territory over the base territory. This part was challenging due to the fact that candidates needed to treat each line of business separately in trending and developing before combining to determine pure premiums for Workers Compensation in total.

Part b. of this question required candidates to calculate the percent change by territory. Since the problem states that no overall premium change is desired, candidates were expected to recognize the need to re-balance the indicated relativities in order to offset any changes to the base rate due to changes in relativities. This part was challenging, requiring candidates to recognize the need for an off-balance factor, and calculate the off-balance factor correctly.

Overall, candidates performed well on this question despite the challenges.

Part a

Candidates were expected to know how to trend losses, calculate the appropriate trend period, and develop losses to ultimate – treating Indemnity and Medical losses separately.

Candidates were expected to calculate indicated pure premium relativities for each territory and then rebase to Territory C.

Common mistakes included:

- Calculating the wrong trend period
- Not rebasing indicated relativities to Territory C
- Not trending and developing losses
- Calculating indicated relativities as ratios of ultimate loss, rather than pure premium

Part b

Candidates were expected to calculate the percentage change in relativities by territory that would result in no overall premium change.

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Common mistakes included:

- Not calculating an off-balance factor, and simply calculating percentage changes for each territory

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QUESTION 14				
TOTAL POINT VALUE: 1.75			LEARNING OBJECTIVE(S): B3	
SAMPLE ANSWERS				
Part a: 0.75 point				
<u>Sample 1</u>				
AY	12 - 24	24 - 36	36 - 48	
2012	1.118	2.053	1.256	
2013	3.143	1.5		
2014	1.778			
Take all year weighted average for stability				
	1.939	1.667	1.256	
AY2015 Ultimate Claims = $1000 * 1.939 * 1.667 * 1.256 = 4059.79$				
<u>Sample 2</u>				
AY	12 - 24	24 - 36	36 - 48	
2012	$950/850=1.1176$	2.0526	1.2564	
2013	3.1429	1.5		
2014	1.7778			
There doesn't seem to be a pattern, and the losses are pretty volatile So I will select a straight average.				
Selection:	2.0128	1.7763	1.2564	
CDF:	4.4921	2.2317	1.2564	
$1000000 * 4.4921 = 4,492,053$				
<u>Sample 3</u>				
AY	12 - 24	24 - 36	36 - 48	
2012	1.118	2.053	1.256	
2013	3.143	1.5		
2014	1.778			
From LDFs, we can see company may suffer large losses in 2013 which distort payment pattern. I decide to use the latest year as selected LDFs to avoid the higher leveraged CDF.				
Selection:	1.778	1.5	1.256	1
CDF:	3.35	1.884	1.256	1
AY2015 company ultimate claims = $1000 * 3.35 = 3,350$				

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Sample 4

First need to calculate ATA factors for company data

AY	12 - 24	24 - 36	36 - 48
2012	1.1176 = 950/850	2.0526 = 1950/950	1.2564 = 2450/1950
2013	3.1429	1.5	
2014	1.7778		

These ATA factors are pretty inconsistent

12-24 --> exclude AY2013 and take average of other two Ays because AY2013 seems too high --> 1.4477

24-36 --> average both years because hard to tell if one is irrelevant --> 1.7763

36-48 --> 1.2564

So, 2015 Ultimate paid claim = (1M) (1.2564) (1.7763) (1.4477) = 3,230,977.61

Sample 5

Company paid link ratios

AY	12 - 24	24 - 36	36 - 48
2012	1.118	2.053	1.256
2013	3.143	1.5	
2014	1.778		

I would ignore 2012 12-24 ATA factor, because it looks like an outlier.

There seems to be change in the settlement rate in 2014

Selecting averages of other factors

Selection:	2.461	1.7765	1.256	
CDF:	5.491	2.231	1.256	1

2015 AY Ultimate Claims = 5.491 * 1000000 = 5,491,189.924

Sample 6

AY	12 - 24	24 - 36	36 - 48
2012	1.11	2.05	1.26
2013	3.14	1.5	
2014	1.77		

Selection: 1.44 2.05 1.26

Selected all-year average excluding AY2013, since it seems like an anomalous year.

Wanted as many years as possible for stability though. Assume high 2.05 factor is normal at 24-36

2015 AY Ultimate Claims = 1000 (1.44) (2.05) (1.26) = 3720

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Sample 7

AY	12 - 24	24 - 36	36 - 48
2012	1.1176	2.0526	1.2564
2013	3.1429	1.5	
2014	1.7778		
Selection:	1.4477	1.5	1.2564

Seems to be a jump in paid claims in CY2014. I will exclude the 3.1429 and 2.0526 from averages
 2015 AY Ultimate Claims = 1000000 (1.4477) (1.5) (1.2564) = 2,728,335

Part b: 0.5 point

Sample 1

Select all year avg of industry ATA as each period is pretty stable and to include as much data as possible.

12 - 24	24 - 36	36 - 48
2.01	1.255	1.1

AY2015 Ultimate Claims = 1000 * 2.01 * 1.255 * 1.1 = 2774.81

Sample 2

For 12-24, I use two year average as it seems to have increased and stabilized at 2.03
 I used simple average for 24-36 --> 1.255

AY2015 Ultimate Claims = 1000 * 2.03 * 1.255 * 1.1 = 2802.42

Sample 3

Slight increase in ATA factors from 2012 to 2013 that continuing to 2014 in 12-24 factor.
 I will thus select the latest diagonal assuming a major legal change in the industry.

Ultimate AY2015 Claims = 1000*2.03*1.27*1.1*1 = 2835.91

Part c: 0.5 point

- I would recommend using 2775 based on industry data. The company data is too volatile to be given any credibility. The large fluctuations in LDFs could be due to large losses and thus don't give good indications of what is to come.
- I would use industry CDFs estimate of 2774.81 because the company ATAs are very volatile and at early maturity (@12 month) you are subject to highly leveraged CDF.
- Since the ATA factors for company data are really volatile and seem biased by large losses, I would recommend using the estimate in part (b) only based on the payment pattern of the industry, which is more stable.
- Recommend average of these two estimates (3941.3) because takes the company development patterns into consideration, but supplements with industry data to help smooth out potential noise in company development.
- Company ATA factors seem volatile. So industry development factors may be more appropriate. However, company has high volume of claims, so I recommend using company's factors. Industry data combines experience of companies with different mix

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of business, UW strategies, and business strategies. Company own experience reflects solely company's tactics. Recommend: 3,230,895 for AY2015 ultimate claims.
EXAMINER'S REPORT
Candidates were expected to apply the loss development method to the same dataset using both company-specific and industry development patterns. Using the results of this analysis, candidates were expected to recommend an ultimate claim estimate, providing support for their recommendation.
This question was straightforward, and candidates performed very well.
Part a
Candidates were expected to calculate and select age-to-age LDFs and use them to determine ultimate development factors to derive an estimate of ultimate claims for AY 2015.
Part b
Candidates were expected to evaluate age-to-age LDFs and use them to determine ultimate development factors to derive an estimate of ultimate claims for AY 2015.
Part c
Candidates were expected to evaluate estimates of AY 2015 ultimate claims, make a recommended estimate of ultimate claims, and justify their recommendation. Candidates were expected to make an explicit recommendation of AY 2015 ultimate claims, and provide reasonable support for the selection.
Common mistakes included: <ul style="list-style-type: none">• Not providing a specific estimate of AY 2015 ultimate claims, but rather naming a vague approach or process that could be taken to estimate ultimate claims• Failing to justify the selected estimate• Providing a justification which did not articulate proper support for the recommendation

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QUESTION 15	
TOTAL POINT VALUE: 1.5	LEARNING OBJECTIVE(S): B1
SAMPLE ANSWERS	
Part a: 0.5 point	
Calendar Year 2013: 10,000 Calendar Year 2014: 13,000 (10,500+(12,500-10,000)) Calendar Year 2015: 14,870 (11,000+(13,120-10,500)+(13,750-12,500))	
Part b: 0.25 point	
<ul style="list-style-type: none"> • Due to its fixed nature, calendar year aggregation does not facilitate estimation of unpaid claims. Few techniques exist that employ calendar year aggregation. • Inappropriate – Because the claim losses at the end of the calendar year is fixed and there is no development. There is no estimation on IBNR. • CY aggregation is not appropriate because losses are fixed at the end of the year, so it can be difficult to account for future development. • It's not appropriate. Since CY claim data will not develop. 	
Part c: 0.25 point	
<ul style="list-style-type: none"> • Accident year aggregation is commonly used, and many acceptable techniques exist for the actuary to use in unpaid claim estimation. Therefore, the use of accident year aggregation appears appropriate. • Appropriate since it is common in the industry with benchmarks. • Accident year is more appropriate since claims still develop after year end and provides a better match of premium to losses than calendar year. • AY provides a better match to premium than CY as it allows development beyond a single year. Also, using AY can allow the actuary to isolate AY's with large claims and then proper adjustments can be made. Appropriate for auto. 	
Part d: 0.5 point	
<ul style="list-style-type: none"> • PA age to age 12-24 1.25; 24-36 1.1 CA age to age 12-24 2 ; 24-36 1.25 Not appropriate. CA has much different development pattern, and CA is growing much faster than PA • Development pattern for commercial auto is longer and it is growing at a faster rate than personal auto. This will distort development patterns and create inaccurate results. The lines should not be combined. • It may appear reasonable because both lines are auto coverages and a lack of credibility might suggest a combination is appropriate. • PA LDF 12-24 1.25; 24-36 1.1 CA LDF 12-24 2 ; 24-36 1.25 There is enough data in both lines of business to be credible, so I wouldn't combine them together since their development patterns are not very similar. • I would not combine the two lines. Although the commercial auto could benefit from having more data, the development patterns are clearly different and could cause distortions, especially if the mix of business continues to change. 	

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EXAMINER'S REPORT
<p>Candidates were expected to calculate calendar year losses from a loss triangle. Candidates were also expected to understand the differences between calendar year and accident year organization of data, as well as homogeneity and credibility of data for estimating unpaid claims.</p> <p>This question was straightforward, and candidates performed well.</p>
<p>Part a</p> <p>Candidates were expected to calculate three years of calendar year losses from a loss triangle</p> <p>Common mistakes included:</p> <ul style="list-style-type: none">• Calculating accident year ultimate losses• Calculating calendar year losses as if the triangles were incremental
<p>Part b</p> <p>Candidates were expected understand appropriate and inappropriate usage of calendar year data.</p> <p>Common mistakes included:</p> <ul style="list-style-type: none">• Defining calendar year data without addressing the appropriateness of using it to estimate unpaid claims
<p>Part c</p> <p>Candidates were expected understand appropriate and inappropriate usage of accident year data.</p> <p>Common mistakes included:</p> <ul style="list-style-type: none">• Defining accident year data without addressing the appropriateness of using it to estimate unpaid claims
<p>Part d</p> <p>Candidates were expected to know when it is appropriate or not appropriate to combine two lines of insurance when estimating unpaid claims. Candidates were expected to observe that the development patterns and growth rates between the two lines were different, or note that credibility could be an issue.</p> <p>Common mistakes included:</p> <ul style="list-style-type: none">• Calculating the development factors without making any observation about the difference in the patterns• Recognizing that the development factors were different, but not addressing how this would impact the lines if they were combined to estimate unpaid claims

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QUESTION 16					
TOTAL POINT VALUE: 2.25			LEARNING OBJECTIVE(S): B3		
SAMPLE ANSWERS					
Part a: 0.75 point					
Case Outstanding = reported – paid = 350 – 150 = 200					
IBNR Using the Expected Claims Technique = Ultimate – Reported = 700*.65 – 350 = 105					
Total Unpaid Claim Estimate using the Expected Claims Technique = Ultimate – Paid = 700*.65 – 305 = 305 or = case outstanding + IBNR = 200 + 105 = 305					
Part b: 1 point					
AY	Cumulative Paid	Ult Paid Technique	CDF	Implied LDF	New CDF
12	600	720	1.2 = 720/600	1.2	1.2
13	500	625	1.25 = 625/500	1.0417 (corrected)	1.68
14			2.0	1.6	2.688
15	150	563 = 150*3.75	3.75	1.875	5.04
Ultimate claims AY 2015 = 5.04 * 150 = 756					
Part c: 0.5 point					
AY 2015 ultimate losses = .65*700*(1-1/5.04) {expected unpaid claims} + 150 {paid losses} = 514.72					
EXAMINER'S REPORT					
Candidates were expected to understand various methods of estimating ultimate losses and understand the derivation of age-age and age-ultimate factors.					
This question was relatively straightforward, focusing on two basic reserving techniques, and candidates performed very well on this question.					
Part a					
Candidates were expected to know the definition of case outstanding, IBNR and unpaid as well as the expected claims technique. Candidates were expected to calculate the three numbers (case outstanding, IBNR and unpaid).					
Common errors were related to incorrect application of the expected claims technique.					
Part b					
Candidates were expected to understand the calculation of development factors, both age-to-age and age-to-ultimate. Candidates were expected to calculate various development factors and subsequently calculate a revised ultimate loss using a corrected age-to-age factor.					
Common mistakes included:					
<ul style="list-style-type: none"> • Replacing a different age-to-age factor than the 36-to-48 month factor • Substituting the 1.4 as an age-to-ultimate factor, instead of an age-to-age factor. 					
Part c					
Candidates were expected to calculate ultimate losses using the paid B-F technique and the LDF calculated in part b.					

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Common mistakes included:

- Using the reported loss instead of the paid loss

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QUESTION 17																																									
TOTAL POINT VALUE: 2	LEARNING OBJECTIVE(S): B3																																								
SAMPLE ANSWERS																																									
Part a: 1.5 points																																									
<p><u>Sample 1</u></p> <p>2015 unpaid: @ 12m = $c/o = 7000 - 3000 = 4000$ @ 24m = $c/o = 4000 * 0.5 = 2000$ @ 36m = $c/o = 0$</p> <p>Paid claim: @ 12m = 3000 @ 24m = $2 * 4000$ @ 36m = $3.5 * 2000$</p> <p>Total unpaid: $2 * 4000 + 3.5 * 2000 = 15000$</p>																																									
<p><u>Sample 2</u></p> <table border="0"> <tr> <td></td> <td align="center" colspan="3">Case Outstanding</td> <td></td> <td align="center" colspan="3">Paid Claims</td> </tr> <tr> <td></td> <td align="center">12</td> <td align="center">24</td> <td align="center">36</td> <td align="center"> </td> <td align="center">24</td> <td align="center">36</td> <td align="center">48</td> </tr> <tr> <td>13</td> <td align="center">-</td> <td align="center">-</td> <td align="center">0</td> <td align="center"> </td> <td align="center">-</td> <td align="center">-</td> <td align="center">-</td> </tr> <tr> <td>14</td> <td align="center">-</td> <td align="center">2000</td> <td align="center">0</td> <td align="center"> </td> <td align="center">-</td> <td align="center">-</td> <td align="center">-</td> </tr> <tr> <td>15</td> <td align="center">4000</td> <td align="center">$4k * .5 = 2000$</td> <td align="center">0</td> <td align="center"> </td> <td align="center">$4000 * 2 = 8000$</td> <td align="center">7000</td> <td></td> </tr> </table> <p>Unpaid 2015 Claims = $8K + 7k = 15,000$</p>			Case Outstanding				Paid Claims				12	24	36		24	36	48	13	-	-	0		-	-	-	14	-	2000	0		-	-	-	15	4000	$4k * .5 = 2000$	0		$4000 * 2 = 8000$	7000	
	Case Outstanding				Paid Claims																																				
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13	-	-	0		-	-	-																																		
14	-	2000	0		-	-	-																																		
15	4000	$4k * .5 = 2000$	0		$4000 * 2 = 8000$	7000																																			
<p><u>Sample 3</u></p> <p>AY 2015 unpaid claims = $4000000 * 2 + 2000000 * 3.5 = \\$ 15000000$</p>																																									
<p><u>Sample 4</u></p> <table border="0"> <tr> <td></td> <td align="center">Age:</td> <td align="center">12</td> <td align="center">24</td> <td align="center">36</td> <td align="center">48</td> </tr> <tr> <td>AY 2015 case outstanding:</td> <td></td> <td align="center">4000</td> <td align="center">2000</td> <td align="center">0</td> <td align="center">0</td> </tr> <tr> <td>AY 2015 incremental paid:</td> <td></td> <td align="center">3000</td> <td align="center">8000</td> <td align="center">7000</td> <td align="center">0</td> </tr> </table> <p>AY 2015 unpaid = $8000 + 7000 = 15000$</p>			Age:	12	24	36	48	AY 2015 case outstanding:		4000	2000	0	0	AY 2015 incremental paid:		3000	8000	7000	0																						
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AY 2015 case outstanding:		4000	2000	0	0																																				
AY 2015 incremental paid:		3000	8000	7000	0																																				
Part b: 0.5 point																																									
<ul style="list-style-type: none"> • Method only valid for report year analysis or where most or all claims are reported in the first accident period. The reported claim development factor is 2.0 means that all losses are not reported in the first accident period thus the method is not valid. • Accident year 2015 has significant pure IBNR thus method is not appropriate. • Accident year 2015 has significant number of unreported claims thus method is not appropriate. • Accident year 2015 claim development factor highly leveraged thus method is not appropriate. 																																									
EXAMINER'S REPORT																																									
<p>Candidates were expected to know how to use the case outstanding development technique to calculate unpaid losses and when the method is not valid.</p> <p>Part a. of the question was straightforward and candidates scored very well on this part.</p>																																									

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part b. was more challenging, requiring candidates to identify that there was significant pure IBNR on the year, making the proposed method inappropriate. Many candidates did not make this connection and scored poorly on this part.

Part a

Candidates were expected to know how to apply the case outstanding development technique to calculate unpaid losses.

Specifically, candidates were required to calculate the case outstanding at 12 months (given the reported and paid), as well as at 24 and 36 months using the case outstanding to previous case outstanding factors from the table. Secondly, candidates were expected to calculate the paid at 12 to 24 months and the paid from 24 to 36 months using the incremental paid claims to previous case outstanding factors from the table to the case outstanding calculated above. Lastly, candidates were expected to add the projected future paid amounts to arrive at a total unpaid at 12 months.

Common mistakes included:

- Correctly calculating the case outstanding at one or more evaluations, but incorrectly calculating the unpaid amounts.
- Including the 3,000 paid at 12 months to calculate unpaid claims. This amount has already been paid and should be excluded from the unpaid claim estimate.

Part b

Candidates were expected to recognize when the case outstanding development technique is not appropriate.

Specifically, candidates were expected to recognize that AY 2015 has significant claim count (pure IBNR) development based on a claim count development factor of 2.0. Candidates were then expected to recall that the case o/s method is only suitable for projecting case o/s development on reported claims, and does not work well when there is pure IBNR.

Common mistakes included:

- Suggesting an alternate method to the case o/s method, without addressing why the case o/s method was inappropriate
- Observing that the claim count development factor of 2.0 was leveraged, but not tying this to why the case o/s method would not work well.
- Stating that there was not enough historical data to use the method.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 18	
TOTAL POINT VALUE: 2	LEARNING OBJECTIVE(S): B3, B5
SAMPLE ANSWERS	
Part a: 0.5 point	
<u>Sample Responses for "Similarity"</u>	
<ul style="list-style-type: none"> • Both use a credibility weighted average of the development technique and an expected claims technique. • Both use an ELR to determine IBNR • Both a credibility weighted average of the expected claims method and the chain ladder method. • Both have the same formula for computing the ultimate claims estimate = Actual Reported + Expected Ultimate x % Unreported • Both methods assume that past data tells you nothing about loss development or IBNR going forward. They assume that IBNR is better determined based off an expected claim technique. 	
<u>Sample Responses for "Difference"</u>	
<ul style="list-style-type: none"> • CC calculates ELR based on actual reported and OL earned premium. BF takes ELR using an a priori estimate • The calculation of the ELR is different. The BF method uses an a priori estimate whereas the CC method uses ratio of reported claims to used up premium. • The ELR in the BF method can be judgmentally selected from industry or pricing data while the ELR in the CC method is calculated using historical data. • The ELR in the BF method is an a priori estimate while the CC uses the past data to calculate the ELR • The process to determine the ELR is different. BF uses an a priori estimate whereas the CC method calculates the ELR based on historical data. 	
Part b: 0.5 point	
<ul style="list-style-type: none"> • Need to trend losses for any severity/frequency trend. Remove shock losses from data and apply a large loss load • Tort Reforms; Loss Trend • Benefit changes; Loss Trend • Loss Trend; For the CC technique, if there has been a change in claims payment pattern or case reserve philosophy, the paid/incurred losses need to be adjusted to match the development patterns used to calculate the "used up" premium. 	
Part c: 0.5 point	
<ul style="list-style-type: none"> • Need to on-level premiums for any rate changes. Need to trend premiums to current level. • Adjust for historical rate changes; Adjust for premium trend • On-Level premiums to current rate level. For the CC method, you also need to calculate "used up" premium by multiplying OL premium by the % reported. 	
Part d: 0.5 point	
<ul style="list-style-type: none"> • Assumption: Court decision ruling will only affect 2014 As such, BF would be more appropriate since I will calculate ELR on an a priori estimate, 	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

- The CC technique. It would be more responsive to changes in payments.
- Depends on if the court decision was related to a particular claim only or if it's expected to impact claims going forward. If it only applies to a single claim in 2014, BF technique would be preferred since the ELR won't be impacted by this large claim. If we expect the court decision to impact claims going forward, the CC method is preferable because it is more responsive.
- The CC technique would be more appropriate if the ELR used in the BF method was not adjusted for the court decision. The ELR in the CC method is more responsive.
- The BF method is preferred because the ELR can be selected to reflect the new claims environment. Unless adjustments are made to historical data, CC will underestimate the ELR as majority of historical years do not reflect new claims environment after the court ruling.
- I would recommend the BF technique if adjustments are made to the ELR to account for the new claims environment.

EXAMINER'S REPORT

Candidates were expected to know the fundamental differences behind the CC and BF methods, namely that the CC technique will automatically react to changing claims environment while the BF method will not automatically react.

Candidates performed very well on this question. The question was a fairly straightforward comparison of two different claims estimation techniques. Candidates were able to fully describe the differences between the CC and BF methods including non-superficial adjustments needed to premium and losses to make the historical data representative of the claims environment applicable to a certain accident year.

Part a

Candidates were expected to know that the BF and CC method are similar in that both techniques credibility-weight the development technique and the expected claims technique based on the % reported / % paid. Candidates were expected to discuss the differences in how the ELR is determined for both methods.

Common errors included:

- Stating that both methods determined the ultimate claim estimate from the expected claim technique. Candidates needed to state that both techniques determined the IBNR or unpaid estimate from the expected claims technique.
- Stating that the only difference between the two methods is that CC considers the current year while BF does not. Candidates were expected to clarify that since the CC method uses historical data directly, it would automatically respond to a changing claims environment if the current accident year was included in the analysis. The BF method can have its ELR adjusted as needed to reflect emerging experience, and as such, the BF method can be altered to account for the current accident year.

Part b

Candidates were expected to know that the historical losses underlying the ELR in the BF and CC technique should be comparable to the losses expected in the year for which the ultimate claims estimate is being calculated, and how to adjust the historical losses to achieve this.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Common errors included:

- Proposing adjustments for “one time changes” or for “continuous changes” without giving an example, such as benefit level changes or trend.
- Discussing adjustments to the data supporting the loss development pattern selected in an external study without also discussing how similar adjustments should be made to the historical experience used directly in the method as well.
- Stating “losses should be brought to current level” without explicitly stating what adjustments should be considered.

Part c

Candidates were expected to know that the historical premium underlying the ELR in the BF and CC technique should be comparable to the premium expected in the year for which the ultimate claims estimate is being calculated, and how to adjust the earned premium to achieve this.

Common errors included:

- Stating “premium should be brought to current level” without explicating stating what adjustments should be considered.
- Proposing adjustments for “one time changes” or for “continuous changes” without giving an example, such as rate level changes or trend.

Part d

Candidates were expected to identify that accident year 2014 would have markedly different experience, and translate that finding into an appropriate recommendation based on how the candidate believed the claims environment would act going forward.

Candidates did not need to agree on how the court decision would apply going forward as long as the method selected was appropriate for the assumption made. Potential answers included:

- This spike was an anomaly (i.e. the court case will not apply going forward). Therefore, the BF technique with an unadjusted ELR is appropriate.
- The court case is expected to apply going forward. Therefore, the BF technique with an adjusted ELR is appropriate.
- The court case is expected to apply going forward. Therefore, the CC technique is appropriate since it is more responsive than the BF technique.

Common errors included:

- Stating a method without discussing why the method was appropriate.
- Stating a method and giving an incorrect or incomplete explanation of why it was appropriate.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 19	
TOTAL POINT VALUE: 2	LEARNING OBJECTIVE(S): B3, B5
SAMPLE ANSWERS	
Part a: 0.5 point	
<ul style="list-style-type: none"> • It is appropriate because the freq & sev may change over time and using freq-sev can help for diagnosis of trending changes • Appropriate. Select Frequency and Severity based on the long-term trend is possible using FS method. • Yes, as it mitigates very-leveraged and uncertain development factors, particularly for immature years. 	
Part b: 0.5 point	
<ul style="list-style-type: none"> • It's not suitable for significant reopen claims for the sev is calculated based on closed claims payments. Claim count definition need to be consistent. • Not Appropriate. Not clear definition of claim count ==> hard to estimate frequency • If the claim count is defined clearly and objectively (re. reopened claims are not new claims) then it may be appropriate. However, they must be defined appropriately. Otherwise, not appropriate. 	
Part c: 0.5 point	
<ul style="list-style-type: none"> • Yes. It's appropriate. One can apply this new trend to restate the sev in the past exposure period. One can use B-F adjustments. • The freq-sev technique can be appropriate if we adjust our incremental severity selections to account for the recent increase in severity. Assuming consistent claim count development, we can use the same freq for all years and judgmentally select incremental severities to reflect the recent increase for recent years with the disposal rate technique. • Not appropriate, F-S technique require a stable mix of types of claims which isn't satisfied here w/ new bigger claims. 	
Part d: 0.5 point	
<ul style="list-style-type: none"> • Changes in reserve adequacy does not impact the paid claims development. If paid claim sev-freq is used, it's appropriate. If reported sev-freq is used then the ult estimation may be distorted if not adjusted properly. (B-F for example can be used for adjustment.) • F-S is valuable when there are changes in case reserve. The 3rd method of F-S doesn't require case reserve data, thus it is independent of case reserving philosophy • Changes in case reserves philosophy will not affect the incremental paid severities or the development of closed claim counts so the freq-sev disposal rate method will be appropriate. • Appropriate: can use pd data only which won't be impacted by case philosophy chgs 	
EXAMINER'S REPORT	
<p>Candidates were expected to know the assumptions of the frequency-severity techniques, when the techniques work and when they don't.</p> <p>This question was challenging, and few candidates scored well on all four parts.</p>	
Part a	
<p>Candidates were expected to know that the frequency-severity techniques are especially useful for long tailed lines, where the development methods do not produce reliable indications for the most recent years.</p>	

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Common mistakes included:

- Stating that F-S techniques are useful for long-tailed lines, but not explaining why.
- Stating that F-S techniques cannot be used for long-tailed lines due to highly-leveraged development factors.

Part b

Candidates were expected to know the underlying assumption of the F-S methods regarding claim counts.

Common mistakes included:

- Incomplete explanations
- Stating that reopened claims could distort the frequency and/or severity calculation, but not explaining why.

Part c

Candidates were expected to know that the F-S methods assume a stable mix of claims and/or that the methods have the flexibility to allow for adjustment for higher severity claims.

Common mistakes included:

- Incomplete explanations, such as stating that an adjustment should be made but not describing what that adjustment would be.

Part d

Candidate were expected to know that there are several methods to applying the F-S technique, which do not necessarily rely upon case reserve levels remaining consistent.

Common mistakes included:

- Stating that a change in case reserve adequacy would impact reported losses and/or not impact paid losses, but failing to demonstrate understanding that F-S techniques may use either paid or reported losses.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 20				
TOTAL POINT VALUE: 2.5			LEARNING OBJECTIVE(S): B5	
SAMPLE ANSWERS				
	<u>Adjusted closed claim counts</u>			
	12	24	36	48
2012	3,504	4,292	4,336	4,380
2013	3,677	4,504	4,550	
2014	3,563	4,365		
2015	3,607			
Sample Calculations:				
$3,504 = 0.8 * 4,380$				
$3,677 = 0.8 * 4,596$				
<u>Construct the Cumulative Adjusted Paid Claims Triangle:</u>				
The latest diagonal is unadjusted				
Age 12 uses the parameters of age 24, and Age 24 uses parameters of age 36 (interpolation)				
Age 36 uses the parameters of age 36 (extrapolation)				
	<u>Cumulative adjusted paid claims</u>			
	12	24	36	48
2012	8,751	14,719	15,785	16,484
2013	10,110	15,606	16,824	
2014	8,730	13,928		
2015	9,113			
Age-to-Age	1.604	1.075	1.044	1.000
Age-to-Ult	1.800	1.122	1.044	1.000
Sample Calculations:				
$8,751 = 1,069 * \exp(0.00060 * 3,504)$				
$15,785 = 16 * \exp(0.00159 * 4,336)$				
<u>Ultimate:</u>				
Ultimate = $9,113 * 1.8 = 16,403$				
EXAMINER'S REPORT				
Candidates were expected to:				
<ul style="list-style-type: none"> • Derive a triangle of adjusted closed claims, using the selected disposal rates provided • Derive a triangle of cumulative adjusted paid claims, using the appropriate parameters for each age • Derive LDFs from the adjusted triangle and use these to calculate the ultimate 				
Although this question was based directly on an example in the Friedland text, candidates performed poorly on this question. Many candidates chose not to attempt this question.				
Common mistakes included:				

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

- Ignoring the selected disposal rates provided in the question and deriving historical disposal rates
- Adjusting the final diagonal, which should not have been modified
- Using incorrect parameters to calculate the adjusted paid triangle
- Not selecting a weighted average for the LDFs, as instructed

A large portion of candidate responses did not show any work or equations for the adjusted paid triangle. Candidates are reminded that the instructions to the exam indicate that calculations should be shown where necessary in order to maximize partial credit.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 21				
TOTAL POINT VALUE: 1.75			LEARNING OBJECTIVE(S): B2, B4, B5	
SAMPLE ANSWERS				
Part a: 1.25 points				
<u>Diagnostic #1</u>				
Paid to Reported				
	12	24	36	
2013	.917	.92	1	.917 = 5500 / 6000
2014	.889	.887		
2015	.867			
OR				
Reported to Paid				
	12	24	36	
2013	1.09	1.09	1	
2014	1.13	1.13		
2015	1.15			
OR				
Case to Reported				
	12	24	36	
2013	.08	.08	0	
2014	.11	.11		
2015	.13			
<u>Diagnostic #2</u>				
Average O/S				
	12	24	36	
2013	20	33.33	0	20 = 500 / 25
2014	20	46.67		
2015	36.67			
- Paid to reported ratios have been decreasing which suggests an increase in case reserve adequacy				
- the latest diagonal of average o/s are much higher than in the past which indicates a reserve adequacy increase				
Part b: 0.5 point				
<ul style="list-style-type: none"> • Since it appears there has been an increase in case reserve adequacy, we can use the reported Berquist-Sherman technique which adjusts prior diagonals for current levels of O/S adequacy and will lead to a reasonable estimate. 				

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

- Use Berquist Sherman case O/S adjustment to restate previous years case o/s to current level so that LDFs will not be distorted and you can get a better estimate of ultimate. When case o/s adequacy is strengthened, unadjusted development methods will overstate LDFs & the ultimate.
- Since reported methods would be distorted by the change in case reserve adequacy, we suggest using the paid development method if paid development and settlement rates are consistent.
- An appropriate technique would be to use the expected claims technique. This is unaffected by operational changes like changes in reserve adequacy or settlement rates, and as such will give an appropriate estimate of ultimate claims

EXAMINER'S REPORT

This question required candidates to calculate two diagnostic triangles, and use those triangles to determine if there had been any changes in case reserve adequacy. Candidates were then expected to identify a reserving technique that would be appropriate to estimate unpaid claims based on their observations regarding case reserve adequacy.

This question was fairly straightforward, and candidates performed well.

Part a

Candidates were expected to identify and calculate two valid diagnostic triangles from the data given that would give the actuary an indication of whether or not there had been a change in case reserve adequacy. Candidates were then expected to interpret the results of the diagnostics to determine whether or not case adequacy had actually changed.

Common mistakes included:

- Only calculating one diagnostic triangle
- Calculating a triangle that is not a diagnostic (e.g., total case reserves, cumulative development factors)
- Calculating what may have been a valid diagnostic without the appropriate data.
 - Reported severity should be reported claims divided by reported claim counts, not reported claims divided by open claim counts
 - Paid severity should be paid claims divided by paid claim counts or closed claim counts, not paid claims divided by open claims.
 - Incremental closed claims cannot be calculated by taking the incremental diagonals from the open claim count triangle because this does not account for newly reported claims.
- Addressing only one diagnostic in the assessment of case reserve adequacy
- Not providing an assessment of the diagnostics
- Not addressing how the diagnostics indicated whether or not there was a change in adequacy.
- Simply stating that there was/was not a change in adequacy without tying the assessment to what was seen in the diagnostics.

Part b

Candidates were expected to identify a technique that would not be affected by the case reserve strengthening observed in part a. and include a justification of why this technique would not be distorted by the strengthening.

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Common mistakes included:

- Simply stating a technique
- Identifying a technique without justifying why it would not be distorted by the change in adequacy identified in part a.
- Identifying a technique that would not address the change in adequacy identified in part a.
- Confusing accident year and calendar year when discussing how the case reserves are restated in the Berquist Sherman adjustment.

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QUESTION 22																
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVE(S): B5, B7															
SAMPLE ANSWERS																
Part a: 1 point																
<p><u>Sample 1</u> Selected ALAE LDF's based on steady state Select Expected ALAE = 2,700 / 2 = 1,350 Perform BF on ALAE, this will precisely reflect the change</p> <table border="0"> <tr> <td></td> <td>12-24</td> <td>24-36</td> <td>36-48</td> <td>48-60</td> </tr> <tr> <td>Incr</td> <td>3.00</td> <td>1.50</td> <td>1.20</td> <td>1.00</td> </tr> <tr> <td>Cum</td> <td>5.40</td> <td>1.80</td> <td>1.20</td> <td>1.00</td> </tr> </table> <p>Unpaid ALAE 2011 = 0 2012 = 0 2013 = $(1 - 1 / 1.2) \times 1,350 = 225$ 2014 = $(1 - 1 / 1.8) \times 1,350 = 600$ 2015 = $(1 - 1 / 5.4) \times 1,350 = 1,100$ Total = 1,925</p> <p><u>Sample 2</u> Assuming historical payments are consistent but future payments -50% 2012: 0 2013: 225 2014: 225 + 375 = 600 2015: 225 + 375 + 500 = 1,100 Total = 1,925</p> <p><u>Sample 3</u> Adjust paid alae to pre-change levels (adding in 50% on amount of most recent incremental payment). Use historical factors, then adjust ultimate for the change. 2011 and 2012 are @ ult 2013: $(1,875 + 375) \times 1.2 = 2,700$ 2014: $(1,000 + 500) \times 1.5 \times 1.2 = 2,700$ 2015: $(250 + 250) \times 3.0 \times 1.5 \times 1.2 = 2,700$</p> <p>2013: $(2,700 - 2,250) / 2 = 225$ 2014: $(2,700 - 1,500) / 2 = 600$ 2015: $(2,700 - 1,500) / 2 = 1,110$ Total = 1,925</p>			12-24	24-36	36-48	48-60	Incr	3.00	1.50	1.20	1.00	Cum	5.40	1.80	1.20	1.00
	12-24	24-36	36-48	48-60												
Incr	3.00	1.50	1.20	1.00												
Cum	5.40	1.80	1.20	1.00												
Part b: 0.5 point																
<p><u>Sample 1</u> Ratio of Paid ULAE to Paid Claims 2011 0.120</p>																

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

2012 0.120
 2013 0.120
 2014 0.120 = 3,240 / 27,000
 2015 0.156 = 4,212 / 27,000
 Select 0.156 since this reflects the change
 Unpaid ULAE = 0.156 (0.5 x 21,000 + 5,000) = 2,418

Sample 2

Ratio of Paid ULAE to Paid Claims & ALAE
 2011 0.109
 2012 0.109
 2013 0.109
 2014 0.109 = 3,240 / (27,000 + 2,700)
 2015 0.149 = 4,212 / (27,000 + 2,700)
 Select 0.149 since this reflects the change
 Unpaid ULAE = 0.149 (0.5 x 21,000 + 5,000) = 2,303

Sample 3

Restate historical ULAE to be 30% higher

Year	ULAE	ULAE Ratio
2011	4,214 (= 3,240 x 1.3)	0.156 (=4,214 / 27,000)
2012	4,214	0.156
2013	4,214	0.156
2014	4,214	0.156
2015	4,214	0.156

Unpaid ULAE = 0.156 x (0.5 x 21,000 + 5,000) = 2,418

Part c: 0.75 point

- The estimate above also assumes ULAE is sustained 50% open and 50% when closed. However since we change in 2015 to move later ALAE development to ULAE, the 50/50 assumption isn't reasonable going forward. Therefore our estimate of 2,418 unpaid ULAE is too low.
- Prior to change, the classical method seems reasonable, but the 30% increase with the change will occur on the use of the legal department which occurs through the life of the claim. The 50% of ULAE at the beginning of the claim assumption of the classical will not be reasonable. The estimate in b is biased and more weight should be on the case O/S, so the estimate of unpaid is understated

EXAMINER'S REPORT

This question required candidates to estimate ALAE and ULAE in a changing expense environment, and assess the reasonability of the resulting estimates.

This question was very challenging. Candidates scored poorly on this question, with many choosing not to attempt the question.

Part a

EXAM 5 SPRING 2016 SAMPLE ANSWERS AND EXAMINER'S REPORT

Candidates were expected to recognize the change in development pattern is due to the change in the handling of legal expenses and then determine the unpaid ALAE using an approach that properly adjusts for the change going forward.

Common mistakes included:

- Pursuing an approach that does not properly adjust for the change. The two most common inappropriate approaches were applying the development technique using an all year average of the LDFs or using solely the most recent diagonal.
 - Using an all year average LDF is not appropriate as it ignores the change in ALAE going forward.
 - Using only the latest diagonal is not appropriate as it fails to distinguish the difference between a calendar year change and an accident year impact. For example, the development technique relates unpaid ALAE to paid ALAE, however in this example the unpaid ALAE will be under the new claims process while the cumulative paid ALAE is a blend of the old process and the new process (other than AY 2015). This results in LDFs that are biased low as the denominator is overstated due to it including ALAE from the old process. This is evident when looking at the 2015 ultimate ALAE from the development technique using only the latest diagonal of LDF's; the ultimate is much lower than 50% of prior years before the change.
 - A proper approach is one that does not relate unpaid ALAE to paid ALAE. Examples of this include BF methods (where unpaid is independent of paid to date), or incremental paid ALAE. With these approaches, the actuary simply needs to adjust the expected future amounts by 50% relative to historical amounts. Using ratios of paid ALAE to paid loss are also appropriate in these approaches.
- Using calendar year ALAE and multiplying those amounts by accident year development factors
- Only adjusting accident year 2015 for the change (failing to recognize the calendar year impact on all accident years)
- Calculating unpaid ALAE for accident year 2015 only

Part b

Candidates were expected to use the classical technique for unpaid ULAE and select a ULAE ratio that reflects the new change going forward.

Common mistakes included:

- Selecting a ULAE to Loss ratio that averaged multiple years, which fails to properly adjust for the change going forward
- Failing to apply the ratio to only half of the case reserves
- Applying the ratio to half of the IBNR

Part c

Candidates were expected to recognize that the change in process would result in more ULAE being recognized after the claim is reported. This can be reasoned from the source of the additional ULAE (legal expenses) or from the development factors given (paid ALAE factors are higher than paid loss factors and some of the ALAE is shifted to ULAE). Given that prior to the change, the 50/50 assumption held, this means that the 50/50 will no longer hold and more ULAE will occur after the claim has been reported. Therefore, the estimate in part b., which uses the

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50/50 assumption, will not be reasonable. It is understated because more than 50% of the ratio should be applied to case reserves when calculating unpaid ULAE.

Common mistakes included:

- Simply stating that the 50/50 assumption was a key part of the classical technique, and thus the answer was reasonable. This failed to recognize that part b. assumed that the 50/50 assumption was valid prior to the change, but that the reserve estimate in part b. is calculating future ULAE amounts after the change.
- Stating that the estimate in part b. wasn't reasonable and that the Kittel method would improve it. This is incorrect as the Kittel method does not properly adjust for this situation. The Kittel method adjusts the ratio of paid ULAE to paid loss by incorporating reported losses in the calculation (in addition to paid losses). In this example, the insurer had perfectly stable loss development. Therefore, paid losses will equal incurred losses, and the ULAE to loss ratio would be the same for both techniques. The part of the classical technique that needs to be adjusted in this scenario is the percent of ULAE paid when claims are reported. The Kittel and classical techniques both share the same assumption regarding the percentage of ULAE paid when claims are reported, so the Kittel method does not appropriately adjust for the change.

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QUESTION 23				
TOTAL POINT VALUE: 2.75			LEARNING OBJECTIVE(S): B7	
SAMPLE ANSWERS				
Part a: 2.25 points				
<u>Additive Approach</u>				
paid alae to paid claims				
	6	18	30	42
12	.05	.08	.11	.12
13	.05	.08	.11	
14	.05	.08		
15	.05			
additive ldfs				
	6-18	18-30	30-42	42-Ult
Sel = stgt avg	.03	.03	.01	0
paid claim ldfs				
	6-18	18-30	30-42	42-ult
12	1.25	1.05	1.01	
13	1.25	1.05		
14	1.25			
Sel	1.25	1.05	1.01	1
cdf	1.326	1.0605	1.01	1
	(1)	(2)	(1) x (2) = (3)	(4) = (3) – paid to dt.
AY	Ult claims	Ult ALAE ratio	Ult ALAE	Unpaid ALAE
12	4,573	.12	549	0
13	4,200 (1.01) = 4,242	.12	509	47
14	4,181 (1.0605) = 4,434	.12	532	197
15	2,950 (1.326) = 3,911	.12	469	321
				565
<u>Multiplicative Approach</u>				
ALAE / pd Ratio				
AY	6	18	30	42
12	.05	.08	.11	.12
13	.05	.08	.11	
14	.05	.08		
15	.05			
ALAE/pd ratio ldfs				
AY	6-18	18-30	30-42	42-ult
12	1.6	1.375	1.09	1
13	1.6	1.375		

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14	1.6			
Sel	1.6	1.375	1.09	1
CDF	2.398	1.499	1.09	1

paid claim ldfs

AY	6-18	18-30	30-42	42-ult
12	1.25	1.05	1.01	1
13	1.25	1.05		
14	1.25			
Sel	1.25	1.05	1.01	1
cdf	1.326	1.061	1.01	1

AY	Ult ALAE Unpaid
12	$4,573 (1) \times (.12 \times 1) - 549 = 0$
13	$4,200 (1.01) \times (.11 \times 1.09) - 462 = 46,616$
14	$4,181 (1.061) \times (.08 \times 1.499) - 335 = 196,970$
15	$2,950 (1.326) \times (.05 \times 2.398) - 149 = 320,013$
	563,599

Part b: 0.5 point

Sample Responses for "Advantage"

- During this change, we can recognize the inherent relationship between paid ALAE and paid claims.
- Ratio can be judgmentally selected if calculated ratio doesn't seem appropriate.
- The development factors of paid ALAE to paid losses are less leveraged than the factors for paid ALAE.

Sample Responses for "Disadvantage"

- This mix of business change might bring with it claims that have low indemnity amounts but substantial ALAE, which would probably render this method unreliable.
- If the mix of business change causes ult claims estimate to be inaccurate → estimated ult ALAE will also be inaccurate as it is a function of this estimate.
- If the new mix of business does not maintain a similar ALAE to Paid ratio it could distort projections.
- If the mix of business increases settlement rate then we will be over-projecting ultimate claims and ultimate ALAE.

EXAMINER'S REPORT

Candidates were expected to estimate unpaid ALAE, and assess how the proposed technique would work in a changing environment.

This question was straightforward in that candidates were expected to perform basic calculations and understand the strengths / weaknesses of a single method. Candidates performed well on this question.

Part a

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Candidates were expected to know how to use the development technique and apply the ratio technique for ALAE / Paid Claims. Two ratio development methods were acceptable – the additive approach and the multiplicative approach.

Common mistakes included:

- Not developing paid claims to ultimate
- Stopping after calculating ultimate ALAE (rather than calculating unpaid ALAE)
- Only calculating one accident year instead of all years

Part b

Candidates were expected to know an advantage and disadvantage of the paid ALAE / paid claim ratio method when there is a shift in the mix of business.

Common mistakes included:

- Providing two disadvantages or two advantages (rather than one of each)

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QUESTION 24				
TOTAL POINT VALUE: 3			LEARNING OBJECTIVE(S): B8	
SAMPLE ANSWERS				
Part a: 1.5 points				
<u>AY</u>	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-Ult</u>
2011	1.44	1.12	1.03	
2012	1.40	1.11		
2013	1.50			
All year avg.	1.45	1.12	1.03	1.00
Age-to-ult.	1.66	1.15	1.03	1.00
	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>
<u>AY</u>	<u>IBNR</u>	<u>Age-to-Ult @ 12/31/2014</u>	<u>Age-to-Ult @ 12/31/2015</u>	<u>2015 Expected Emergence</u>
2011	0	1.00	1.00	0
2012	1000-780=220	1.03	1.00	220.00
2013	1050-750=300	1.15	1.03	238.43
2014	1200-700=500	1.66	1.15	337.26
Total				795.69
$\% \text{ Reported} = \frac{1}{\text{Age-to-Ult}}$ $(4) = \text{IBNR} \times \frac{\% \text{ Reported } 2014 - \% \text{ Reported } 2015}{1 - \% \text{ Reported } 2015}$				
	<u>(5)</u>	<u>(6)</u>	<u>(7)</u>	
<u>AY</u>	<u>Actual Emergence</u>	<u>Expected Emergence</u>	<u>Difference</u>	
2011	0	0.00	0	
2012	950-780=170	220.00	-50	
2013	900-750=150	238.43	-88	
2014	950-700=250	337.26	-87	
Total			-226	
<p>In all the years, actual emergence came in below expected emergence. The total difference between them for 2011-2014 is expected is 226 higher than actual emergence in CY 2015.</p>				
Part b: 1.5 points				
<p>i. The reported development technique would reduce unpaid claims because it will apply the development factors to the lower-than-expected actual reported claims amount as of 12/31/2015.</p> <p>ii. The Bornhuetter-Ferguson technique will leave unpaid claims unchanged since it continues to project future claims according to the a priori expected claims ratio.</p> <p>iii. The expected claims technique will increase the unpaid claims because it assumes that the ultimate claims will not change. If actual emergence is low, then it just means actual emergence will be higher in future periods.</p>				
EXAMINER'S REPORT				

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This was a challenging question that tasks candidates with a topic that is of great concern to regulators and public policymakers. The actuary has a duty to ensure the financial soundness of the various entities that relies upon his work. When estimated claims deviate from actual, additional analysis is required.

Candidates performed very poorly on this question.

Part a

Candidates were expected to know either the formula or understand how to derive it. Intuitively, the formula takes the ratio of the percent of claims expected to be reported (i.e., emerge) in the upcoming calendar year divided by the percent of claims expected to reported in all future calendar years.

The question provided 3 elements of data:

- A development triangle of reported claims (in dollars)
- A column labeled "Selected Ultimate claims"
- A column labeled "Reported Claims (\$)" as of December 31, 2015"

A common mistake was to divide the reported claims in the latest diagonal with the "Selected Ultimate Claims" and use this as the percent reported. The question does not provide any detail on how these "Selected Ultimate Claims" values are derived, so there is no indication that dividing the latest diagonal by them will provide a meaningful number. This would only be true if the ultimate claims were selected based on the reported claim development method, which was not indicated in the question. Additionally, a simple division like this would use only each individual accident year in calculating its own percent reported. This approach results in far less credibility in the estimation as all the data off the diagonal is ignored. On the other hand, Friedland's example of this scenario uses the reported development technique to calculate age-to-age factors and age-to-ultimate factors, which in turn are used to determine the percent reported values.

In this context, "Selected Ultimate Claims" can be used only as a pre-conceived expected ultimate or a priori ultimate, used only for the calculation of IBNR and an a priori complement to credibility.

Other common mistakes included:

- Comparing the IBNR to amount reported in 2015.
- Using CY 2015 in the calculation of the expected reported.
- Using the inverse of the age-to-age factor, not the inverse of the age-to-ultimate factor.
- Incorrectly calculating IBNR (e.g., subtracted the amount reported in 2015 as the total IBNR)
- Calculating the percent of IBNR to emerge (e.g., subtracting the 2015 reported from the 2014 reported, but not dividing by percent unreported).
- Neglecting to compare actual and expected

Part b

Candidates were expected not only to identify actuarial methods, but also to evaluate if the method would produce the desired result. Candidates were required to state whether actual

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development or expected development was higher, state a valid method for each sub-part, and provide a valid justification.

For part i., when, as in the problem, expected emergence is higher than actual, favorable development is occurring. Candidates were expected to identify a technique where the historical pattern of favorable development is used. The paid or reported development technique are ideal answers. These techniques do not use any complement of credibility or expected amount—100% of the historical data is used in the estimation of the unpaid amounts. As the current emergence is lower than expected, this will result in lower than expected future emergence, thus, lower than expected unpaid claims.

For part ii., the ideal method is the Bornhuetter-Ferguson method. The key property with Bornhuetter-Ferguson is that it provides weight to both the historical pattern and an expected ultimate. When the percent reported is used as the weight—as is typical—this results in the unpaid amount being the same regardless of the reporting pattern.

For part iii., candidates were expected to identify a technique where unpaid amounts would be higher given the amount already reported. The Expected Claims Technique is the ideal answer as it presumes that any development deviation will be undone and the claims will ultimately settle for the expected amount.

Part a. of this question provided a reported development pattern and part b. asked for a recommendation to adjust unpaid claims. However, the intention of part a. was identify whether emergence was more or less than expected. Many candidates implicitly assumed that the lower-than-expected reported emergence translated to lower-than-expected paid emergence. Candidates working under a different assumption who answered appropriately given their stated assumption were also awarded credit.

Some candidates attempted to name a technique that would result in all three scenarios, rather than one technique for each scenario.

Part b. specifically asks for a reserving technique. Reserving techniques are items such as Paid/Reported Development, Expected Claims Method, Bornhuetter-Ferguson, Cape Cod, Berquist-Sherman, etc. Many candidates responded with proposed adjustments to data rather than reserving techniques, with responses such as, “adjust the expected ultimate downward” or “assume that a large loss remains unpaid.” These responses are incorrect as they do not propose and support the proposal of a reserving technique.

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QUESTION 25	
TOTAL POINT VALUE: 2	LEARNING OBJECTIVE(S): B8
SAMPLE ANSWERS	
Part a: 1 point	
<ul style="list-style-type: none"> • Since the paid and reported development techniques are larger than the case outstanding and both BF techniques, combined with the case outstanding, BF paid and BF reported methods being in line with each other, I would estimate that a large paid loss has impacted the paid and reported development techniques. I would select the Paid BF method which will capture the large paid losses, but not be influenced by it for calculating the unpaid portion. • It is possible that there exists changes in LR. In this case, the LR is increasing and the EC would understate the ultimate claims (development gives correct ultimate claims estimate). BF, which is the credibility weighted Dev and EC, will give understated ultimate claims. Therefore, I will use reported development (3,400) as selection. • There could have been an increase in case reserve adequacy coupled with an increase in settlement rates, causing both the reported and paid development method to be inflated because they are applying historical LDFS to higher reported/paid at early maturities. I would suggest using one of the BF methods, as they will bring more stability to the estimates (relying more on unbiased EC) and are both similar. 	
Part b: 1 point	
<ul style="list-style-type: none"> • A large reported (unpaid) claim would explain the differences. With a large unpaid claim, the reported development estimate would be high because the large reported amount multiplied by LDF that assumes lower level or reported claims. I recommend the reported BF estimate of 3,000 because it includes the large unpaid claim, but the large unpaid claim does not impact estimate of IBNR. • Since reported, case outstanding, and BF reported are all larger than the paid methods, there must be an increase in case reserve adequacy. I would choose either the paid development or paid BF method (both close together) since it is not impacted by a change in case reserve adequacy. • There could be a slowdown in settlement rates. This will cause the paid development technique to underestimate the true IBNR because it will apply historical LDFs to lower levels of paid losses at early maturities. To remedy this, I would recommend using either the reported development or reported BF techniques, as reported data is not affected by changes in settlement rates. 	
EXAMINER'S REPORT	
<p>Candidates were expected to be able to diagnose a potential change in underlying loss data from the results of various methods of unpaid claims analysis. From here, candidates were expected to select an analysis method or methods that react appropriately to the change, and briefly explain why they made that selection.</p> <p>The question was relatively straightforward, though it required some reasoning to diagnose a cause from its effects. Candidates generally performed well on this question.</p>	
Part a	
<p>Candidates were expected to observe the discrepancy between the results of both development methods when compared to the results of both Bornhuetter-Ferguson methods, with</p>	

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development showing higher results. Candidates were expected to propose a scenario that would cause similar discrepancies (development higher than B-F) for both paid and reported data, select the method(s) that were less distorted by the scenario selected, and provide a supporting statement for their selection.

Common mistakes included:

- Selecting settlement rate or case adequacy changes, which would explain the discrepancy on either the paid data or the reported data but not both.
- Selecting an estimate that was distorted by the selected scenario rather than one that reacts appropriately (e.g. selecting Bornhuetter-Ferguson results in the face of a deteriorating loss ratio).
- Not making a selection or not supporting the selection.

Part b

Candidates were expected to observe the discrepancy between the results of methods that rely on case reserves and those that rely only on paid data, with all methods that rely on case reserves showing higher results. Candidates were expected to propose a scenario that would have caused this discrepancy, selected the method(s) that were less distorted by the scenario selected, and provide a supporting statement for their selection.

Common mistakes included:

- Selecting estimates that were distorted by the selected scenario rather than one that reacts appropriately (e.g. selected reported development in the face of increased case reserve adequacy).
- Not making a selection or not supporting the selection.