SOCIETY OF ACTUARIES
Introduction to Ratemaking & Reserving

Exam GIIRR

AFTERNOON SESSION

Date: Wednesday, April 25, 2018
Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 8 questions numbered 12 through 19 for a total of 40 points. The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIIRR.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

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****BEGINNING OF EXAMINATION****
Afternoon Session
Beginning with Question 12

12. (*4 points*)

(a) (*0.5 points*) Define retrospective rating.

(b) (*1 point*) Explain how a retrospectively-rated policy works.

(c) (*0.5 points*) Describe a benefit of retrospective experience rating.

You are a consulting actuary for a client who is considering retrospective rating for its experience rating plan. The client's experience rating plan has the following characteristics:

- The claim experience is worse than industry average claim experience but has been very stable.
- The line of business is characterized by high frequency with average severity.

(d) (*2 points*) Evaluate whether or not you would recommend this client for retrospective rating.

13. (*5 points*) You are the reserving actuary for a homeowners book of business. Although business volume and mix have remained stable, there have been changes involving key staff in the claims department in recent years, and some functions have been automated or outsourced.

(a) (*0.5 points*) Recommend one method to project ultimate claims for this book. Justify your recommendation.

(b) (*1.5 points*) Describe the steps involved in adjusting data for changes in case reserve adequacy.

(c) (*1.5 points*) Describe the steps involved in adjusting data for changes in claim settlement rate.

You are provided with the following claims data by development month:

Accident Year	Case Estimates (000)			
	12	**24**	**36**	**48**
2014	321	182	152	131
2015	277	190	143	
2016	310	186		
2017	316			

Accident Year	Average Case Estimates			
	12	**24**	**36**	**48**
2014	3,690	7,280	16,890	21,830
2015	2,800	9,500	20,430	
2016	4,310	12,400		
2017	4,790			

- The annual frequency trend is 2%.
- The annual severity trend is 3%.

(d) (*1.5 points*) Assess whether or not there has been a change in the overall adequacy of case estimates.

14. (*5 points*) You are given the following aggregated industry information for a line of business:

Indemnity Range	Counts in Interval	Indemnity
0 – 500	3,100	1,147,000
501 – 1,000	2,300	1,610,000
1,001 – 2,000	2,100	2,982,000
2,001 – unlimited	3,500	15,300,000
Total	**11,000**	**21,039,000**

The base deductible is 500.

(a) (*2 points*) Calculate the indicated deductible factor for a deductible of 1,000.

(b) (*2 points*) Recommend a factor for a deductible of 1,500. Justify your recommendation.

(c) (*1 point*) Describe two challenges in using industry data for your company's deductible analysis.

15. (*7 points*) You are estimating ultimate claims and unpaid claims for an auto insurance product using the frequency-severity closure method.

You are given the following information:

Accident Year	Earned Exposure	Projected Ultimate Counts from Development Method	Incremental Closed Counts			
			12	24	36	48
2014	55,000	1,507	910	305	230	62
2015	56,000	1,500	905	300	225	
2016	57,100	1,465	890	295		
2017	58,000	1,435	870			

Accident Year	Paid Claims to Date (000)	Incremental Paid Severity on Closed Counts			
		12	24	36	48
2014	21,290	9,000	18,000	25,000	30,000
2015	17,877	8,400	17,000	23,000	
2016	12,965	8,700	17,700		
2017	7,830	9,000			

- The annual frequency trend is –3%.
- The annual claim severity trend in a stable environment is 4%.
- Tort reform resulted in an estimated claim severity decrease of 10% for all accidents that occur on or after January 1, 2015.

(a) (*1 point*) Calculate the indicated ultimate frequency at the 2017 cost level using a simple average of accident years 2014 to 2017.

(b) (*0.5 points*) Calculate the selected ultimate counts for accident years 2014 to 2017 using the indicated ultimate frequency from part (a).

(c) (*1 point*) Calculate the proportion of closed counts at 24 months maturity using a simple average of accident years 2014 to 2016 and the selected ultimate counts from part (b).

15. Continued

(d) (*1 point*) Calculate the incremental paid severity at the 2017 cost level for the 12 and 24 month maturities using a weighted average of all accident years.

You are also given the following information for your frequency-severity closure method analysis:

	36	**48**
Selected proportion of closed counts	0.79	1.00
Selected incremental paid severity at 2017 cost level	25,000	30,000

(e) (*2 points*) Calculate the ultimate claims for accident years 2015 to 2017.

(f) (*0.5 points*) Calculate the unpaid claims for accident years 2015 to 2017.

At the end of year 2018, you are performing an actual versus expected analysis, and the table below has been populated with actual results for the accident years 2015 to 2017.

Accident Year	**Actual versus Expected Paid Claims on Closed Counts from Dec. 31, 2017 through Dec. 31, 2018 (000)**		
	Actual	**Expected**	**Difference**
2015	1,600		
2016	5,440		
2017	5,450		

(g) (*0.5 points*) Complete the table by calculating the expected paid claims on closed counts for accident years 2015 to 2017.

(h) (*0.5 points*) Explain what the result of part (g) implies about using the frequency-severity closure method to estimate ultimate claims in this case.

16. (*4 points*) You are the actuary for a self-insured company. You are conducting a ratemaking analysis on an automobile physical damage coverage with rates to be effective January 1, 2018. The company's program year starts on January 1.

(a) (*1 point*) Explain why vehicle rate group drift should be reflected in the ratemaking for an automobile book of business.

You are given the following information:

Vehicle Rating Group	Earned Vehicles by Vehicle Rating Group				Current Differentials
	2013	2014	2015	2016	
1	400	385	285	250	1.00
2	300	385	380	450	1.90
3	300	330	285	300	2.50
Total	**1,000**	**1,100**	**950**	**1,000**	

Your actuarial student has recommended using an annual premium trend of 2.3% to reflect vehicle rate group drift.

(b) (*2.5 points*) Assess the reasonableness of the student's recommendation.

(c) (*0.5 points*) Calculate the trend factor applicable to calendar year 2015, using the annual premium trend of 2.3% recommended by the student.

17. (*4 points*) You are performing a risk classification ratemaking analysis.

(a) (*0.5 points*) Explain why implied development factors are required to estimate ultimate claims.

(b) (*0.5 points*) Explain why the pure premium method and the claim ratio method might not provide the same result for a risk classification analysis.

You are provided with the following information:

Territory	Ultimate Counts	Calendar Year 2017 Earned Premium at Current Rates	Initial Indicated Claim Ratio Relativity	Current Relativity	Industry Relativity	Industry Credibility
A	1,200	25,000	1.025	1.000	1.000	100%
B	900	18,000	1.035	1.100	1.050	100%
C	400	13,000	1.011	0.900	0.850	50%
D	800	15,000	0.907	0.850	0.900	75%
Total	**3,300**	**71,000**	**1.000**	**0.975**	**0.964**	

- The full credibility standard is 4,331 ultimate counts.
- The square root rule is used for partial credibility.
- The complement of credibility is applied to the industry experience with any remaining balance being applied to the existing territory relativity.

(c) (*3 points*) Calculate the indicated relativities to the base Territory A using the claim ratio approach.

18. (*5 points*) Homeowners insurers in State F have experienced significant water related hurricane claims in recent years and are considering discontinuing insurance sales in the state.

(a) (*0.5 points*) Provide an example of what an insurer could to do to continue to provide consumer access to homeowners insurance coverage in hurricane prone areas.

Creative Insurance Company (CIC), believes a new water detection product has potential to reduce water related claims countrywide. Because this technology is new to the market, historical claims experience will not reflect any improvements from using this product. The manufacturer has estimated that this will reduce water related losses by 10%.

(b) (*0.5 points*) Assess the appropriateness of using this noninsurance data for a ratemaking analysis.

CIC is considering the following incentive structures to encourage adoption of the water detection product in customer homes:

I. Giving agents a bonus amount for each policy sold with this product,
II. Increasing the commission percentage to participating agents, and
III. Creating an annual targeted marketing campaign to promote use of this technology.

(c) (*1.5 points*) Describe whether the expense associated with each incentive structure above should be categorized as fixed or variable.

(d) (*0.5 points*) Describe a consequence of an insurer treating fixed expenses as variable expenses when determining rates.

(e) (*1.5 points*) Describe whether the expense associated with each incentive structure above should be related to earned premium or written premium when calculating an expense ratio.

(f) (*0.5 points*) Describe the result of selecting an inappropriate premium type to calculate an expense ratio in times of significant growth.

19. (*6 points*) You are estimating ultimate claims for a line of business and are considering several approaches to selecting a tail factor.

(a) (*1 point*) State two potential limitations of using benchmark data for tail factors.

You have been provided age-to-age development factors from a benchmark source.

(b) (*1 point*) Explain how you would decide whether or not to use this benchmark data in the selection of a tail factor.

You are given the following information:

Accident Year	Cumulative Paid Claims			
	12	24	36	48
2014	29,000	35,000	38,000	39,000
2015	21,000	30,000	33,000	
2016	23,000	29,000		
2017	27,000			

(c) (*1 point*) Calculate the age-to-age factors for paid claims using the geometric method.

(d) (*0.5 points*) Calculate the accident year 2017 ultimate claims using the original Bondy method for the tail factor.

(e) (*1 point*) State one advantage and one disadvantage of Boor's algebraic method.

You are given the following additional information:

Accident Year	Reported Claims as of Dec. 31, 2017
2014	41,000
2015	36,000
2016	35,000
2017	31,000

Selected Reported Age-to-Age Factors			
12-24	24-36	36-48	48-Ult
1.350	1.152	1.050	1.020

(f) (*1.5 points*) Calculate paid claims tail factors for accident years 2014 and 2015 using Boor's algebraic method.

****END OF EXAMINATION****
Afternoon Session

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