SOCIETY OF ACTUARIES
Introduction to Ratemaking & Reserving

Exam GIIRR

MORNING SESSION

Date: Wednesday, November 2, 2016
Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).

   a) The morning session consists of 11 questions numbered 1 through 11.

   b) The afternoon session consists of 8 questions numbered 12 through 19.

   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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Exam GIIRR-Front Cover

1. (*5 points*) You are conducting a ratemaking analysis for a book of business with annual policies that are written and earned evenly throughout the year.

    (a)   (*1 point*) Compare the written and earned premium approaches for determining the trending period.

    (b)   (*1 point*) Explain why you would use each approach identified in part (a).

You are given the following information:
- The trend analysis is based on 2015 earned premiums.
- Rates will be in effect for one year beginning January 1, 2017.

    (c)   (*1 point*) Calculate the trending periods for both of the written and earned premium approaches.

    (d)   (*2 points*) Provide two reasons why exposures are preferable to premiums when analyzing shifts in the mix of business.

2.   (*6 points*)

(a)   (*0.5 points*) Define an exposure base.

(b)   (*0.5 points*) Define a leading indicator.

(c)   (*0.5 points*) State an example of a leading indicator used for estimating ultimate claims.

(d)   (*0.5 points*) Explain why a pure premium approach is preferred over an expected claim ratio approach when developing expected claims for self-insurers.

You are estimating ultimate claims using the expected method and are given the following information from an automobile line of business:

Accident Year	Earned Premiums (000)	Projected Ultimate Reported Claims (000)	Premium On-Level Factor
2010	9,300	6,805	1.025
2011	9,800	6,460	1.065
2012	9,410	5,650	1.045
2013	9,700	5,830	1.035
2014	8,300	5,810	1.020
2015	8,950	5,600	1.000

- The annual claim trend is 2%.
- Tort reform reduced claim costs by 25% for all accidents occurring on or after January 1, 2012.

(e)   (*2.5 points*) Calculate the trended on-level reported claim ratios at the cost and rate level of 2015 for accident years 2010-2014.

(f)   (*1 point*) Recommend an expected claim ratio for accident year 2015. Justify your recommendation.

(g)   (*0.5 points*) Estimate the expected ultimate claims for accident year 2015.

3.   (*6 points*)

(a)   (*0.5 points*) State the two primary assumptions of the development method.

(b)   (*1 point*) Explain how the Bornhuetter Ferguson method and the Cape Cod method each reflect a change in claim experience.

You are given the following information relating to accident year 2014:

Earned exposures	1,050
Earned premium	126,000
A priori expected claim ratio	70%
Reported claims as of September 30, 2015	63,000

Incremental Reporting Pattern	
0 - 12 months	50%
12 - 24 months	30%
24 - 36 months	15%
36 - 48 months	5%

A rate change of +5% was effective January 1, 2015.

(c)   (*1 point*) Compare actual reported claims with expected reported claims as of September 30, 2015.

(d)   (*0.5 points*) Calculate estimates of ultimate pure premium from the Bornhuetter Ferguson method and the expected method as of September 30, 2015.

(e)   (*0.5 points*) Estimate IBNR reserves as of December 31, 2015 using the Bornhuetter Ferguson method.

(f)   (*0.5 points*) Estimate reported claims between December 31, 2015 and December 31, 2016 using the a priori expected claims ratio.

(g)   (*1 point*) Calculate the on-level premium needed for ratemaking for policies written on or after January 1, 2017.

(h)   (*1 point*) Calculate the used-up on-level earned premium as of December 31, 2015 needed to apply the Cape Cod method.

4. (*7 points*) You are conducting a ratemaking analysis of a property line of business. You are including an earthquake catastrophe loading in the ratemaking analysis that was determined from a single catastrophe model, and are given the following information:

Earthquake modeled expected claims	150,000
Date of expected claims cost level	July 1, 2015
Date of in-force exposures reflected in catastrophe model	September 1, 2014
Calendar year 2015 trended earned premium at current rate level	9,440,000
Annual exposure trend	2%
Annual severity trend	4%
Effective date of new rates	April 1, 2017

All policies are written for 12-month terms and new rates will be in effect for one year.

(a) (*1 point*) Explain why two trend adjustments must be made to the modeled expected catastrophe claims in order to calculate the catastrophe loading for ratemaking.

(b) (*2 points*) Calculate the catastrophe loading to be used for ratemaking, as a claim ratio.

You are given the following additional information:

Weighted average trended claim ratio, excluding catastrophe claims	64%
ULAE to claim ratio	12%
Fixed expenses to premium ratio	7%
Variable expenses to premium ratio	20%
Target profit and contingencies to premium ratio	4%

(c) (*1.5 points*) Calculate the indicated rate level change.

Your company's management decides to increase rates by 2%.

(d) (*1 point*) Calculate the profit and contingencies to premium ratio implied by increasing rates by 2%.

4. **Continued**

    (e)   (*0.5 points*) Describe an approach that would increase your confidence in the estimate of expected earthquake claims.

You want to add a risk load to the earthquake modeled expected claims of 150,000.

    (f)   (*1 point*) State two measures from the earthquake model that could be used to determine a risk load.

5. (*6 points*) You are given the following information:

Accident Year	Earned Exposures	Incremental Paid Claims in Calendar Year		
		2013	**2014**	**2015**
2010	10,000	75,000		
2011	10,000	250,000	75,000	
2012	10,000	300,000	250,000	75,000
2013	7,000	140,000	210,000	175,000
2014	4,900		100,000	150,000
2015	2,450			50,000

This is a short-tail line of business with no development after 48 months.

	As of December 31, 2015
Total Reserves	371,250
Case Reserves	270,000

Calendar Year	Paid ULAE
2013	71,520
2014	55,420
2015	35,630

Approximately 30% of claim department expenses relate to opening a claim file and 70% relate to maintaining and closing a claim file.

A simple three-year average of historical experience is used to estimate ULAE reserves.

(a)   (*2 points*) Estimate the unpaid ULAE as of December 31, 2015 using a paid-to-paid method.

5. **Continued**

You prepare another ULAE reserve estimate using the Wendy Johnson count-based method. The following weights for the three different types of claim counts are used:

Newly reported counts	30%
Open counts	60%
Closed counts	10%

You are given the following additional information:

Calendar Year	Historical ULAE Counts		
	Newly Reported	Open	Closed
2013	86	43	93
2014	67	32	78
2015	44	19	57

Calendar Year	Projected ULAE Counts		
	Newly Reported	Open	Closed
2016	19	7	31
2017	6	1	12
2018	1	0	2

Trend has been 0% over the past three years and you expect this to continue.

(b)   (*3 points*) Estimate the unpaid ULAE as of December 31, 2015 using the Wendy Johnson count-based method.

(c)   (*1 point*) Recommend the unpaid ULAE from either part (a) or (b) to management. Justify your recommendation.

6. (*4 points*) You are reviewing development triangles and estimates of ultimate claims for several lines of business where conditions have been changing.

You are analyzing the reported development triangle for an auto line of business where there was a change in claim department processing three years ago that allowed for the earlier recording of more adequate case estimates. All other aspects of the business are in a steady-state environment.

    (a)   (*1 point*) Describe what effect the change in claim department processing would have had on the reported claim age-to-age development factors.

    (b)   (*1 point*) Explain which of the following two methods is likely to produce a more accurate estimate of ultimate claims in recent accident years under this scenario:

        (i)   the reported Bornhuetter Ferguson method, or

        (ii)   the reported Cape Cod method.

You are analyzing the reported development triangle for a general liability line of business where there was a one-time increase in policy limits sold beginning three years ago. All other aspects of the business are in a steady-state environment.

    (c)   (*1.5 points*) Describe what effect an increase in policy limits would have had on the reported claim age-to-age development factors.

    (d)   (*0.5 points*) Describe an approach to selecting an appropriate tail factor under this scenario.

7. (*5 points*) Boutique Oriental Occidental ("BOO") is an association of interior designers. BOO has engaged you to provide actuarial services with respect to errors and omissions coverage design and self-insurance cost allocation to its three regions: East, Central and West. Assume that each region has equal exposure and equal claims history in the aggregate. None of the members of BOO have ever purchased errors and omissions insurance or been in a self-insurance program.

    (a)   (*1 point*) Explain which coverage would be preferable for BOO: claims-made or occurrence.

The initial 2017 pricing for mature claims-made pure premium only is 1,000,000 for each region. Expenses are separate and vary by region.

    (b)   (*1 point*) Demonstrate, with a hypothetical numerical example, how individual designer claims experience and exposure can be used to allocate the 1,000,000 to designers within the East region.

    (c)   (*1 point*) Describe how an actuary can use credibility in the allocation procedure in part (b).

In the first year, the East region has claims of 3,000,000 while the Central and the West regions have no claims. The exposures are still the same for each region.

You are recommending regional pure premiums for the second year.

    (d)   (*1 point*) Provide an argument to support the same pure premium for all regions.

    (e)   (*1 point*) Provide an argument to support different regional pure premiums.

8. (*5 points*) You are calculating the premium liabilities for PL Insurance Company as of December 31, 2015. PL is a special purpose public liability reinsurer with three annual policies providing coverage as follows:

Policy	Inception	Deposit Premium	Covered Locations
A	April 1, 2015	24,000	30
B	July 1, 2015	40,000	50
C	October 1, 2015	36,000	40
Total		**100,000**	

You are provided with the following information:

Expected annual claims cost per covered location, including ALAE	600
Expected premium development	10%
Deferred acquisition expenses as % unearned premium	15%
ULAE as % claims cost including ALAE	20%
Maintenance expenses as % earned premium	5%

- Premiums and acquisition expenses are recognized evenly over the policy period.
- There is no reinsurance.

(a)   (*1 point*) Calculate the unearned premium as of December 31, 2015.

(b)   (*1 point*) Calculate the premium deficiency reserve or equity in the unearned premium as of December 31, 2015.

(c)   (*0.5 points*) Calculate the reported deferred policy acquisition expense (DPAE) as of December 31, 2015.

Recent legislative changes will increase the cost of all claims incurred after April 1, 2016 by 50%.

(d)   (*1 point*) Recalculate the premium deficiency reserve or equity in the unearned premium as of December 31, 2015, allowing for this legislative change.

(e)   (*0.5 points*) Recalculate the reported DPAE as of December 31, 2015.

8. **Continued**

    (f)   (*1 point*) Explain, but do not calculate, how the following expected changes during 2016 will affect your calculations of year-end 2015 premium liabilities:

        (i)   Premiums will be increased by 30% upon renewal.

        (ii)   Claims department expenses are expected to fall by 20% in 2016.

9. (*6 points*)

(a) (*0.5 points*) State two lines of business for which claims-made coverage is prevalent.

(b) (*0.5 points*) State one reason why claims-made is a preferred form of coverage for the lines of business in part (a) from the insurer's perspective.

(c) (*1 point*) Describe two methods of individual risk rating that can apply to the rating of small groups of physicians.

Assume claims-made coverage in a zero claims inflation environment with equal reporting of claims across ten years (i.e., 10% per year).

(d) (*2 points*) Calculate the following items:

   (i) The ratio of the mature claims-made rate to the occurrence rate

   (ii) The tail factor for mature claims-made coverage

   (iii) The tail factor for a new physician who plans to change careers after three years of claims-made coverage

(e) (*2 points*) Explain how a coverage gap can exist when the insured switches:

   (i) Between claims-made insurers

   (ii) From claims-made to occurrence coverage

   (iii) Between occurrence insurers

   (iv) From occurrence to claims-made coverage

10. (*6 points*)

    (a)   (*0.5 points*) Define downward development.

    (b)   (*1 point*) Identify two reasons why downward development may occur.

You are analyzing the claims data for ABC Auto Insurers and have been given the following reported claims age-to-age factors for the collision coverage:

Accident Half-Year	Reported Claims Age-to-Age Factors		
	6-12	**12-18**	**18-24**
2012-1	1.057	0.990	1.001
2012-2	1.099	0.988	0.999
2013-1	1.053	0.988	1.002
2013-2	1.104	0.989	1.002
2014-1	1.055	0.990	1.000
2014-2	1.109	0.988	
2015-1	1.051		

There is no development beyond 24 months.

    (c)   (*1 point*) Select age-to-age factors for 6-12 months and 12-18 months and justify your selection.

    (d)   (*1 point*) Explain why an analysis of frequency and severity might be appropriate in this case.

You are also given the following claims as of December 31, 2015:

Accident Half-Year	Paid Claims	Reported Claims
2015-1	20,100	24,500
2015-2	15,700	22,100

    (e)   (*1 point*) Calculate the ultimate claims for accident year 2015.

    (f)   (*1.5 points*) Calculate the accident year 2015 unpaid claims using the ultimate claims calculated in part (e), showing the case estimate and indicated IBNR separately.

11. (*4 points*) You are estimating ultimate claims for ABC Insurance. You are provided with the following information:

| Accident | Closed Counts | | | Selected |
Year	12	24	36	Ultimate Counts
2013	80	100	180	200
2014	84	108		240
2015	101			337

The expected annual severity trend for ABC Insurance is 5%.

The claims department manager advises you that increased business volume is leading to delays in claims processing.

(a)   (*1 point*) Calculate the disposal ratio triangle.

(b)   (*0.5 points*) Explain how this disposal ratio triangle does or does not provide evidence of delays in claims processing.

You have decided to use a Berquist-Sherman adjustment to allow for changing settlement rates. Analysis indicates that the average claim paid varies only by accident year trend. The selected average claim cost for accident year 2015 was 110.

(c)   (*2 points*) Calculate the adjusted paid claims triangle.

(d)   (*0.5 points*) Explain whether or not a Berquist-Sherman adjustment would be appropriate for a new line of business.

END OF EXAMINATION
Morning Session

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