

---

**SOCIETY OF ACTUARIES**  
**Introduction to Ratemaking & Reserving**

# Exam GIIRR

## AFTERNOON SESSION

**Date:** Wednesday, May 4th, 2016

**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.

Tournez le cahier d'examen pour la version française.



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

**12.** (4 points) You are given the following claim count information for a primary insurer:

<b>Accident Year</b>	<b>Reported Counts</b>			
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>
2012	500	1,850	2,532	2,875
2013	580	2,160	3,030	
2014	510	2,243		
2015	515			

- (a) (2 points) Calculate the ultimate claim counts for each accident year using the development method with a simple all-year average and a tail factor of 1.05.
- (b) (0.5 points) Identify one item to investigate based on the reported count triangle and the development factors calculated in part (a).
- (c) (0.5 points) Describe how you would investigate the item identified in part (b).
- (d) (1 point) Identify three reasons a reinsurer's experience may be more variable than the primary insurer's experience.

**13.** (5 points) You are estimating ultimate claims using the frequency-severity closure method.

(a) (1 point) Describe a data adjustment to use with the closure method if the line of business has a significant number of partial payments.

You are given the following count information for ABC Auto Insurer:

Accident Year	Cumulative Closed Counts				Selected Ultimate Counts
	12	24	36	48	
2012	9,670	12,120	12,980	13,380	13,380
2013	6,950	8,400	9,270		9,800
2014	5,960	7,420			8,500
2015	5,090				7,030

(b) (1.5 points) Calculate the proportion of closed counts at each maturity age for accident year 2012.

You are given the following information:

Accident Year	Incremental Paid Severity at Total Limits			
	12	24	36	48
2012	1,455	5,500	13,500	15,000
2013	1,095	3,850	12,000	
2014	1,175	4,200		
2015	1,320			

Months	Incremental Severity at 2015 Cost Level
12	1,400
24	4,500
36	12,800
48	14,500

Months	Selected Proportion of Closed Counts
12	0.70
24	0.65
36	0.70
48	1.00

### **13. Continued**

The annual severity trend is 3.5%.

- (c) *(1 point)* Calculate the incremental closed counts for accident year 2014 at all maturities 12 through 48 months.
- (d) *(1 point)* Calculate the incremental paid severity for accident year 2014 at all maturities 12 through 48 months.
- (e) *(0.5 points)* Calculate the accident year 2014 projected ultimate claims.

- 14.** (7 points) You have been asked to project ultimate claims using the Cape Cod method and have been given the following information as of December 31, 2015:

<b>Accident Year</b>	<b>Earned Premiums</b>	<b>Actual Reported Claims</b>	<b>Reported Cumulative Development Factors</b>
2013	40,000	22,000	1.25
2014	41,000	14,000	2.00
2015	40,000	6,000	5.00

- A rate decrease of 6% was effective July 1, 2014.
  - All policies are written for twelve-month policy terms and are written evenly throughout the year.
  - The annual claim trend is 2%.
  - Tort reform resulted in an estimated claim decrease of 10% for all accidents occurring on or after July 1, 2014.
- (a) (1.5 points) Calculate the used-up on-level earned premiums for each accident year.
- (b) (1.5 points) Calculate the expected claims for each accident year.
- (c) (1 point) Calculate the estimated ultimate claims for each accident year.
- (d) (0.5 points) Explain why the Cape Cod method may not be appropriate for coverages such as property or collision.

You have also been asked to project ultimate claims using the Generalized Cape Cod method that requires the selection of a decay factor.

- (e) (0.5 points) Explain the purpose of a decay factor.
- (f) (0.5 points) Identify the methods that the Generalized Cape Cod method approaches when the decay factor approaches zero and approaches one.
- (g) (1.5 points) Calculate the expected claims for accident year 2015 using the Generalized Cape Cod method with a decay factor of 70%.

**15.** (5 points) You are estimating ultimate claim ratios for personal auto liability business in a single state using data evaluated as of December 31, 2015. You are given the following information:

- The experience period is accident years 2000-2015.
- You generally use the development method and the Bornhuetter Ferguson method for projecting claims.
- The data includes accident year reported claim ratios at annual evaluations in triangle format.
- The pricing actuaries have given you a priori accident year claim ratios at the beginning of each year.

You are evaluating each of the following events:

- (i) The state increased posted highway speed limits in 2012.
  - (ii) A hurricane occurred in October 2013 causing significant roof damage and flooding in a major claims office. As a result, there was a claims processing backlog, which was not corrected until the end of the next quarter.
  - (iii) A significant judicial decision increased the average payment for all open claims effective June 2010.
- (a) (1.5 points) Explain the likely row, column, or diagonal effects each event had on the data.
- (b) (3 points) Explain how you would handle each event through a data adjustment, assumption, or method selection.
- (c) (0.5 points) Describe one situation (different from those above) that might lead you to use a Berquist-Sherman adjustment in estimating ultimate claim ratios for auto liability business.

**16.** (5 points) Generic Insurance Company (GIC) is considering adding a portfolio of commercial property insurance coverage for regional hamburger chains. It is currently in discussions with three such chains:

- ABC Burgers has its outlets in California with significant earthquake risk.
- FGH Burgers has its outlets in Kansas with significant tornado risk.
- XYZ Burgers has its outlets in Florida with significant hurricane risk.

Each chain sells its hamburgers at freestanding buildings (as opposed to, for example, at shopping centers or strip malls). For a given chain, the buildings are identical with regard to design and construction. Each chain has the same number of outlets with the same total value.

As part of its decision process, GIC assumes that its current portfolio of commercial property policies has no significant catastrophe risk.

As GIC negotiates with each chain, it may or may not come to an agreement with all of them. For example, it may be able to insure ABC and XYZ but not FGH.

(a) (2 points) Rank the following portfolios from least to most catastrophe risk from GIC's perspective, with the possibility that some may be roughly equal in risk. Justify your ranking.

- I. ABC only
- II. FGH only
- III. XYZ only
- IV. ABC and FGH
- V. ABC and XYZ
- VI. FGH and XYZ
- VII. ABC, FGH, and XYZ



## 16. Continued

GIC has decided to offer coverage to ABC Burgers.

- (b) *(0.5 points)* Describe an action GIC may take to improve its underwriting to account for ABC's earthquake risk.
- (c) *(1 point)* Describe coverage modifications GIC may use to reduce its earthquake risk.
- (d) *(1 point)* Describe how a catastrophe model could be used to set the coverage modifications from part (c).
- (e) *(0.5 points)* Describe an action other than using coverage modifications that GIC may use to reduce its earthquake risk.

**17.** (5 points) You are the Executive Director and Chief Actuary for ERR, a group of international consulting actuaries. The Board of Directors of ERR has asked you to consider a professional indemnity program for the 1,000 members.

- (a) (1 point) Provide two advantages of claims-made and two advantages of occurrence coverage for ERR.
- (b) (1 point) Identify three risk characteristics that can be used in schedule rating for the group.
- (c) (0.5 points) Provide a reason why the total allowable schedule rating credits or debits for all risk characteristics combined is generally limited.

Assume that all coverage begins on January 1, 2016 with a January 1, 2016 retroactive date and that claims from one accident year are reported equally over four report years. Further, assume that 50% of the claims reported in a year are paid in the year of reporting and 50% are paid in the following year.

The Board has asked you to consider both claims-made and claims-paid coverage. Claims-paid refers to coverage that is triggered at the time a claim is paid, rather than at the time a claim is first reported (claims-made policy) or at the time the injury or damage occurs (occurrence policy).

There are ten years of data and 100 claim counts in that period. The annual claim trend is 0%.

- (d) (0.5 points) Assess the credibility of the historical data from ERR.
- (e) (1 point) Calculate the step factors from first-year through maturity for the following cases:
  - (i) Claims-made
  - (ii) Claims-paid
- (f) (1 point) Calculate the tail factor applicable to a mature policy for the following cases:
  - (i) Claims-made
  - (ii) Claims-paid

**18.** (4 points) You are the ratemaking actuary for the ABC Insurance Company working on a premium trend analysis for setting rates to be effective September 1, 2016.

(a) (0.5 points) Explain one reason not to use actual premium when analyzing premium trend.

Based on your analysis, you found there was a significant change in the economic environment in 2012. Therefore, you select an annual trend of 2% for all policies written prior to January 1, 2012 and an annual trend of 0.75% afterward. All policies are twelve-month policies, written evenly throughout each year. The new rates will be in effect for one year.

(b) (1.5 points) Calculate the 2010 premium trend factor.

(c) (1 point) Describe what would have been different in the calculation if the work done in part (b) was for a self-insurer.

(d) (1 point) Explain how the premium trend factors would be affected by the following:

- (i) An increasing proportion of insureds choosing a higher policy limit at the beginning of 2014.
- (ii) An increasing proportion of insureds choosing a higher deductible at the beginning of 2014.

- 19.** (5 points) You are given the following information for an automobile line of business for which you are performing a ratemaking analysis:

Accident Year	Trended Earned Premiums at Current Rates	Earned Exposures	Ultimate Counts	Ultimate Claims	Weights
2013	2,601,000	5,100	561	2,082,000	20%
2014	2,751,000	5,250	567	2,250,000	30%
2015	2,761,000	5,200	546	2,178,000	50%

- New rates are to be effective October 1, 2016 for one year, with all policies written as twelve-month policies.
- The annual pure premium trend is 2%.
- The annual fixed expense trend is 1%.

- (a) (1 point) Calculate the weighted average trended pure premium.

The government assesses all insurance companies a health levy each year. Insurance companies can include a provision for the health levy in their rate structures. Your company has been assessed 119,000 for 2016.

- (b) (1 point) Recommend how you would include a provision for the health levy in your ratemaking analysis. Justify your recommendation.
- (c) (1 point) Calculate the provision for the health levy to include in your ratemaking analysis.

You are given the following additional information:

- Unallocated loss adjustment expenses are 5% of ultimate claims.
- Fixed expenses per vehicle are 20 for the future rating period.
- Variable expenses are 12% of premium.
- The loading for profit and contingencies is 3% of premium.

- (d) (1 point) Calculate the indicated rate.

## **19. Continued**

You are forecasting future experience and expect to observe 5,400 earned exposures and ultimate claims of 2,450,000 during the future rating period.

- (e) *(1 point)* Determine whether or not the target for profit and contingencies will be met based on your indicated rate from part (d).

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

**USE THIS PAGE FOR YOUR SCRATCH WORK**

**USE THIS PAGE FOR YOUR SCRATCH WORK**

**USE THIS PAGE FOR YOUR SCRATCH WORK**