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# CURATED PAST EXAM ITEMS

## - Questions -

### GI 101 – Ratemaking and Reserving

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#### **Important Information:**

- These curated past exam items are intended to allow candidates to focus on past SOA fellowship assessments. These items are organized by topic and learning objective with relevant learning outcomes, source materials, and candidate commentary identified. We have included items that are relevant in the new course structure, and where feasible we have made updates to questions to make them relevant.
- Where an item applies to multiple learning objectives, it has been placed under each applicable learning objective.
- Candidate solutions other than those presented in this material, if appropriate for the context, could receive full marks. For interpretation items, solutions presented in these documents are not necessarily the only valid solutions.
- Learning Outcome Statements and supporting syllabus materials may have changed since each exam was administered. New assessment items are developed from the current Learning Outcome Statements and syllabus materials. The inclusion in these curated past exam questions of material that is no longer current does not bring such material into scope for current assessments.
- Thus, while we have made our best effort and conducted multiple reviews, alignment with the current system or choice of classification may not be perfect. Candidates with questions or ideas for improvement may reach out to [education@soa.org](mailto:education@soa.org). We expect to make updates annually.

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## GI 101 – LEARNING OBJECTIVE 1

### 1. Topic: Introduction and Key Considerations

The candidate will understand the key considerations for and key concepts underlying general insurance actuarial work.

## GIRR Fall 2020 Question 15 (LOs 1d, 1i, 4b, 4c)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (1i) Describe how and why data are segregated and aggregate.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 4, and 23.

### Question:

**15.** (4 points) You are estimating unpaid ULAE.

- (a) (0.5 points) Describe one way a reinsurer might assess the reasonableness of an estimate of unpaid ULAE.

ANSWER:

You are given the following information for an insurance company:

Calendar Year	Earned Exposures	Paid ULAE	Ratio of ULAE to Claims	
			Classical Paid	Kittel Refinement
2017	7,430	810,000	7.4%	7.5%
2018	7,890	850,000	7.5%	7.3%
2019	8,310	880,000	7.6%	7.1%

- The Kittel refinement reflects the average of actual paid and reported claims.
- (b) (0.5 points) Recommend one of the two approaches from the table above to use in estimating unpaid ULAE. Justify your recommendation.

ANSWER:



You are given the following additional information:

	<b>As of December 31, 2019</b>
Case Estimates	3,510,000
IBNR	1,600,000

- Approximately 80% of IBNR is a provision for development on known claims.
- Approximately 25% of claim department expenses relate to opening a claim file and 75% relate to maintaining and closing a claim file.

- (c) (1.5 points) Estimate unpaid ULAE as of December 31, 2019 using the approach you selected in part (b).

*The response for part (c) is to be provided in the Excel spreadsheet.*

Unpaid ULAE as of December 31, 2018 was 270,000.

- (d) (0.5 points) Determine calendar year 2019 incurred ULAE.

*The response for part (d) is to be provided in the Excel spreadsheet.*

You work for an insurance company that writes only auto insurance. The company's practice is to set up zero case estimates for ALAE because ALAE for the company is relatively small and stable.

Your colleague recommends estimating unpaid ALAE using the same paid-to-paid approach as ULAE because there are no ALAE case estimates, the experience is stable, and auto insurance is the only line of business.

- (e) (1 point) Critique your colleague's recommendation.

ANSWER:

**GIRR Fall 2021 Question 6 (LOs 1d, 1f, 3g, 3j)****Learning Outcomes:**

- (1d) Understand the components of ultimate values.
- (1f) Demonstrate the importance of understanding key terminology and interrelationships.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 16 and 22.

**Question:****6.***(4 points)*

- (a) *(0.5 points)* Describe what an *actuarial central estimate* represents according to U.S. ASOPs.

ANSWER:

- (b) *(0.5 points)* Assess the validity of the following statement:

“Credibility is not utilized in projecting unpaid claims for reserving.”

ANSWER:

You are given the following information as of December 31, 2020 for a general liability line of business:

Accident Year	Earned Premiums	Projected Ultimate Claims Based on Frequency-Severity Method	
		Development Based	Claim Closure
2015	7,770,781	5,053,162	5,053,487
2016	8,054,874	5,508,456	5,506,686
2017	8,669,122	5,901,592	5,867,259
2018	9,068,601	6,242,941	6,305,001
2019	9,896,451	6,826,075	7,055,995
2020	10,833,340	7,153,796	7,378,065

You are also given the following diagnostic results:

Accident Year	Reported Claim Ratios					
	12	24	36	48	60	72
2015	52.7%	58.1%	61.3%	63.3%	64.4%	65.0%
2016	54.7%	60.9%	65.3%	66.4%	67.7%	
2017	54.9%	61.3%	65.7%	66.5%		
2018	56.8%	63.9%	65.8%			
2019	56.1%	63.6%				
2020	55.2%					

- (c) (1 point) Calculate the indicated IBNR as of December 31, 2020 for each of the frequency-severity method projections above.

*The response for this part is to be provided in the Excel spreadsheet.*

You are given the following IBNR estimates for an auto insurer's bodily injury liability claims:

Accident Year	IBNR Claim Estimates (000)			
	Development Method		Bornhuetter Ferguson	
	Paid	Reported	Paid	Reported
2016	2,852	2,628	2,825	2,650
2017	4,103	4,218	4,185	4,235
2018	4,352	6,318	4,161	5,511
2019	8,072	7,317	7,767	7,467
2020	11,835	10,664	11,409	11,109

- A large claim was reported in accident year 2018.
- The case estimate on the large claim appears adequate.

- The large claim remains unpaid as of December 31, 2020.
- None of the methods have an explicit adjustment for the large claim.

Company management has asked you to recommend an accident year 2018 IBNR reserve as of December 31, 2020.

- (d) (2 points) Critique the appropriateness of each method as a potential IBNR selection for accident year 2018.
- (i) Paid development method
  - (ii) Reported development method
  - (iii) Paid Bornhuetter Ferguson method
  - (iv) Reported Bornhuetter Ferguson method

*The response for this part is to be provided in the Excel spreadsheet.*

## GIRR Fall 2021 Question 18 (LOs 1d, 3f, 3g, 4a, 4b)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 15, and 23.

### Question:

## 18.

(6 points) You are projecting ultimate claims as of December 31, 2020 using the paid development method and are given the following data:

Accident Year	Paid Claims (000)							
	12	24	36	48	60	72	84	96
2013	162	517	866	1,171	1,402	1,573	1,716	1,824
2014	171	523	875	1,142	1,372	1,565	1,712	
2015	182	518	876	1,169	1,424	1,610		
2016	190	543	923	1,219	1,460			
2017	198	540	1,082	1,391				
2018	205	560	968					
2019	211	573						
2020	224							

Accident Year	12-24	24-36	36-48	48-60	60-72	72-84	84-96
2013	3.191	1.675	1.352	1.197	1.122	1.091	1.063
2014	3.058	1.673	1.305	1.201	1.141	1.094	
2015	2.846	1.691	1.334	1.218	1.131		
2016	2.858	1.700	1.321	1.198			
2017	2.727	2.004	1.286				
2018	2.732	1.729					
2019	2.716						

Accident year 2017 includes a large claim of 150,000 paid and closed on March 15, 2019. The claim was unusual, and a similar claim is not likely to occur.

- (a) *(1 point)* Select age-to-age development factors for all periods excluding the tail factor. Justify your selections.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

<b>Accident Year</b>	<b>Projected Ultimate Claims from Reported Development Method (000)</b>
2013	1,975
2014	1,974
2015	2,032
2016	2,078
2017	2,234
2018	2,216
2019	2,261
2020	2,295
<b>Total</b>	<b>17,065</b>

- (b) *(1.5 points)* Derive a paid tail factor using Boor's algebraic method.

*Provide the response for this part in the Excel spreadsheet.*

Subsequently, the Chief Actuary provides you with an alternative tail factor of 1.072 based on industry benchmark data.

- (c) *(1 point)* Calculate ultimate claims using the paid development method and the tail factor of 1.072.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for estimating ULAE:

- Selected ultimate claims for each accident year are based on the results from the reported development method shown above (and not the paid development method).
- Actual reported claims as of December 31, 2020 are 14,660,000.

- The selected ratio of calendar year paid unallocated loss adjustment expenses (ULAE) to paid claims is 8%.
- (d) (1 point) Calculate the unpaid ULAE as of December 31, 2020 using the classical paid-to-paid method and a multiplier of 50%.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1 point) Describe the Kittel refinement to the classical paid-to-paid method and the weakness it is designed to address.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (0.5 points) Describe the Mango and Allen smoothing adjustment.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2022 Question 2 (LOs 1d, 2a, 3c, 3d)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11 and 14.

### Question:

**2.**

(7 points) You are given the following claim information evaluated as of December 31, 2021.

Accident Year	Reported Claims (000)			
	12	24	36	48
2018	1,196	1,525	1,638	1,723
2019	1,269	1,607	1,908	
2020	1,294	1,707		
2021	1,451			

Accident Year	Reported Counts			
	12	24	36	48
2018	230	250	260	265
2019	235	255	265	
2020	231	251		
2021	234			

You are also informed that the following six claim transactions were not captured in the triangles due to a system error.

Trans #	Claim ID	Transaction Date	Transaction Description	Occurrence Date	Case Estimate (000)	Indemnity Payment (000)	ALAE Payment (000)
1	1020	May 17, 2019	Open new claim file	Apr. 27, 2018	10	5	
2	1377	Nov. 3, 2019	Open & close new claim file	Sep. 15, 2019		50	25
3	1944	Jan. 2, 2021	Close reported claim file	Sep. 15, 2019	-25	10	5
4	2135	Feb. 28, 2021	Change in case estimate	Jan. 6, 2020	65		
5	2260	Apr. 24, 2021	Open new claim file	Feb. 3, 2018	20		
6	2260	June 5, 2021	Close reported claim file	Feb. 3, 2018	-20		20

- (a) (4 points) Update both development triangles shown above to include the claim transactions not captured due to the system error.

*The response for this part is to be provided in the Excel spreadsheet.*



- (b) (0.5 points) Determine calendar year 2021 reported claims.

*The response for this part is to be provided in the Excel spreadsheet.*

Accident year 2021 paid claims and ALAE evaluated as of December 31, 2021, were 800,000.

- (c) (0.5 points) Determine case reserves as of December 31, 2021, for accident year 2021 only.

*The response for this part is to be provided in the Excel spreadsheet.*

You are subsequently given a variety of corrected claim and count triangles and have been asked to conduct investigative tests.

- (d) (1 point) Describe the investigative tests you would recommend using for the following independent situations:
- (i) The claim department implemented a new definition of claims to distinguish between reported incidents that are valid claims and incidents not covered under the insurance policy.
  - (ii) The claim department implemented a new initiative to increase their use of partial settlements.

*The response for this part is to be provided in the Excel spreadsheet.*

During investigative testing, you observe an increase in average reported claims, with changes greater than the rate of trend going down each column (from accident year to accident year). However, the reported counts are stable.

- (e) (1 point) Provide two examples of company operational changes that could cause an increase in average reported claims without affecting reported counts.

*The response for this part is to be provided in the Excel spreadsheet.*

### GIRR Fall 2022 Question 7 (LOs 1j, 3c, 3d)

#### Learning Outcomes:

- (1j) Describe qualitative information required for actuarial work.
- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 5 and 14.

#### Question:

**7.**

(4 points) You are given the following information for an investigative analysis:

Accident Year	Reported Claim Frequency							
	12	24	36	48	60	72	84	96
2014	0.017	0.018	0.019	0.019	0.019	0.019	0.019	0.019
2015	0.018	0.019	0.019	0.019	0.019	0.018	0.018	
2016	0.017	0.018	0.018	0.018	0.018	0.018		
2017	0.018	0.019	0.020	0.020	0.019			
2018	0.015	0.016	0.017	0.018				
2019	0.015	0.015	0.016					
2020	0.014	0.015						
2021	0.013							

You noticed that the claim frequency has been decreasing since accident year 2018.

- (a) (1 point) Describe two operational changes that could have caused this decrease.

ANSWER:

- (b) (0.5 points) Describe one external environmental change that could have caused this decrease.

ANSWER:

You are given the following diagnostic triangle for a different line of business:

Accident Year	Ratios of Paid Claims to Reported Claims							
	12	24	36	48	60	72	84	96
2014	0.205	0.363	0.454	0.575	0.670	0.829	0.902	0.960
2015	0.187	0.357	0.425	0.570	0.667	0.813	0.868	
2016	0.213	0.367	0.442	0.559	0.656	0.772		
2017	0.198	0.359	0.438	0.551	0.614			
2018	0.196	0.373	0.447	0.490				
2019	0.190	0.365	0.375					
2020	0.203	0.295						
2021	0.150							

- (c) (0.5 points) Identify a change in pattern in this triangle.

ANSWER:

- (d) (1 point) Describe two possible operational changes that could have caused the pattern change identified in part (b).

ANSWER:

- (e) (1 point) Describe an additional test to further investigate the change in pattern identified in part (b).

ANSWER:

## GIRR Fall 2022 Question 18 (LOs 1d, 2a)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3 and 11.

### Question:

## 18.

(5 points) You are given the following claims-made data for Nurses Professional Liability coverage from the claims department.

Report Year	Nurses - Professional Liability						
	Incremental Paid Claims (000) During Calendar Year						
	2015	2016	2017	2018	2019	2020	2021
2015	330	1,380	1,315	577	118	21	5
2016		351	1,855	1,479	428	91	8
2017			436	1,489	1,252	933	168
2018				423	1,592	1,182	670
2019					449	1,675	1,540
2020						354	1,709
2021							584

Report Year	Case Estimates (000) at Evaluation Date						
	Dec. 31, 2015	Dec. 31, 2016	Dec. 31, 2017	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2020	Dec. 31, 2021
2015	1,169	1,368	362	116	21	5	0
2016		1,321	1,348	222	94	23	16
2017			1,456	1,378	689	177	18
2018				1,404	1,349	520	203
2019					1,247	1,701	553
2020						1,543	1,711
2021							1,350

- (a) (1 point) Construct a cumulative reported claim development triangle by report year.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (0.5 points) Calculate the calendar year 2020 reported claims for the coverage above.

*Provide the response for this part in the Excel spreadsheet.*

You are subsequently informed that the following six claim transactions were not captured in the previous dataset.

Trans. #	Transaction Date	Transaction Description	Occurrence Date	Report Date	Change in Case Estimate (000)	Indemnity Payment (000)
1	Aug. 5, 2019	subrogation recovery	May 6, 2017	July 2, 2018		–15
2	Dec. 19, 2019	payment on reported claim file	Mar. 1, 2016	Aug. 27, 2017	–45	45
3	Dec. 28, 2019	open and close new claim file	Oct. 17, 2018	Dec. 23, 2019		10
4	Jan. 28, 2020	payment & change in case estimate	Aug. 1, 2015	Nov. 28, 2016	–20	15
5	Feb. 4, 2021	open new claim file	Sept. 12, 2020	Feb. 3, 2021	30	
6	May 11, 2021	payment on reported claim file with no change in case estimate	June 14, 2017	Apr. 19, 2020		5

- (c) (3 points) Update the reported claim development triangle from part (a) to include the missing claim transactions.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following carried IBNR reserves for the Nurses coverage above:

IBNR Reserves (000)	
December 31, 2020	3,900
December 31, 2021	4,100

- (d) (0.5 points) Calculate the calendar year 2021 incurred claims.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2023 Question 2 (LOs 1g, 2a)

### Learning Outcomes:

- (1g) Identify different types of data used for actuarial work.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 4 and 11.

### Question:

**2.**

(5 points) You are constructing claims data files for a ratemaking analysis.

- (a) (1 point) Provide one advantage and one disadvantage to aggregating claims data by policy year.

ANSWER:

- (b) (0.5 points) Provide one disadvantage to aggregating claims data by report year.

ANSWER:

You are given the following claims data aggregated by accident year:

Accident Year	Reported Claims					
	12	24	36	48	60	72
2017	2,147,785	3,025,674	3,620,901	4,136,684	4,362,359	4,382,594
2018	2,219,814	3,071,925	3,876,926	4,331,668	4,596,920	
2019	2,342,602	4,154,013	4,922,135	5,074,225		
2020	2,591,328	3,398,123	4,339,405			
2021	2,582,962	3,768,518				
2022	2,735,738					

<b>Accident Year</b>	<b>Paid Claims</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	1,249,954	2,244,328	3,004,204	3,728,241	4,161,007	4,367,084
2018	1,271,502	2,218,377	3,235,509	3,896,228	4,382,244	
2019	1,346,283	2,368,791	3,339,691	4,154,460		
2020	1,525,699	2,505,764	3,625,546			
2021	1,435,742	2,756,999				
2022	1,589,295					

<b>Accident Year</b>	<b>Reported Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	729	895	998	1,082	1,119	1,122
2018	727	900	1,019	1,089	1,130	
2019	743	911	1,022	1,102		
2020	765	902	1,042			
2021	763	939				
2022	767					

<b>Accident Year</b>	<b>Closed Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	466	697	855	991	1,075	1,118
2018	469	696	877	997	1,085	
2019	474	706	874	1,007		
2020	489	700	896			
2021	491	727				
2022	494					

It was subsequently discovered that a claim file was miscoded in the system as follows:

<b>Transaction</b>	<b>Original</b>		<b>Corrected</b>	
	<b>Date</b>	<b>Amount</b>	<b>Date</b>	<b>Amount</b>
Accident Date	Sep. 22, 2019	n/a	Sep. 22, 2019	n/a
Claim reported to company, case estimate established	<i>Nov. 1, 2020</i>	<i>900,000</i>	<i>Nov. 1, 2019</i>	<i>90,000</i>
Claim Payment	Dec 1, 2020	1,500	Dec 1, 2020	1,500
Claim Payment	Jul. 1, 2021	1,000	Jul. 1, 2021	1,000
Claim Payment	Mar. 1, 2022	57,500	Mar. 1, 2022	57,500
Change in case estimate	Mar. 1, 2022	<i>–500,000</i>	Mar. 1, 2022	<i>–50,000</i>

- (c) (2.5 points) Construct new data triangles with corrections for this claim file.

*Provide the response for this part in the Excel spreadsheet.*

The calendar year 2022 changes for accident years 2016 and prior were:

- 15,700 in paid claims
- –8,500 in case estimates

- (d) (1 point) Calculate calendar year 2022 reported claims, based on corrected data.

*Provide the response for this part in the Excel spreadsheet.*



## GIRR Fall 2023 Question 1 (LOs 1d, 2a, 3d)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11, and 14.

### Question:

**1.**

(6 points) An insurer began writing policies in 2019. You are given the following:

Accident Year	Reported Claims (000)			
	12	24	36	48
2019	1,148	1,783	2,526	3,410
2020	3,427	4,893	6,847	
2021	5,710	12,170		
2022	8,035			

Accident Year	Paid Claims (000)			
	12	24	36	48
2019	138	466	882	1,425
2020	413	1,269	3,148	
2021	689	4,140		
2022	1,286			

It was subsequently discovered that the following claims and their transactions were not captured in the triangles.

Claim ID	Occurrence Date
100	Oct. 11, 2019
200	Jan. 5, 2020
300	Feb. 28, 2021

Trans #	Claim ID	Transaction Date	Transaction Description	Change in Case Estimate (000)	Payment (000)
1	200	Feb. 7, 2020	Open new claim file	17	
2	100	May 12, 2020	Open new claim file	5	
3	300	Mar. 8, 2021	Open new claim file	29	
4	100	Jul. 22, 2021	Payment & change in case estimate	–5	6
5	200	Nov. 13, 2021	Payment & change in case estimate	–13	6
6	300	Jun. 4, 2022	Payment		11

- (a) (3 points) Update both triangles to include the missing transactions.
- (b) (1 point) Identify an anomaly in the triangle of ratios of paid claims to reported claims based on the corrected triangles from part (a).
- (c) (1 point) Describe two operational changes that could have caused the anomaly you identified in part (b).

You are given the following carried IBNR reserves:

IBNR Reserves (000)	
Dec 31, 2019	4,591
Dec 31, 2020	17,722
Dec 31, 2021	38,476
Dec 31, 2022	61,299

- (d) (1 point) Calculate incurred claims for calendar year 2021.

## GIRR Spring 2024 Question 7 (LOs 1d, 3e, 3f, 3g)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 15, 17, 18.

### Question:

**7.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are estimating IBNR for a line of business using the following information:

Accident Year (AY)	Historical Earned Premiums	Premium On-Level Factor	Cumulative Paid Claims	Case Estimates
2021	10,119,409	1.034	5,155,384	457,851
2022	10,552,425	1.020	3,785,833	896,859
2023	10,850,455	1.000	2,247,631	1,306,801

Reported Claim Development Factors by Development Months					
12-24	24-36	36-48	48-60	60-72	72-Ult.
1.445	1.271	1.154	1.073	1.014	1.000

- The expected claim ratio at the 2023 cost level is 76.0%.
- The annual claim ratio trend is 6.1%.
- The annual premium trend is 0%.

- (a) (3.5 points) Calculate the IBNR for each AY as of December 31, 2023 using:
- (i) the Development method,
  - (ii) the Bornhuetter Ferguson method, and
  - (iii) two iterations of the Benktander method.
- (b) (1 point) Explain if this business is performing better or worse than expected for AY 2023 using the methods above.

One of the weaknesses of the Benktander method is that there is no clear guidance with respect to the appropriate number of iterations to perform.

- (c) (0.5 points) Identify one other weakness of the Benktander method.

### GIRR Fall 2024 Question 3 (LOs 1l, 6d, 6e)

#### Learning Outcomes:

- (1l) Understand credibility as used for actuarial work.
- (6d) Calculate loadings for catastrophes and large claims.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 6 and 31.

#### Question:

**3.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) Credibility procedures often require the actuary to exercise professional judgment as the assignment of a credibility value is frequently not a precise mathematical exercise. One consideration in assigning credibility is the volume of claims in the experience set of data.

- (a) (1 point) Identify two other considerations in assigning credibility to an experience set of data.

You are estimating ultimate property claims for ratemaking purposes for State Z. The claims experience of State Z is not fully credible for calculating trend. You are given the following:

Accident Year	Selected Ultimate Claims at 1,000,000 Limit	Selected Ultimate Claims at Total Limits
2021	4,298,400	4,483,200
2022	4,368,900	4,607,900
2023	4,890,200	5,097,900

Selections	1,000,000 Limit	Total Limits
Severity Trend State Z	7.0%	8.6%
Pure Premium Trend State Z	5.5%	6.0%
Credibility State Z	70%	50%
Countrywide Severity Trend	6.0%	7.0%
Countrywide Pure Premium Trend	4.0%	5.0%

- The claim trend period for accident year 2023 is 32 months.

You are given the following loadings for large claims for the 500,000 to 1 million limit:

<b>Accident Year</b>	<b>500,000 to 1 Million Limit</b>
2021	1.196
2022	1.165
2023	1.185

- (b) (3 points) Calculate the loadings for 500,000 to total limits for each accident year.
- (c) (1 point) Recommend a loading for 500,000 to total limits for ratemaking purposes. Justify your recommendation.

**GIRR Fall 2024 Question 4 (LOs 1d, 2a, 2c)****Learning Outcomes:**

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11, and 12.

**Question:****4.***Provide the response for this question in the Excel spreadsheet.*

(6 points) ABC Insurance is a new insurer that started writing business in 2021. You are given:

- One policy was written on the first day of each month from April 2021 to March 2024, for a total of 36 policies.
- Each policy is a two-year policy.
- The two-year premium of 120 per policy is recorded on the effective date of each policy.
- There are no cancellations or changes to policies.
- None of the policies were renewed upon expiration.
- Policies are earned evenly through the policy term.
- The earned premiums are:

Calendar Year	Earned Premiums
2021	225
2022	930
2023	1,425

- (a) (2 points) Verify the earned premiums for calendar years 2021, 2022, and 2023.
- (b) (1 point) Calculate the unearned premiums as of each year-end for 2021, 2022, and 2023.
- (c) (0.5 points) Calculate in-force premiums as of December 31, 2023.

DEF Insurance is another insurer. DEF's total in-force premiums are 50% of ABC's total in-force premiums. A market analyst is comparing total in-force premiums and concludes that DEF has lower written premium volume than ABC Insurance.

- (d) (0.5 points) Describe a scenario where the market analyst's conclusion would be incorrect.

The following claim development triangle is given for ABC Insurance:

Accident Year	Reported Claims		
	12	24	36
2021	68	108	135
2022	279	446	
2023	428		

- (e) (1 point) Calculate the reported claim ratios for each of calendar years 2022 and 2023.

You are also given:

- There is no development beyond 36 months.
- Ultimate claim ratios for accident years 2022 and 2023 are the same as accident year 2021.

- (f) (1 point) Calculate IBNR for accident years 2022 and 2023.



## GI 101 – LEARNING OBJECTIVE 2

### 2. Topic: Preparing Claims and Exposure Data for Actuarial Work

The candidate will demonstrate the ability to prepare claims and exposure data for general insurance actuarial work.

## GIRR Fall 2020 Question 1 (LOs 2a)

### Learning Outcomes:

(2a) Create development triangles of claims and counts from detailed claim transaction data.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 11.

### Question:

- 1.** (4 points) You are given the following information for a line of business that started in 2016:

Accident Year	Reported Claims (000)			
	12	24	36	48
2016	12,800	16,380	18,350	19,080
2017	13,700	17,810	19,590	
2018	15,200	19,150		
2019	14,800			

Accident Year	Paid Claims (000)			
	12	24	36	48
2016	9,730	14,580	17,430	18,300
2017	9,450	15,320	18,410	
2018	10,940	16,090		
2019	11,100			

Accident Year	Case Estimates (000)			
	12	24	36	48
2016	3,070	1,800	920	380
2017	4,250	2,490	1,140	
2018	4,260	2,980		
2019	3,620			

- (a) (1 point) Identify the inconsistencies in the data triangles.

*The response for part (a) is to be provided in the Excel spreadsheet.*

- (b) (0.5 points) Provide one potential cause for the data issue identified in part (a).

ANSWER:

You are provided with the following additional transactions from a single claim that occurred on March 1, 2017 and was not included in the above data:

	<b>Transaction Description</b>	<b>Transaction Date</b>	<b>Case Estimate</b>	<b>Indemnity Payment</b>	<b>ALAE Payment</b>
1	Open new claim file	May 1, 2017	42,000	0	0
2	Payment on reported claim file	Dec. 1, 2017	30,000	10,000	1,000
3	Payment on reported claim file	Jun. 1, 2018	20,000	12,000	2,000

- (c) (1.5 points) Construct revised paid claims and case estimates triangles incorporating this additional information.

*The response for part (c) is to be provided in the Excel spreadsheet.*

- (d) (1 point) Calculate the calendar year 2018 reported claims using the revised triangles from part (c).

*The response for part (d) is to be provided in the Excel spreadsheet.*

**GIRR Fall 2020 Question 9 (LOs 2d, 3e, 3f, 3g)****Learning Outcomes:**

- (2d) Adjust historical earned premiums to current rate levels.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 15 and 19.

**Question:****9.** (8 points)

- (a) (0.5 points) Describe why premium on-level factors are typically used in the Cape Cod method but not in the Bornhuetter Ferguson method.

ANSWER:

- (b) (0.5 points) Describe a situation in which an actuary may choose to derive an adjusted expected pure premium instead of an adjusted expected claim ratio when using the Cape Cod method.

ANSWER:

In selecting a decay factor for the Generalized Cape Cod method, actuaries should consider their confidence in the development method.

- (c) (1 point) Explain why confidence in the development method is a consideration in selecting the decay factor.

ANSWER:

You have been asked to project ultimate claims using the Cape Cod method and have been given the following information as of December 31, 2019:

<b>Accident Year</b>	<b>Earned Premiums (000)</b>	<b>Actual Reported Claims (000)</b>	<b>Reported Cumulative Development Factors</b>
2015	16,100	11,150	1.030
2016	17,600	11,380	1.055
2017	18,300	11,190	1.100
2018	19,800	11,470	1.300
2019	21,600	9,040	1.700

- All policies are written for 12-month policy terms.
- The following rate changes have occurred:
  - 6% effective January 1, 2016
  - 5% effective July 1, 2018
- The annual claim ratio trend is 5%.
- Tort reform resulted in a claim decrease of 10% for all accidents occurring on or after July 1, 2016.
- Accident year 2018 includes one unusually large claim of 600,000 which has been recorded as a case estimate.

- (d) (2 points) Calculate premium on-level factors for each accident year, to use in the Cape Cod method as of December 31, 2019.

*The response for part (d) is to be provided in the Excel spreadsheet.*

- (e) (4 points) Calculate the projected ultimate claims for each accident year using the Cape Cod method.

*The response for part (e) is to be provided in the Excel spreadsheet.*

## GIRR Fall 2020 Question 16 (LOs 2d, 5b, 5e, 6g)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 26, 27, and 32.

### Question:

- 16.** (7 points) You are conducting a ratemaking analysis for an automobile line of business and are given the following information:

Rate Change History	
Effective Date of Rate Change	Rate Change %
July 1, 2015	8.0%
January 1, 2017	10.0%
January 1, 2019	5.0%

- Premiums are written and earned evenly throughout the year.
  - All policies are written for 12-month policy terms.
  - In addition to the above rate changes, there was a regulation change where all premiums in force on July 1, 2017 were required to be reduced by 20%.
- (a) (2 points) Calculate premium on-level factors for accident years 2015-2019 to use for ratemaking purposes.

*The response for part (a) is to be provided in the Excel spreadsheet.*

You are given the following additional information:

<b>Accident Year</b>	<b>Earned Premiums</b>	<b>Ultimate Claims</b>
2015	11,755,570	8,130,150
2016	11,864,520	7,970,110
2017	12,406,530	7,781,380
2018	12,492,860	8,001,680
2019	12,394,530	7,995,960

- The annual premium trend is 1%.
- The annual pure premium trend is 4%.
- The new rates will be effective November 1, 2020 through October 31, 2021.
- The historical data is considered fully credible for ratemaking purposes.
- The regulation change which reduced premiums also reduced claim costs by 20% for all accidents occurring on or after July 1, 2017.

- (b) (2.5 points) Calculate the trended on-level claim ratios for each accident year.

*The response for part (b) is to be provided in the Excel spreadsheet.*

- (c) (1 point) Recommend a trended claim ratio to use for ratemaking. Justify your recommendation.

*The response for part (c) is to be provided in the Excel spreadsheet.*

You are given the following additional information:

- The ratio of ULAE to claims is 10%.
- The ratio of fixed expenses to premiums at current rates is 6%.
- The ratio of variable expenses to premiums is 19%.
- The ratio of profit and contingencies to premiums is 5%.

- (d) (0.5 points) Calculate the indicated rate change.

*The response for part (d) is to be provided in the Excel spreadsheet.*

The purpose of the legislative change effective July 1, 2017 was to reduce increases in premiums arising from poor industry claims experience. As a result, management questions your required increase of 5% in 2019.

- (e) (1 point) Explain why an indicated rate increase of 5% is not necessarily indicative of deteriorating experience.

ANSWER:

### GIRR Spring 2021 Question 1 (LOs 2c, 2d)

#### Learning Outcomes:

- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.
- (2d) Adjust historical earned premiums to current rate levels.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 12 & 13.

#### Question:

**1.**

(4 points) You are calculating on-level earned premiums for a line of business and are given the following information:

- All policies written on or before December 31, 2017 were 6-month policies. These policies were written uniformly throughout the year.
- All policies written or renewed after December 31, 2017 are 12-month policies.
- All new policies are written uniformly throughout the year.
- All policies are earned uniformly through the policy period.
- As of December 31, 2017, there were 2,500 policies in force, with an average annualized premium of 750.
- During calendar year 2018:
  - 80% of the policies in force on December 31, 2017 renewed in 2018, and
  - 2,750 new policies were written in 2018 with an average annualized premium of 780.
- The following historical rate changes were made:
  - 4% increase effective January 1, 2018, and
  - 5% increase effective July 1, 2020.

- (a) (3 points) Calculate the 2018 earned premium.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1 point) Calculate the 2018 on-level earned premium to use for ratemaking.

*Provide the response for this part in the Excel spreadsheet.*



**GIRR Fall 2021 Question 1 (LOs 2c, 2d)****Learning Outcomes:**

- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.
- (2d) Adjust historical earned premiums to current rate levels.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 12 and 13.

**Question:****1.**

(5 points) You are analyzing the following policies:

- Policy #1: 12-month policy first written on November 1, 2019 for a premium of 2,100, renewed in 2020, and in force on December 31, 2020.
- Policy #2: 6-month policy first written on February 1, 2020 for a premium of 720, renewed in 2020, and in force on December 31, 2020.
- Policy #3: 12-month policy first written on April 1, 2020 for a premium of 1,800 and cancelled on November 30, 2020.

There was a premium level increase of 5% for each policy written or renewed after September 1, 2020. All rating characteristics remained the same for each policy at each renewal.

- (a) (1 point) Calculate the 2020 calendar year total written premiums.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1.5 points) Calculate the 2020 calendar year total earned premiums.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Calculate the total unearned premiums as of December 31, 2020.

*Provide the response for this part in the Excel spreadsheet.*

You are calculating 2020 total earned premiums adjusted to the current rate level.

- (d) (1 point) Explain why the parallelogram approach would be inaccurate for this calculation.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (0.5 points) Calculate the 2020 total earned premiums adjusted to the current rate level.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2021 Question 6 (LOs 2d, 3g)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 17, and 19.

### Question:

## 14.

(8 points) You are given the following information for estimating ultimate claims as of December 31, 2020:

Accident Year	Earned Premiums	Paid Claims as of December 31, 2020	Cumulative Development Factors	Projected Ultimate Claims from Development Method
2011	5,787,959	4,930,400	1.036	5,107,894
2012	5,275,346	4,273,000	1.081	4,619,113
2013	4,875,955	2,896,000	1.156	3,347,776
2014	4,823,604	2,864,600	1.279	3,663,823
2015	5,128,880	2,447,000	1.424	3,484,528
2016	5,398,707	1,780,460	1.803	3,210,169
2017	5,175,419	1,395,000	2.530	3,529,350
2018	4,771,338	829,600	3.801	3,153,310
2019	4,563,448	396,900	7.316	2,903,720
2020	4,919,527	180,900	22.168	4,010,191

Rate Change History	
Effective Date	Rate Change
January 1, 2013	6%
July 1, 2016	−3%
January 1, 2020	5%

- All policies are annual and are written and earned evenly throughout the year.
- Tort reform resulted in an estimated claim decrease of 20% for all accidents occurring on or after July 1, 2014.
- The annual claim trend is 0%.

- (a) (1.5 points) Calculate premium on-level factors for all accident years for projecting claim ratios as of December 31, 2020.

*The response for this part is to be provided in the Excel spreadsheet.*

- (b) (3.5 points) Calculate projected ultimate claims for all accident years using the expected method.

*The response for this part is to be provided in the Excel spreadsheet.*

- (c) (3 points) Calculate projected ultimate claims for all accident years using the Cape Cod method.

*The response for this part is to be provided in the Excel spreadsheet*

### GIRR Fall 2021 Question 16 (LOs 2a, 3c, 3d)

#### Learning Outcomes:

- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 11 and 14.

#### Question:

**16.**

(7 points)

- (a) (0.5 points) Define “maturity age” in the context of a claim development triangle.

ANSWER:

You are given the following claim information.

Claim ID	Incremental Paid Claims					
	2018H1	2018H2	2019H1	2019H2	2020H1	2020H2
<b>Occurrence Year: 2018</b>						
1	0	100	250	0	0	75
2	50					
3				0	55	0
4						
<b>Occurrence Year: 2019</b>						
5			190	0	30	
6				0	0	
7			75	0	0	185
<b>Occurrence Year: 2020</b>						
8					0	0
9					0	100
10					0	175

Claim ID	Case Estimates at the End of Each Half Year					
	2018H1	2018H2	2019H1	2019H2	2020H1	2020H2
<b>Occurrence Year: 2018</b>						
1	150	200	75	75	75	0
2	0					
3				315	260	260
4					75	90
<b>Occurrence Year: 2019</b>						
5			35	35	0	
6				225	0	
7			0	0	225	0
<b>Occurrence Year: 2020</b>						
8					250	65
9					25	0
10					275	0

- (b) (3 points) Construct a development triangle of cumulative reported claims, by accident year, with maturity ages 6, 12, 18, 24, 30 and 36 months.

*The response for this part is to be provided in the Excel spreadsheet.*

The above claim information provides claims from the following three lines of business:

- Medical malpractice
  - Workers' compensation
  - Automobile physical damage
- (c) (1.5 points) Select which line of business was the likely source for each of the following claims, providing a justification for each selection:
- (i) Claim 2
  - (ii) Claim 3
  - (iii) Claim 7

*The response for this part is to be provided in the Excel spreadsheet.*

You are given the following general liability development triangle for investigative analysis.

<b>Accident Year</b>	<b>Reported Pure Premiums</b>							
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>	<b>84</b>	<b>96</b>
2013	199	295	394	471	545	586	620	637
2014	196	293	393	469	544	626	618	
2015	170	257	344	419	485	521		
2016	168	258	346	424	494			
2017	178	280	377	468				
2018	190	300	408					
2019	202	321						
2020	271							

- (d) (1 point) Identify two anomalies relating to this triangle.

*The response for this part is to be provided in the Excel spreadsheet.*

- (e) (1 point) Describe a business, operational, or environmental change that could cause each of the anomalies identified in part (d).

*The response for this part is to be provided in the Excel spreadsheet.*

## GIRR Spring 2022 Question 1 (LOs 2c, 2d)

### Learning Outcomes:

- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.
- (2d) Adjust historical earned premiums to current rate levels.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 12 and 13.

### Question:

**1.**

(6 points) You are given the following information for a single line of business:

Calendar Year	Unearned Premiums at End of Year	Earned Premiums
2017	785,000	778,650
2018	792,500	782,020
2019	801,240	789,880

- (a) (0.5 points) Calculate the calendar year 2018 written premiums.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following historical rate changes for this line of business:

Rate Change History	
Effective Date of Rate Change	Overall Rate Change %
Apr. 1, 2016	2.0%
Jul. 1, 2017	4.0%
Oct. 1, 2018	7.0%
Feb. 1, 2020	3.0%

- There have been no additional rate changes after February 1, 2020.
- All policies are written for 12-month terms.



- Premiums are written evenly throughout the year.
  - Premiums are earned evenly throughout the policy term.
- (b) (2 points) Calculate the 2017, 2018, and 2019 on-level earned premiums, applicable for ratemaking, using the parallelogram method.

*Provide the response for this part in the Excel spreadsheet.*

Following an audit of the data for this line of business, it was discovered that the following two policies were not included in the earned premiums given above:

- Policy 1 was written on May 1, 2018, for an annual premium of 5,000.
  - Policy 2 was written on November 1, 2018, for an annual premium of 7,000.
  - Policies 1 and 2 were subject to the overall rate changes from the table above with no additional rating factors.
- (c) (1.5 points) Calculate the 2018 earned premium adjusted to current rate levels for ratemaking purposes for these two policies using the extension of exposures approach.

*Provide the response for this part in the Excel spreadsheet.*

- (d) (1.5 points) Explain why the answer in part (c) results in a different answer from multiplying the 2018 earned premiums for these two policies by the 2018 on-level factor calculated in part (b).

*Provide the response for this part in the Excel spreadsheet.*

Your co-worker recommends combining the on-level earned premiums from part (b) and part (c) for the total on-level earned premiums to use for ratemaking.

- (e) (0.5 points) Critique this recommendation.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2022 Question 2 (LOs 1d, 2a, 3c, 3d)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11 and 14.

### Question:

**2.**

(7 points) You are given the following claim information evaluated as of December 31, 2021.

Accident Year	Reported Claims (000)			
	12	24	36	48
2018	1,196	1,525	1,638	1,723
2019	1,269	1,607	1,908	
2020	1,294	1,707		
2021	1,451			

Accident Year	Reported Counts			
	12	24	36	48
2018	230	250	260	265
2019	235	255	265	
2020	231	251		
2021	234			

You are also informed that the following six claim transactions were not captured in the triangles due to a system error.

Trans #	Claim ID	Transaction Date	Transaction Description	Occurrence Date	Case Estimate (000)	Indemnity Payment (000)	ALAE Payment (000)
1	1020	May 17, 2019	Open new claim file	Apr. 27, 2018	10	5	
2	1377	Nov. 3, 2019	Open & close new claim file	Sep. 15, 2019		50	25
3	1944	Jan. 2, 2021	Close reported claim file	Sep. 15, 2019	-25	10	5
4	2135	Feb. 28, 2021	Change in case estimate	Jan. 6, 2020	65		
5	2260	Apr. 24, 2021	Open new claim file	Feb. 3, 2018	20		
6	2260	June 5, 2021	Close reported claim file	Feb. 3, 2018	-20		20

- (a) (4 points) Update both development triangles shown above to include the claim transactions not captured due to the system error.

*The response for this part is to be provided in the Excel spreadsheet.*

- (b) (0.5 points) Determine calendar year 2021 reported claims.

*The response for this part is to be provided in the Excel spreadsheet.*

Accident year 2021 paid claims and ALAE evaluated as of December 31, 2021, were 800,000.

- (c) (0.5 points) Determine case reserves as of December 31, 2021, for accident year 2021 only.

*The response for this part is to be provided in the Excel spreadsheet.*

You are subsequently given a variety of corrected claim and count triangles and have been asked to conduct investigative tests.

- (d) (1 point) Describe the investigative tests you would recommend using for the following independent situations:
- (iii) The claim department implemented a new definition of claims to distinguish between reported incidents that are valid claims and incidents not covered under the insurance policy.
  - (iv) The claim department implemented a new initiative to increase their use of partial settlements.

*The response for this part is to be provided in the Excel spreadsheet.*

During investigative testing, you observe an increase in average reported claims, with changes greater than the rate of trend going down each column (from accident year to accident year). However, the reported counts are stable.

- (e) (1 point) Provide two examples of company operational changes that could cause an increase in average reported claims without affecting reported counts.

*The response for this part is to be provided in the Excel spreadsheet.*

## GIRR Fall 2022 Question 2 (LOs 2d)

### Learning Outcomes:

(2d) Adjust historical earned premiums to current rate levels.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13.

### Question:

**2.**

(4 points) You are conducting a ratemaking analysis for a personal automobile line of business. You are given the following information:

The following rate changes have occurred since 2017:

Effective Date	Rate Change
July 1, 2017	5.0%
September 1, 2018	−2.0%
February 1, 2020	7.0%
October 1, 2021	3.0%

- There was a regulatory change where all premiums in force on May 1, 2019 were reduced by 10%.
- All policies are written for twelve-month policy terms.
- All policies are assumed to be written uniformly throughout a calendar year.
- New rates will be effective January 1, 2023.
- Calendar year 2019 earned premium is 1,400,000.

- (a) (2 points) Calculate the 2019 earned premium adjusted to current rate levels for ratemaking purposes.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1 point) Explain why the answer to part (a) would be higher if all policies were six-month policies instead of twelve-month policies.

*Provide the response for this part in the Excel spreadsheet.*

The regulator is considering an increase to the state-mandated minimum policy limits effective January 1, 2023. Premiums will change to reflect this policy limits change.

- (c) (1 point) Explain what effect this change would have on the on-level calculation from part (a).

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2022 Question 11 (LOs 2b, 2c)

### Learning Outcomes:

- (2b) Describe the different types of exposures used for conducting actuarial work.
- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 12.

### Question:

## 11.

(5 points) You are given the following information for two policies with exposures that are earned evenly throughout the policy period:

- Policy number 101 is a semi-annual policy written on November 1, 2021.
- Policy number 102 is a two-year policy written on July 15, 2021.

- (a) (1 point) Describe the option(s) for recognizing written exposures on each policy.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (0.5 points) Calculate the percentage premium *earned* on December 31, 2021 for policy number 101.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Calculate the percentage premium *unearned* on December 31, 2021 for policy number 102.

*Provide the response for this part in the Excel spreadsheet.*

For some lines of general insurance, written exposures are not earned evenly throughout the policy term.

- (d) (1.5 points) Explain why a warranty policy is not likely to have exposures earned evenly throughout the policy term.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1.5 points) Describe three types of coverages or policies, other than a warranty policy, where it may not be appropriate to assume premiums are earned evenly throughout the policy term.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2022 Question 18 (LOs 1d, 2a)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3 and 11.

### Question:

## 18.

(5 points) You are given the following claims-made data for Nurses Professional Liability coverage from the claims department.

Report Year	Nurses - Professional Liability						
	Incremental Paid Claims (000) During Calendar Year						
	2015	2016	2017	2018	2019	2020	2021
2015	330	1,380	1,315	577	118	21	5
2016		351	1,855	1,479	428	91	8
2017			436	1,489	1,252	933	168
2018				423	1,592	1,182	670
2019					449	1,675	1,540
2020						354	1,709
2021							584

Report Year	Case Estimates (000) at Evaluation Date						
	Dec. 31, 2015	Dec. 31, 2016	Dec. 31, 2017	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2020	Dec. 31, 2021
2015	1,169	1,368	362	116	21	5	0
2016		1,321	1,348	222	94	23	16
2017			1,456	1,378	689	177	18
2018				1,404	1,349	520	203
2019					1,247	1,701	553
2020						1,543	1,711
2021							1,350

- (a) (1 point) Construct a cumulative reported claim development triangle by report year.

*Provide the response for this part in the Excel spreadsheet.*



- (b) (0.5 points) Calculate the calendar year 2020 reported claims for the coverage above.

*Provide the response for this part in the Excel spreadsheet.*

You are subsequently informed that the following six claim transactions were not captured in the previous dataset.

Trans. #	Transaction Date	Transaction Description	Occurrence Date	Report Date	Change in Case Estimate (000)	Indemnity Payment (000)
1	Aug. 5, 2019	subrogation recovery	May 6, 2017	July 2, 2018		–15
2	Dec. 19, 2019	payment on reported claim file	Mar. 1, 2016	Aug. 27, 2017	–45	45
3	Dec. 28, 2019	open and close new claim file	Oct. 17, 2018	Dec. 23, 2019		10
4	Jan. 28, 2020	payment & change in case estimate	Aug. 1, 2015	Nov. 28, 2016	–20	15
5	Feb. 4, 2021	open new claim file	Sept. 12, 2020	Feb. 3, 2021	30	
6	May 11, 2021	payment on reported claim file with no change in case estimate	June 14, 2017	Apr. 19, 2020		5

- (c) (3 points) Update the reported claim development triangle from part (a) to include the missing claim transactions.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following carried IBNR reserves for the Nurses coverage above:

IBNR Reserves (000)	
December 31, 2020	3,900
December 31, 2021	4,100

- (d) (0.5 points) Calculate the calendar year 2021 incurred claims.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Spring 2023 Question 1 (LOs 2b, 2c, 2d)****Learning Outcomes:**

- (2b) Describe the different types of exposures used for conducting actuarial work.
- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.
- (2d) Adjust historical earned premiums to current rate levels.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 12 and 13.

**Question:****1.***Provide the response for this question in the Excel spreadsheet.*

(5 points) HIJ Insurance writes both 6-month and 12-month policies for a line of business. You are given the following:

- On January 1, 2020, the following policies were in-force:
    - 7,500 6-month policies with an average premium of 400
    - 12,000 12-month policies with an average premium of 750
  - There were no new policies written in 2020, but all in-force policies were renewed upon expiry.
  - All premiums were increased by 5% for policies renewed on or after January 1, 2020.
  - Due to COVID-19, there was a 10% rate reduction effective for all new, renewed, and in-force policies on April 1, 2020.
  - All premiums were increased by 8% for policies written or renewed on or after July 1, 2021.
  - There have been no additional rate changes since July 1, 2021.
  - It is assumed that the key assumptions of the parallelogram method are valid.
- (a) (1 point) State the two key assumptions of the parallelogram method.
- (b) (3.5 points) Calculate the calendar year 2020 on-level premium to be used for a ratemaking analysis.
- (c) (0.5 points) Provide two examples of general insurance policies where exposures are not usually earned evenly throughout the policy term.

## GIRR Spring 2023 Question 2 (LOs 1g, 2a)

### Learning Outcomes:

- (1g) Identify different types of data used for actuarial work.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 4 and 11.

### Question:

**2.**

(5 points) You are constructing claims data files for a ratemaking analysis.

- (a) (1 point) Provide one advantage and one disadvantage to aggregating claims data by policy year.

ANSWER:

- (b) (0.5 points) Provide one disadvantage to aggregating claims data by report year.

ANSWER:

You are given the following claims data aggregated by accident year:

Accident Year	Reported Claims					
	12	24	36	48	60	72
2017	2,147,785	3,025,674	3,620,901	4,136,684	4,362,359	4,382,594
2018	2,219,814	3,071,925	3,876,926	4,331,668	4,596,920	
2019	2,342,602	4,154,013	4,922,135	5,074,225		
2020	2,591,328	3,398,123	4,339,405			
2021	2,582,962	3,768,518				
2022	2,735,738					

<b>Accident Year</b>	<b>Paid Claims</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	1,249,954	2,244,328	3,004,204	3,728,241	4,161,007	4,367,084
2018	1,271,502	2,218,377	3,235,509	3,896,228	4,382,244	
2019	1,346,283	2,368,791	3,339,691	4,154,460		
2020	1,525,699	2,505,764	3,625,546			
2021	1,435,742	2,756,999				
2022	1,589,295					

<b>Accident Year</b>	<b>Reported Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	729	895	998	1,082	1,119	1,122
2018	727	900	1,019	1,089	1,130	
2019	743	911	1,022	1,102		
2020	765	902	1,042			
2021	763	939				
2022	767					

<b>Accident Year</b>	<b>Closed Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	466	697	855	991	1,075	1,118
2018	469	696	877	997	1,085	
2019	474	706	874	1,007		
2020	489	700	896			
2021	491	727				
2022	494					

It was subsequently discovered that a claim file was miscoded in the system as follows:

<b>Transaction</b>	<b>Original</b>		<b>Corrected</b>	
	<b>Date</b>	<b>Amount</b>	<b>Date</b>	<b>Amount</b>
Accident Date	Sep. 22, 2019	n/a	Sep. 22, 2019	n/a
Claim reported to company, case estimate established	<i>Nov. 1, 2020</i>	<i>900,000</i>	<i>Nov. 1, 2019</i>	<i>90,000</i>
Claim Payment	Dec 1, 2020	1,500	Dec 1, 2020	1,500
Claim Payment	Jul. 1, 2021	1,000	Jul. 1, 2021	1,000
Claim Payment	Mar. 1, 2022	57,500	Mar. 1, 2022	57,500
Change in case estimate	Mar. 1, 2022	<i>–500,000</i>	Mar. 1, 2022	<i>–50,000</i>

- (c) (2.5 points) Construct new data triangles with corrections for this claim file.

*Provide the response for this part in the Excel spreadsheet.*

The calendar year 2022 changes for accident years 2016 and prior were:

- 15,700 in paid claims
- –8,500 in case estimates

- (d) (1 point) Calculate calendar year 2022 reported claims, based on corrected data.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2023 Question 1 (LOs 1d, 2a, 3d)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11, and 14.

### Question:

**1.**

(6 points) An insurer began writing policies in 2019. You are given the following:

Accident Year	Reported Claims (000)			
	12	24	36	48
2019	1,148	1,783	2,526	3,410
2020	3,427	4,893	6,847	
2021	5,710	12,170		
2022	8,035			

Accident Year	Paid Claims (000)			
	12	24	36	48
2019	138	466	882	1,425
2020	413	1,269	3,148	
2021	689	4,140		
2022	1,286			

It was subsequently discovered that the following claims and their transactions were not captured in the triangles.

Claim ID	Occurrence Date
100	Oct. 11, 2019
200	Jan. 5, 2020
300	Feb. 28, 2021

Trans #	Claim ID	Transaction Date	Transaction Description	Change in Case Estimate (000)	Payment (000)
1	200	Feb. 7, 2020	Open new claim file	17	
2	100	May 12, 2020	Open new claim file	5	
3	300	Mar. 8, 2021	Open new claim file	29	
4	100	Jul. 22, 2021	Payment & change in case estimate	-5	6
5	200	Nov. 13, 2021	Payment & change in case estimate	-13	6
6	300	Jun. 4, 2022	Payment		11

- (a) (3 points) Update both triangles to include the missing transactions.
- (b) (1 point) Identify an anomaly in the triangle of ratios of paid claims to reported claims based on the corrected triangles from part (a).
- (c) (1 point) Describe two operational changes that could have caused the anomaly you identified in part (b).

You are given the following carried IBNR reserves:

IBNR Reserves (000)	
Dec 31, 2019	4,591
Dec 31, 2020	17,722
Dec 31, 2021	38,476
Dec 31, 2022	61,299

- (d) (1 point) Calculate incurred claims for calendar year 2021.

## GIRR Fall 2023 Question 9 (LOs 2d)

### Learning Outcomes:

(2d) Adjust historical earned premiums to current rate levels.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13.

### Question:

**9.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are conducting a ratemaking analysis and are given the following historical rate change information:

Effective Date of Rate Change	Rate Change
July 1, 2019	3%
July 1, 2020	7%
April 1, 2022	6%

- Premiums are written evenly throughout the year.
  - Premiums are earned evenly throughout the policy term.
  - Prior to January 1, 2020, all policies were written for 12-month terms.
  - Since January 1, 2020, 50% of policies have been written for 12-month terms and 50% of policies have been written for 6-month terms.
  - There have been no rate changes since April 1, 2022.
- (a) (0.5 points) Provide one reason why the company would want to write more 6-month policies in this situation.
- (b) (3 points) Calculate the premium on-level factors for calendar years 2019 through 2022 to use in estimating expected claim ratios for the ratemaking analysis.

You also need to determine premium on-level factors to use in estimating expected claim ratios for reserves as of December 31, 2022.

- (c) (1 point) Explain why the on-level factors needed for reserving would be lower than the on-level factors calculated in part (b).



Premiums also need to be adjusted to ultimate values in certain situations.

- (d) *(0.5 points)* Provide one situation where actuaries would need to determine an estimate of ultimate premiums.

## GIRR Fall 2023 Question 15 (LOs 2c, 2d)

### Learning Outcomes:

- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.
- (2d) Adjust historical earned premiums to current rate levels.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 12 and 13.

### Question:

**15.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are given the following:

Policy Number	Policy Premium	Policy Effective Date	Policy Expiration Date
501	5,000	July 1, 2020	June 30, 2022
502	3,600	April 1, 2021	March 31, 2024
503	2,400	January 1, 2022	December 31, 2024
504	4,800	September 1, 2022	August 31, 2024

- The written premiums are divided into equal annual values and recorded on each anniversary of the effective date.
- Premiums are earned evenly throughout the policy term.
- There were no cancellations.

- (a) (1 point) Calculate the written premiums for 2022.
- (b) (1 point) Calculate the earned premiums for 2022.
- (c) (1 point) Calculate the unearned premiums as of December 31, 2022.

It was subsequently noticed that policy 504 was a motorcycle policy that was priced assuming it was not operated from October 1 through March 31 each year.

- (d) (1 point) Recalculate the 2022 earned premium for policy 504.

- (e) *(0.5 points)* Recalculate the unearned premium as of December 31, 2022 for policy 504.
- (f) *(0.5 points)* Describe why the parallelogram approximation would not be appropriate when adjusting historical premiums to current rate levels for policies such as policy 504.

## GIRR Spring 2024 Question 1 (LOs 2c, 2d)

### Learning Outcomes:

- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.
- (2d) Adjust historical earned premiums to current rate levels.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 12 and 13.

### Question:

**1.**

*Provide the response for this question in the Excel spreadsheet.*

(6 points) ABC Insurance has a book of business with the following information:

- There were 1,000 annual policies in force on January 1, 2022, each with an annual premium of 2,100, and a renewal date of April 1.
- These policies had a renewal rate of 80% on April 1, 2022, and a renewal rate of 70% on April 1, 2023.
- The following four other policies have been written:

Policy Number	Effective Date	Policy Term (months)	Written Premium
100	Mar. 1, 2022	12	3,000
200	May 1, 2022	24	4,200
300	Jul. 1, 2022	18	2,100
400	Sep. 1, 2023	6	1,200

- Policy 100 was renewed on March 1, 2023.
- Policy 300 was cancelled on October 1, 2023.
- Policies 100, 200, and 400 were still in force on December 31, 2023.
- Premiums for all policies written or renewed on or after April 1, 2022, were increased by 5%.
- Premiums for all policies written or renewed on or after April 1, 2023, were increased by 8%.
- ABC earns premium evenly throughout the year.

(a) (2 points) Calculate the total earned premium for calendar year 2022.

- (b) (2 points) Calculate the total unearned premium as of December 31, 2023.

ABC is conducting a ratemaking analysis with new rates to be effective April 1, 2024.

- (c) (1.5 points) Calculate the calendar year 2022 earned premium at current rate levels using the extension of exposures method.
- (d) (0.5 points) State why the parallelogram approach is not as accurate as the extension of exposures method used in part (c).

## GIRR Spring 2024 Question 5 (LOs 1d, 1f, 3g, and 3j)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6f) Explain the requirements for loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate loadings for catastrophes and large claims.
- (6h) Apply loadings for catastrophes and large claims in ratemaking.
- (6j) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6k) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 26, 31, and 32.

### Question:

**5.**

*Provide the response for this question in the Excel spreadsheet.*

(11 points) You are conducting a ratemaking analysis for a line of business in state S with the following information:

- The new rates are to be effective September 1, 2024, through August 31, 2025.
- All policies are written for 6-month policy terms.
- The annual frequency trend is  $-1\%$ .
- The annual severity trend is  $5\%$ .

You are also given the following state S claims data for non-hurricane weather excluding hail:

Accident Year	Ultimate	
	Frequency per 100 earned house years (EHY)	Severity
2014	2.02	4,100
2015	0.39	3,500
2016	1.99	2,900
2017	0.10	4,400
2018	1.99	2,800
2019	0.80	4,200

Accident Year	Ultimate	
	Frequency per 100 earned house years (EHY)	Severity
2020	0.63	2,600
2021	2.73	3,600
2022	0.56	2,100
2023	1.69	3,100

- (a) *(2 points)* Calculate the trended ultimate non-hurricane weather excluding hail pure premium per 100 EHY for all years.
- (b) *(0.5 points)* Recommend the trended ultimate non-hurricane weather excluding hail pure premium per 100 EHY to use in determining a weather loading. Justify your recommendation.

You are given the following additional information:

- Calendar year 2023 earned premiums at current rate level are 13,089,711.
  - Calendar year 2023 EHY are 17,931.
  - State S is part of region R.
  - The trended ultimate pure premium per 100 EHY for region R is 4,000.
  - The credibility that relates to the non-hurricane weather excluding hail loading for state S is 70%.
- (c) *(1 point)* Calculate the non-hurricane weather excluding hail loading percentage to use for ratemaking.

Actuaries can have flexibility in choosing the number of years to include in the experience period for ratemaking purposes.

- (d) *(1 point)* Identify two considerations when choosing the number of years and/or the weights to assign to each of the years.

You are given the following data:

<b>Accident Year</b>	<b>Earned Exposures</b>	<b>Ultimate Counts</b>	<b>Historical Earned Premiums</b>	<b>Ultimate Claims</b>
2019	20,675	1,070	13,510,549	8,709,600
2020	19,937	1,075	13,268,660	8,673,608
2021	17,061	1,074	11,739,370	7,919,295
2022	17,992	1,141	12,638,750	8,605,528
2023	17,931	1,087	13,089,711	9,489,317

The full credibility standard is 3,654 ultimate counts.

- (e) *(1 point)* Recommend the number of years to include when estimating the weighted average trended claim ratio for the indicated rate change. Justify your recommendation.
- (f) *(1 point)* Recommend the weights to assign to each year when estimating the weighted average trended claim ratio for the indicated rate change. Justify your recommendation.

You are given the following additional information:

- Rate change history:
    - A rate change of +3% was effective July 1, 2020
    - A rate change of +4% was effective July 1, 2022
  - Premiums are written and earned evenly throughout the year.
  - The annual premium trend is 0%.
  - The ratio of ULAE to claims is 5%.
  - The ratio of fixed expenses to premiums at current rates is 3%.
  - The ratio of variable expenses to premiums is 12%.
  - The ratio of profit and contingencies to premiums is 4%.
- (g) *(4.5 points)* Calculate the indicated rate change for this line of business.



## GIRR Spring 2024 Question 13 (LOs 2a)

### Learning Outcomes:

(2a) Create development triangles of claims and counts from detailed claim transaction data.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 11.

### Question:

**13.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are given the following data for a line of business from your company's internal data source:

Accident Year	Reported Claims from Internal Data Source					
	12	24	36	48	60	72
2015	2,073,186	2,977,355	3,689,430	4,344,924	4,635,919	4,691,541
2016	2,214,894	3,167,365	4,021,756	4,613,081	4,945,867	5,014,244
2017	2,339,966	3,357,699	4,299,159	4,992,272	5,303,741	5,364,852
2018	2,442,143	3,577,869	4,576,972	5,228,180	5,653,369	5,760,949
2019	2,592,402	3,757,301	4,853,532	5,625,219	6,054,505	
2020	2,817,613	4,182,588	5,212,351	6,024,272		
2021	3,075,951	4,425,866	5,613,235			
2022	3,232,412	4,682,692				
2023	3,554,432					

Accident Year	Cumulative Paid Claims from Internal Data Source					
	12	24	36	48	60	72
2015	1,286,342	2,412,544	3,380,499	4,184,900	4,587,477	4,691,541
2016	1,419,281	2,553,776	3,692,376	4,472,461	4,899,904	5,014,244
2017	1,474,216	2,703,709	3,940,993	4,833,876	5,248,486	5,364,852
2018	1,470,542	2,889,545	4,189,625	5,064,468	5,604,641	5,760,949
2019	1,607,264	2,999,878	4,445,019	5,419,708	5,967,598	
2020	1,747,620	3,387,292	4,766,703	5,724,228		
2021	1,964,983	3,552,637	5,155,384			
2022	1,980,306	3,785,833				
2023	2,247,631					

There is no development beyond 72 months.

Your company reports its data to an industry bureau that aggregates industry data. The industry bureau provided the following summary of the information they received from your company:

<b>Calendar Year (CY)</b>	<b>Claims Paid During CY</b>	<b>Change in Case Estimates During CY</b>
2021	1,762,048	114,622
2022	1,564,355	291,478
2023	2,332,776	–156,760

- (a) (1.5 points) Verify that the change in case estimates during calendar year 2023 from the industry summary should be 223,240.

An investigation into the difference in the numbers found that it was due to an incorrect value reported to the industry bureau.

- (b) (1.5 points) Identify the value that was reported in error to the industry bureau.

You are given the following claims information regarding two claims for a different line of business:

- Claim #4400 is a claim file from an accident that occurred on March 1, 2021 and was reported to the insurer on October 1, 2021. The claim file originally closed in 2022 but was later reopened in 2023. The company does not treat such claims as a new claim, but as reopening the original claim file.
  - Claim #5500 is a claim file from an accident that occurred on July 1, 2021 and was reported to the insurer on February 1, 2022. The adjuster set an initial case estimate of 12,000. Upon further investigation, on February 1, 2023 this claim was found to not be covered under the insurance policy purchased by the insured, and the claim file was closed with no claim payments made.
- (c) (1 point) Construct a *reported* count triangle that reflects the development on these two claim files over time. Make sure to correctly label your triangles.
- (d) (1 point) Construct a *closed* count triangle that reflects the development on these two claim files over time. Make sure to correctly label your triangles.

**GIRR Fall 2024 Question 4 (LOs 1d, 2a, 2c)****Learning Outcomes:**

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (2c) Calculate written, earned, in-force and unearned premiums for portfolios of policies with various policy terms and earnings patterns.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11, and 12.

**Question:****4.***Provide the response for this question in the Excel spreadsheet.*

(6 points) ABC Insurance is a new insurer that started writing business in 2021. You are given:

- One policy was written on the first day of each month from April 2021 to March 2024, for a total of 36 policies.
- Each policy is a two-year policy.
- The two-year premium of 120 per policy is recorded on the effective date of each policy.
- There are no cancellations or changes to policies.
- None of the policies were renewed upon expiration.
- Policies are earned evenly through the policy term.
- The earned premiums are:

Calendar Year	Earned Premiums
2021	225
2022	930
2023	1,425

- (a) (2 points) Verify the earned premiums for calendar years 2021, 2022, and 2023.
- (b) (1 point) Calculate the unearned premiums as of each year-end for 2021, 2022, and 2023.

- (c) (0.5 points) Calculate in-force premiums as of December 31, 2023.

DEF Insurance is another insurer. DEF's total in-force premiums are 50% of ABC's total in-force premiums. A market analyst is comparing total in-force premiums and concludes that DEF has lower written premium volume than ABC Insurance.

- (d) (0.5 points) Describe a scenario where the market analyst's conclusion would be incorrect.

The following claim development triangle is given for ABC Insurance:

Accident Year	Reported Claims		
	12	24	36
2021	68	108	135
2022	279	446	
2023	428		

- (e) (1 point) Calculate the reported claim ratios for each of calendar years 2022 and 2023.

You are also given:

- There is no development beyond 36 months.
- Ultimate claim ratios for accident years 2022 and 2023 are the same as accident year 2021.

- (f) (1 point) Calculate IBNR for accident years 2022 and 2023.

## GIRR Fall 2024 Question 10 (LOs 2a, 3e, 3g)

### Learning Outcomes:

- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 16 and 22.

### Question:

**10.**

*Provide the response for this question in the Excel spreadsheet.*

(7 points) General liability claims may have a long lag between the occurrence date and the report date.

- (a) (0.5 points) Provide an example of another line of business that often has a long lag between the occurrence date and the report date.
- (b) (0.5 points) Provide an example of a line of business where claim files are commonly reopened.

You are given:

Accident Year	Cumulative Paid Claims					
	12	24	36	48	60	72
2018	1,518,006	3,284,534	4,838,338	6,146,551	6,945,034	7,149,672
2019	1,582,770	3,552,084	5,075,462	6,140,083	7,043,201	
2020	1,573,601	3,607,985	4,923,578	6,208,567		
2021	1,608,502	3,404,322	4,897,059			
2022	1,448,977	3,339,496				
2023	1,791,306					

A legislative change became effective July 1, 2021, reducing claim costs 20% for all claims paid on or after this date.

- (c) (2 points) Construct a revised cumulative paid claims triangle adjusted for the legislative change.

You are given:

Accident Year	Projected Earned Exposures	Projected Ultimate Claims
2024	10,600	7,105,054
2025	10,710	7,694,043

- The annual claim frequency trend is expected to be  $-0.3\%$ .
- The annual claim severity trend is expected to be  $7.5\%$ .
- The 2023 cost level claim frequency is  $10.6\%$ .
- The 2023 cost level severity is 5,900.

- (d) (1 point) Verify the projected ultimate claims for accident years 2024 and 2025.

The ultimate claims for all accident years are estimated as:

Accident Year	Projected Ultimate Claims
2018	7,149,672
2019	7,289,724
2020	7,484,846
2021	7,571,028
2022	7,534,985
2023	9,222,361
2024	7,105,054
2025	7,694,043

- (e) (3 points) Calculate the claims expected to be paid in calendar years 2024 and 2025, using the results from part (c).

## GIRR Fall 2024 Question 11 (LOs 2d, 5b, 5e)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13 and 27.

### Question:

**11.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) Your company started writing a new line of business on March 1, 2022. You are conducting a ratemaking analysis for this line of business and are given the following:

<b>Historical Rate Changes Since March 1, 2022</b>	
<b>Effective Date of Rate Change</b>	<b>Rate Change</b>
September 1, 2022	5%
January 1, 2024	7%

- The first policy was issued March 1, 2022.
- Premiums are written evenly throughout the year.
- Premiums are earned evenly throughout the policy term.
- All policies were written for 12-month terms.
- There have been no rate changes since January 1, 2024.
- New rates will be effective April 1, 2025, for one year.
- The annual premium trend is  $-0.5\%$ .

You are adjusting historical earned premiums to the future rating period.

- (a) (3 points) Calculate the on-level premium factors for calendar year 2022 and 2023.
- (b) (2 points) Calculate premium trend factors for calendar year 2022 and 2023.

## GI 101 – LEARNING OBJECTIVE 3

### 3. Topic: Projecting Ultimate Claims

The candidate will know how to calculate and evaluate projected ultimate values.



## GIRR Fall 2020 Question 2 (LOs 3e, 3f, 3g)

### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 18.

### Question:

- 2.** (4 points) You are estimating ultimate claims as of December 31, 2019 using the Bornhuetter Ferguson method, and are given the following information:

Accident Year	Actual Claims as of Dec. 31, 2019		Ultimate Claims from Development Method on		Expected Claims
	Paid	Reported	Paid	Reported	
2016	889,190	898,170	916,755	916,133	889,488
2017	916,340	964,570	1,014,895	1,003,537	998,479
2018	824,940	959,230	1,065,872	1,077,820	1,113,814
2019	586,850	838,362	1,140,237	1,139,829	1,142,919

- (a) (1 point) Calculate the total ultimate claims using the Bornhuetter Ferguson method applied to the following two claim amounts:
  - (i) Paid claims
  - (ii) Reported claims

*The response for part (a) is to be provided in the Excel spreadsheet.*

- (b) (1.5 points) Evaluate the reasonableness of the inputs for the Bornhuetter Ferguson method in part (a) by comparing the following two amounts:
  - (i) Actual paid claims to expected paid claims
  - (ii) Actual reported claims to expected reported claims

*The response for part (b) is to be provided in the Excel spreadsheet.*

- (c) (0.5 points) Identify two reasons that might cause the differences shown in part (b).

ANSWER:

You have decided to estimate ultimate claims as of December 31, 2019 using the Benktander method.

- (d) (0.5 points) Describe a reason why the Benktander method might be preferred to estimate ultimate claims.

ANSWER:

- (e) (0.5 points) Calculate the total ultimate claims applied to paid claims using one iteration of the Benktander method.

*The response for part (e) is to be provided in the Excel spreadsheet.*

**GIRR Fall 2020 Question 7 (LOs 3j)****Learning Outcomes:**

(3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 22.

**Question:**

**7.** (4 points) You are given the following characteristics for two different lines of business:

Line of Business A:

- Twenty years of data available for claims and counts
- Long-tailed coverage
- Volatile claim experience
- Significant annual claim ratio (pure premium) trend of 9%
- Increasing claim frequency over the most recent 10 years
- Policy limits have increased over time

Line of Business B:

- Newer growing line of business with six years of claim data available, but count data is unreliable due to change in definition of a claim count
- Short-tailed coverage
- Relatively stable experience for reported claims except for occasional large claims
- Paid claim experience includes a decrease in claim settlement patterns due to the strain of a growing business

Recommend two methods for projecting ultimate claims that are appropriate for each line of business without repeating any methods. Justify your recommendations for all four methods.

ANSWER:
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**GIRR Fall 2020 Question 9 (LOs 2d, 3e, 3f, 3g)****Learning Outcomes:**

- (2d) Adjust historical earned premiums to current rate levels.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 15 and 19.

**Question:****9.** (8 points)

- (a) (0.5 points) Describe why premium on-level factors are typically used in the Cape Cod method but not in the Bornhuetter Ferguson method.

ANSWER:

- (b) (0.5 points) Describe a situation in which an actuary may choose to derive an adjusted expected pure premium instead of an adjusted expected claim ratio when using the Cape Cod method.

ANSWER:

In selecting a decay factor for the Generalized Cape Cod method, actuaries should consider their confidence in the development method.

- (c) (1 point) Explain why confidence in the development method is a consideration in selecting the decay factor.

ANSWER:

You have been asked to project ultimate claims using the Cape Cod method and have been given the following information as of December 31, 2019:

<b>Accident Year</b>	<b>Earned Premiums (000)</b>	<b>Actual Reported Claims (000)</b>	<b>Reported Cumulative Development Factors</b>
2015	16,100	11,150	1.030
2016	17,600	11,380	1.055
2017	18,300	11,190	1.100
2018	19,800	11,470	1.300
2019	21,600	9,040	1.700

- All policies are written for 12-month policy terms.
- The following rate changes have occurred:
  - 6% effective January 1, 2016
  - 5% effective July 1, 2018
- The annual claim ratio trend is 5%.
- Tort reform resulted in a claim decrease of 10% for all accidents occurring on or after July 1, 2016.
- Accident year 2018 includes one unusually large claim of 600,000 which has been recorded as a case estimate.

- (d) (2 points) Calculate premium on-level factors for each accident year, to use in the Cape Cod method as of December 31, 2019.

*The response for part (d) is to be provided in the Excel spreadsheet.*

- (e) (4 points) Calculate the projected ultimate claims for each accident year using the Cape Cod method.

*The response for part (e) is to be provided in the Excel spreadsheet.*

**GIRR Fall 2020 Question 17 (LOs 3h, 3i)****Learning Outcomes:**

- (3h) Explain the effect of changing conditions on the projection methods cited in (3e).
- (3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 21.

**Question:****17.** (3 points)

- (a) (0.5 points) Provide two different examples of changing conditions that are likely to decrease the latest diagonal of a reported claim triangle.

ANSWER:

- (b) (0.5 points) Describe how an increase in attachment point for an excess of loss reinsurer could affect a reported claim triangle.

ANSWER:

You are analyzing a reported development triangle for a line of business where the ultimate claim ratio is increasing unexpectedly apparently due to inadequate price increases. All other aspects of the business are in a steady-state environment.

- (c) (1 point) Explain what affect the claim ratio deterioration is likely to have on reported claim development factors.

ANSWER:

- (d) *(1 point)* Explain which of the following two methods is likely to produce a more accurate estimate of ultimate claims in recent accident years in this scenario:
- i) the development method applied to reported claims, or
  - ii) the Bornhuetter Ferguson method applied to reported claims.

ANSWER:
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### GIRR Fall 2020 Question 19 (LOs 3e, 3g)

#### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 15 and 20.

#### Question:

- 19.** (4 points) You are estimating ultimate claims for a line of business and need to apply a Berquist-Sherman adjustment for a change in settlement rates. You are given the following information:

Accident Year	Closed Counts excluding Large Claim Counts				
	12	24	36	48	60
2015	618	860	1,042	1,187	1,256
2016	801	1,035	1,273	1,426	
2017	627	882	1,082		
2018	606	929			
2019	699				

Selected Disposal Ratios by Maturity Age				
12	24	36	48	60
0.449	0.688	0.844	0.945	1.000

- (a) (1 point) Calculate the triangle of adjusted closed counts.

*The response for part (a) is to be provided in the Excel spreadsheet.*



You are given the following additional information:

<b>Accident Year</b>	<b>Paid Claims Excluding Large Claims</b>				
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>
2015	756,000	2,101,000	4,562,000	6,689,000	7,213,000
2016	865,000	2,250,000	5,230,000	8,044,000	
2017	696,000	1,967,000	4,601,000		
2018	699,000	2,145,000			
2019	832,000				

<b>Accident Year</b>	<b>Large Claims as of December 31, 2019</b>	
	<b>Paid</b>	<b>Reported</b>
2016	615,000	801,000
2018	297,000	923,000

- A 3-year volume-weighted average is used to select age-to-age development factors.
- There is no development after 60 months.

An exponential curve of the form  $y = ae^{bx}$  can be used to approximate the relationship between cumulative closed counts ( $x$ ) and cumulative paid claims ( $y$ ). You are given the following values for  $a$  and  $b$ :

<b>Accident Year</b>	<b>Parameter "a" Values</b>			
	<b>12&amp;24</b>	<b>24&amp;36</b>	<b>36&amp;48</b>	<b>48&amp;60</b>
2015	55,580	53,863	291,585	1,827,615
2016	32,800	57,432	145,499	
2017	54,100	46,377		
2018	85,287			

<b>Accident Year</b>	<b>Parameter "b" Values</b>			
	<b>12&amp;24</b>	<b>24&amp;36</b>	<b>36&amp;48</b>	<b>48&amp;60</b>
2015	0.00422	0.00426	0.00264	0.00109
2016	0.00409	0.00354	0.00281	
2017	0.00407	0.00425		
2018	0.00347			

- (b) (2.5 points) Calculate total unpaid claims using the development method applied to paid claims, adjusted for changes in settlement rates.

*The response for part (b) is to be provided in the Excel spreadsheet.*

- (c) *(0.5 points)* Assess the appropriateness of relying on the accident year 2019 ultimate claims from part (b) when selecting ultimate claims.

ANSWER:

## GIRR Spring 2021 Question 2 (LOs 3c, 3d)

### Learning Outcomes:

- (3c) Identify the types of development triangles that can be used for investigative testing.  
 (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 14.

### Question:

**2.**

(4 points) You are given the following development triangles for investigative analysis on a book of business:

Accident Year	Ratios of Closed Counts to Reported Counts								
	12	24	36	48	60	72	84	96	108
2012	0.882	0.865	0.895	0.897	0.911	0.956	0.975	1.000	1.000
2013	0.882	0.865	0.895	0.897	0.911	0.956	0.975	1.000	
2014	0.882	0.865	0.895	0.897	0.911	0.951	0.976		
2015	0.882	0.865	0.895	0.897	0.894	0.951			
2016	0.882	0.865	0.895	0.864	0.894				
2017	0.882	0.865	0.825	0.864					
2018	0.882	0.774	0.825						
2019	0.711	0.774							
2020	0.711								

Accident Year	Average Reported Claims								
	12	24	36	48	60	72	84	96	108
2012	882	1,135	1,382	1,564	1,709	1,792	1,856	1,875	1,875
2013	882	1,135	1,382	1,564	1,709	1,792	1,856	1,875	
2014	882	1,135	1,647	1,823	1,964	2,046	2,108		
2015	882	1,135	1,382	1,564	1,709	1,793			
2016	882	1,135	1,382	1,564	1,709				
2017	882	1,135	1,381	1,564					
2018	882	1,135	1,381						
2019	882	1,135							
2020	882								

Accident Year	Average Paid Claims								
	12	24	36	48	60	72	84	96	108
2012	625	1,055	1,324	1,500	1,667	1,678	1,731	1,744	1,800
2013	625	1,055	1,323	1,500	1,667	1,678	1,731	1,744	
2014	625	1,055	1,323	1,500	1,667	1,669	1,731		
2015	625	1,055	1,323	1,500	1,658	1,669			
2016	625	1,055	1,323	1,491	1,657				
2017	625	1,055	1,316	1,491					
2018	625	1,048	1,316						
2019	620	1,048							
2020	620								

Accident Year	Ratios of Paid Claims to Reported Claims								
	12	24	36	48	60	72	84	96	108
2012	0.625	0.804	0.857	0.861	0.889	0.895	0.909	0.930	0.960
2013	0.625	0.804	0.857	0.861	0.889	0.895	0.909	0.930	
2014	0.625	0.804	0.719	0.739	0.773	0.776	0.802		
2015	0.625	0.804	0.857	0.861	0.867	0.884			
2016	0.625	0.804	0.857	0.824	0.867				
2017	0.625	0.804	0.786	0.824					
2018	0.625	0.714	0.786						
2019	0.500	0.714							
2020	0.500								

- The annual claims trend is 0% and experience has generally been stable.

Accident Year 2014 seems to show an anomaly.

- (a) (1.5 points) Provide one possible interpretation of this anomaly. Justify your interpretation.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1 point) Identify another anomaly from the diagnostics.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1.5 points) Provide one possible interpretation of the anomaly you identified in part (b). Justify your interpretation.

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Spring 2021 Question 3 (LOs 3g, 4a, 4b, 4c, 5b, 5c, 5d, 5e)

#### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.
- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16, 23, and 26.

#### Question:

### 3.

(7 points) You are estimating ultimate claims using the development-based frequency-severity method, and are given the following information:

Accident Year	Earned Exposures	Projected Ultimate Based on Development Method		
		Counts	Claims	Severity
2015	25,200	2,088	9,028,629	4,324
2016	26,700	2,194	9,779,132	4,458
2017	25,300	2,063	9,477,060	4,594
2018	24,500	1,983	9,378,997	4,733
2019	23,900	1,933	8,988,618	4,724
2020	24,200	1,709	7,810,625	4,749
<b>Total</b>	<b>149,800</b>	<b>11,970</b>	<b>54,463,061</b>	

You have noticed that the ultimate severity from the development method is not equal to the development method ultimate claims divided by the development method ultimate counts in this case.

- (a) (0.5 points) Explain why this may happen when using the development-based frequency-severity method.

ANSWER:

- (b) (2.5 points) Recommend a claim frequency at the accident year 2020 cost level. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Calculate ultimate claims using the development-based frequency-severity method and the recommended claim frequency from part (b).

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for calculating unpaid ULAE for this line of business:

	12	24	36	48	60	72
Cumulative paid claims development factors by maturity age (months)	11.245	2.017	1.228	1.063	1.010	1.000

Calendar Year	Paid ULAE
2017	738,905
2018	851,350
2019	883,245
2020	879,224
<b>Total</b>	<b>3,352,724</b>

- Ultimate claims are selected from the development-based frequency-severity method.
- You are using the classical paid method with a Mango-Allen smoothing adjustment to estimate unpaid ULAE.
- Approximately 25% of claim department expenses relate to opening a claim file and 75% relate to maintaining and closing a claim file.
- The total case estimate is 4,351,459.
- The total IBNR is 11,117,813.

- (d) (1.5 points) Calculate the expected claims paid for calendar years 2017 through 2020.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1 point) Recommend a ULAE ratio using the classical paid-to-paid method with the Mango-Allen smoothing adjustment. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (0.5 points) Calculate the unpaid ULAE.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Spring 2021 Question 4 (LOs 3i, 4a)****Learning Outcomes:**

- (3i) Assess the appropriateness of the projection methods cited in (e) in varying circumstances.
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 22 and 23.

**Question:****4.**

(5 points) You are an insurance company actuary reviewing year-end reserves for a line of business with the following characteristics:

- The coverage is long-tailed.
- There are five years of company experience available including exposure, premium, rate changes, paid and reported claims, closed and reported claim counts, and paid ULAE.
- Business has been growing steadily over the last five years.
- The annual claim trend is 2%.
- Tort reform was implemented two years ago.
- Industry experience is available for a comparable coverage.

- (a) (1 point) Explain why the development method may not be appropriate for estimating unpaid claims for this coverage.

ANSWER:

- (b) (2 points) Recommend an appropriate method for estimating unpaid claims for this coverage. Justify your recommendation.

ANSWER:

- (c) (1 point) Explain why the classical paid-to-paid method may not be appropriate for estimating unpaid ULAE for this coverage.

ANSWER:



- (d) *(1 point)* Recommend an appropriate method for estimating unpaid ULAE for this coverage. Justify your recommendation.

ANSWER:

### GIRR Spring 2021 Question 9 (LOs 3d, 3f, 3g)

#### Learning Outcomes:

- (3d) Analyze development triangles for investigative testing.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 14 and 20.

#### Question:

**9.**

(6 points) As part of your investigations into IBNR reserves, you are conducting investigative tests for changing levels of case reserve adequacy. You are given the following information:

Accident Year	Reported Claims (000)				
	12	24	36	48	60
2016	32,000	54,000	61,400	70,240	76,000
2017	34,827	58,270	65,388	74,040	
2018	35,998	61,348	72,363		
2019	37,820	67,306			
2020	44,192				

Accident Year	Paid Claims (000)				
	12	24	36	48	60
2016	24,400	42,800	57,600	65,000	72,400
2017	25,965	45,571	61,341	69,225	
2018	28,075	49,276	66,327		
2019	28,824	50,626			
2020	30,891				

<b>Accident Year</b>	<b>Reported Counts</b>				
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>
2016	1,040	1,320	1,480	1,540	1,600
2017	1,061	1,346	1,510	1,571	
2018	1,113	1,413	1,585		
2019	1,091	1,385			
2020	1,136				

<b>Accident Year</b>	<b>Closed Counts</b>				
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>
2016	792	1,092	1,284	1,392	1,540
2017	808	1,114	1,310	1,420	
2018	848	1,169	1,375		
2019	831	1,146			
2020	865				

- The annual severity trend is 5%.
- There is no development after 60 months.

- (a) (1.5 points) Calculate the average case estimate triangle.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1 point) Evaluate whether the average case estimate triangle indicates either decreasing, increasing or stable case reserve adequacy.

*Provide the response for this part in the Excel spreadsheet.*

You have decided to estimate IBNR using the development method with a Berquist-Sherman adjustment.

- (c) (3 points) Calculate IBNR by accident year using the reported development method, with a Berquist-Sherman adjustment.

*Provide the response for this part in the Excel spreadsheet.*

- (d) (0.5 points) Explain why the reported development method without a Berquist-Sherman adjustment would have overstated the IBNR.

ANSWER:

## GIRR Spring 2021 Question 14 (LOs 2d, 3g)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 17, and 19.

### Question:

## 14.

(8 points) You are given the following information for estimating ultimate claims as of December 31, 2020:

Accident Year	Earned Premiums	Paid Claims as of December 31, 2020	Cumulative Development Factors	Projected Ultimate Claims from Development Method
2011	5,787,959	4,930,400	1.036	5,107,894
2012	5,275,346	4,273,000	1.081	4,619,113
2013	4,875,955	2,896,000	1.156	3,347,776
2014	4,823,604	2,864,600	1.279	3,663,823
2015	5,128,880	2,447,000	1.424	3,484,528
2016	5,398,707	1,780,460	1.803	3,210,169
2017	5,175,419	1,395,000	2.530	3,529,350
2018	4,771,338	829,600	3.801	3,153,310
2019	4,563,448	396,900	7.316	2,903,720
2020	4,919,527	180,900	22.168	4,010,191

Rate Change History	
Effective Date	Rate Change
January 1, 2013	6%
July 1, 2016	−3%
January 1, 2020	5%

- All policies are annual and are written and earned evenly throughout the year.
- Tort reform resulted in an estimated claim decrease of 20% for all accidents occurring on or after July 1, 2014.
- The annual claim trend is 0%.

- (a) (1.5 points) Calculate premium on-level factors for all accident years for projecting claim ratios as of December 31, 2020.

*The response for this part is to be provided in the Excel spreadsheet.*

- (b) (3.5 points) Calculate projected ultimate claims for all accident years using the expected method.

*The response for this part is to be provided in the Excel spreadsheet.*

- (c) (3 points) Calculate projected ultimate claims for all accident years using the Cape Cod method.

*The response for this part is to be provided in the Excel spreadsheet*

**GIRR Spring 2021 Question 15 (LOs 3h, 3i)****Learning Outcomes:**

- (3h) Explain the effect of changing conditions on the projection methods cited in (3e).  
(3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 21.

**Question:****15.**

(4 points) You are reviewing estimates of ultimate claims for two books of business where conditions have been changing.

Book of business 1:

- This book is comprised of package policies combining property and liability coverages.
- The liability claims have been increasing at a faster rate than property claims in the most recent three accident years. This change was anticipated and has been appropriately reflected in rates.

Book of business 2:

- This book is comprised of liability coverage only.
- Claim ratios have increased unexpectedly in the most recent two accident years due to an increase in claim frequency which was not anticipated in rates.
- Also, an unusually large claim has been reported in the current accident year.

(a) (2 points) Explain how the changes occurring to book of business 1 might influence the estimates of ultimate claims under each of the following methods:

- (i) The Bornhuetter Ferguson method  
(ii) The frequency-severity method

ANSWER:
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- (b) (2 points) Explain how the changes occurring to book of business 2 might influence the estimates of ultimate claims under each of the following methods:
- (i) The development method applied to reported claims
  - (ii) The Cape Cod method applied to reported claims

ANSWER:
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### GIRR Spring 2021 Question 19 (LOs 3e, 3g, 3j)

#### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 15, 18, and 22.

#### Question:

**19.**

(5 points)

- (a) (1 point) Describe two situations when the Bornhuetter Ferguson method may be preferable to the development method.

ANSWER:

You are given the following information for the purpose of estimating unpaid claims for an automobile insurance line of business:

Accident Year	Earned Premiums (000)	Cumulative Paid Claims (000)					
		12	24	36	48	60	72
2015	23,313	5,108	8,571	11,226	12,960	13,912	14,520
2016	22,459	5,241	8,759	11,451	13,129	14,071	
2017	22,525	5,436	8,640	11,222	12,825		
2018	21,688	5,787	9,153	11,822			
2019	20,743	5,103	7,968				
2020	17,850	3,370					

- The tail factor at 72 months is 1.100.
- The a priori claim ratio for accident years 2015 to 2019 is 65%.



- The a priori claim ratio for accident year 2020 is 60% reflecting a lower expected claim frequency during COVID stay-at-home orders.
- (b) (1 point) Select age-to-age development factors to be used in applying the development method.
- Provide the response for this part in the Excel spreadsheet.*
- (c) (1 point) Estimate ultimate claim ratios as of December 31, 2020 for all accident years using the development method and selections from part (b).
- Provide the response for this part in the Excel spreadsheet.*
- (d) (1 point) Estimate ultimate claim ratios as of December 31, 2020 for all accident years using the Bornhuetter Ferguson method.
- Provide the response for this part in the Excel spreadsheet.*
- (e) (1 point) Recommend unpaid claims by accident year as of December 31, 2020. Justify your recommendations.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Fall 2021 Question 2 (LOs 3a, 3e, 3f, 3g)****Learning Outcomes:**

- (3a) Identify considerations for selecting methods for estimating ultimate claims.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 15, 17 and 18.

**Question:****2.***(7 points)*

- (a) *(0.5 points)* Describe one advantage of using the pure premium approach to the expected method, rather than the claim ratio approach.

ANSWER:

- (b) *(0.5 points)* Describe why reinsurers typically use the claim ratio approach to the expected method, rather than the pure premium approach.

ANSWER:

- (c) *(0.5 points)* Describe why reinsurers often use the expected method rather than the development method.

ANSWER:

The effect of leveraged actuarial factors should be considered when projecting ultimate claims.

- (d) (1 point) Contrast the leveraged nature of cumulative development factors with the leveraged nature of trend factors.

ANSWER:

- (e) (0.5 points) Describe one approach the actuary may consider to moderate the leveraging effect of actuarial factors.

ANSWER:

You are given the following information to estimate ultimate claims as of December 31, 2020.

Report Year	Earned Exposures	Actual Reported Claims	Cumulative Development Factors
2013	12,603	12,974,000	1.042
2014	13,190	13,846,250	1.087
2015	13,631	14,074,250	1.149
2016	13,988	13,332,300	1.235
2017	15,364	14,057,100	1.351
2018	15,949	13,586,400	1.515
2019	16,270	12,601,600	1.754
2020	16,468	10,118,900	2.128
<b>Total</b>	<b>117,464</b>	<b>104,590,800</b>	

The annual claim trend is 3%.

- (f) (2 points) Calculate ultimate claims using the pure premium approach to the expected method.

*The response for this part is to be provided in the Excel spreadsheet.*

- (g) (1 point) Calculate ultimate claims using the Bornhuetter Ferguson method, where the a priori expected claims are the estimated ultimate claims from the expected method in part (f).

*The response for this part is to be provided in the Excel spreadsheet.*

- (h) (1 point) Evaluate the reasonableness of the inputs for the Bornhuetter Ferguson method in part (g).

*The response for this part is to be provided in the Excel spreadsheet.*

**GIRR Fall 2021 Question 6 (LOs 1d, 1f, 3g, 3j)****Learning Outcomes:**

- (1d) Understand the components of ultimate values.
- (1f) Demonstrate the importance of understanding key terminology and interrelationships.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 16 and 22.

**Question:****6.***(4 points)*

- (a) *(0.5 points)* Describe what an *actuarial central estimate* represents according to U.S. ASOPs.

ANSWER:

- (b) *(0.5 points)* Assess the validity of the following statement:

“Credibility is not utilized in projecting unpaid claims for reserving.”

ANSWER:

You are given the following information as of December 31, 2020 for a general liability line of business:

Accident Year	Earned Premiums	Projected Ultimate Claims Based on Frequency-Severity Method	
		Development Based	Claim Closure
2015	7,770,781	5,053,162	5,053,487
2016	8,054,874	5,508,456	5,506,686
2017	8,669,122	5,901,592	5,867,259
2018	9,068,601	6,242,941	6,305,001
2019	9,896,451	6,826,075	7,055,995
2020	10,833,340	7,153,796	7,378,065

You are also given the following diagnostic results:

Accident Year	Reported Claim Ratios					
	12	24	36	48	60	72
2015	52.7%	58.1%	61.3%	63.3%	64.4%	65.0%
2016	54.7%	60.9%	65.3%	66.4%	67.7%	
2017	54.9%	61.3%	65.7%	66.5%		
2018	56.8%	63.9%	65.8%			
2019	56.1%	63.6%				
2020	55.2%					

- (c) (1 point) Calculate the indicated IBNR as of December 31, 2020 for each of the frequency-severity method projections above.

*The response for this part is to be provided in the Excel spreadsheet.*

You are given the following IBNR estimates for an auto insurer's bodily injury liability claims:

Accident Year	IBNR Claim Estimates (000)			
	Development Method		Bornhuetter Ferguson	
	Paid	Reported	Paid	Reported
2016	2,852	2,628	2,825	2,650
2017	4,103	4,218	4,185	4,235
2018	4,352	6,318	4,161	5,511
2019	8,072	7,317	7,767	7,467
2020	11,835	10,664	11,409	11,109

- A large claim was reported in accident year 2018.
- The case estimate on the large claim appears adequate.

- The large claim remains unpaid as of December 31, 2020.
- None of the methods have an explicit adjustment for the large claim.

Company management has asked you to recommend an accident year 2018 IBNR reserve as of December 31, 2020.

- (d) (2 points) Critique the appropriateness of each method as a potential IBNR selection for accident year 2018.
- (v) Paid development method
  - (vi) Reported development method
  - (vii) Paid Bornhuetter Ferguson method
  - (viii) Reported Bornhuetter Ferguson method

*The response for this part is to be provided in the Excel spreadsheet.*

## GIRR Fall 2021 Question 11 (LOs 3e, 3g)

### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 15.

### Question:

## 11.

(4 points) You are given the following information:

Accident Year	Earned Exposures	Reported Claims as of Dec. 31, 2020	Projected Ultimate Based on Development Method	
			Claims	Counts
2014	8,184	10,004,008	10,004,008	347
2015	8,526	10,840,679	10,924,953	364
2016	8,548	11,298,364	11,580,235	367
2017	8,903	12,069,806	12,667,017	384
2018	9,147	12,334,362	13,668,559	399
2019	9,365	11,346,431	14,692,016	407
2020	9,542	5,778,161	16,270,027	436

- For claims occurring prior to 2020, the following trends were observed for this line of business:
    - Annual severity trend of 4.7%
    - Annual frequency trend of 0.5%
  - There was a court ruling that expanded policy coverage for claims occurring in 2020. It was expected to increase claim frequency 6% over the trended historical average but have no effect on claim severity beyond the observed annual severity trend.
- (a) (2.5 points) Calculate the ultimate claims for accident year 2020 using the development-based frequency-severity method. Justify any selections.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (0.5 points) Calculate the percentage growth in accident year 2020 IBNR in changing from the development method to the development-based frequency-severity method.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Explain why the accident year 2020 IBNR calculated using the development-based frequency-severity method is likely to be more appropriate than the IBNR calculated using the development method.

*Provide the response for this part in the Excel spreadsheet.*



**GIRR Fall 2021 Question 12 (LOs 3f, 3h, 3i)****Learning Outcomes:**

- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3h) Explain the effect of changing conditions on the projection methods cited in (3e).
- (3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 21 and 22.

**Question:****12.**

(5 points) Diagnostic reviews can be valuable for actuaries when evaluating projections and selecting ultimate claims.

- (a) (1 point) Describe two diagnostics that can be used to confirm the reasonableness of projected ultimate claims.

ANSWER:

You are analyzing a reported development triangle for a products liability coverage where state-legislated tort reform effective two years ago capped the cost of large claims reported after the effective date of the legislation. All other aspects of the business are in a steady-state environment.

- (b) (1 point) Explain what effect the tort reform is likely to have on reported claim development factors if the data is organized as follows:
  - (iii) On an accident year basis.
  - (iv) On a report year basis.

ANSWER:

(i)

(ii)

- (c) (1 point) Recommend a preferred approach to estimating ultimate claims for each scenario in part (b). Justify your recommendation.

ANSWER:

(i)

(ii)

You are given the following method results for a line of business:

Accident Year (AY)	Paid CDFs	Reported CDFs	Projected Ultimate Claims			
			Expected Method: Reported Claim Ratio	Development Method: Paid Data	Cape Cod Method: Paid Data	Bornhuetter Ferguson Method: Reported Claim Ratio
2013	1.055	1.007	6,303,396	6,710,368	6,696,546	<b>6,422,916</b>
2014	1.133	1.014	7,212,445	7,610,141	7,586,251	7,274,264
2015	1.181	1.049	7,832,913	8,094,627	8,081,606	7,797,684
2016	1.356	1.117	8,716,621	8,868,690	<b>8,880,447</b>	8,570,436
2017	1.660	1.212	9,846,962	9,461,628	9,703,338	9,719,451
2018	2.223	1.373	10,649,381	10,822,452	10,859,544	10,648,168
2019	4.265	1.862	11,950,431	<b>11,666,839</b>	12,090,525	12,025,016
2020	10.807	3.068	<b>13,289,524</b>	11,985,818	13,441,214	13,235,975
<b>Total</b>			<b>75,801,673</b>	<b>75,220,563</b>	<b>77,339,471</b>	<b>75,693,910</b>

- Based on the results of diagnostic testing for this line of business, the data includes a change in case outstanding adequacy.

You are given four accident year selections as follows:

- (i) AY2013: Bornhuetter Ferguson method using reported claim ratio data
  - (ii) AY2016: Cape Cod method using paid claim data
  - (iii) AY2019: Development method using paid claim data
  - (iv) AY2020: Expected method using reported claim ratio data
- (d) (2 points) Assess the appropriateness of each selection (i) to (iv).

ANSWER:

### GIRR Fall 2021 Question 16 (LOs 2a, 3c, 3d)

#### Learning Outcomes:

- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 11 and 14.

#### Question:

**16.**

(7 points)

- (a) (0.5 points) Define “maturity age” in the context of a claim development triangle.

ANSWER:

You are given the following claim information.

Claim ID	Incremental Paid Claims					
	2018H1	2018H2	2019H1	2019H2	2020H1	2020H2
<b>Occurrence Year: 2018</b>						
1	0	100	250	0	0	75
2	50					
3				0	55	0
4						
<b>Occurrence Year: 2019</b>						
5			190	0	30	
6				0	0	
7			75	0	0	185
<b>Occurrence Year: 2020</b>						
8					0	0
9					0	100
10					0	175

Claim ID	Case Estimates at the End of Each Half Year					
	2018H1	2018H2	2019H1	2019H2	2020H1	2020H2
<b>Occurrence Year: 2018</b>						
1	150	200	75	75	75	0
2	0					
3				315	260	260
4					75	90
<b>Occurrence Year: 2019</b>						
5			35	35	0	
6				225	0	
7			0	0	225	0
<b>Occurrence Year: 2020</b>						
8					250	65
9					25	0
10					275	0

- (b) (3 points) Construct a development triangle of cumulative reported claims, by accident year, with maturity ages 6, 12, 18, 24, 30 and 36 months.

*The response for this part is to be provided in the Excel spreadsheet.*

The above claim information provides claims from the following three lines of business:

- Medical malpractice
- Workers' compensation
- Automobile physical damage

- (c) (1.5 points) Select which line of business was the likely source for each of the following claims, providing a justification for each selection:

(iv) Claim 2

(v) Claim 3

(vi) Claim 7

*The response for this part is to be provided in the Excel spreadsheet.*

You are given the following general liability development triangle for investigative analysis.

<b>Accident Year</b>	<b>Reported Pure Premiums</b>							
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>	<b>84</b>	<b>96</b>
2013	199	295	394	471	545	586	620	637
2014	196	293	393	469	544	626	618	
2015	170	257	344	419	485	521		
2016	168	258	346	424	494			
2017	178	280	377	468				
2018	190	300	408					
2019	202	321						
2020	271							

- (d) (1 point) Identify two anomalies relating to this triangle.

*The response for this part is to be provided in the Excel spreadsheet.*

- (e) (1 point) Describe a business, operational, or environmental change that could cause each of the anomalies identified in part (d).

*The response for this part is to be provided in the Excel spreadsheet.*

## GIRR Fall 2021 Question 18 (LOs 1d, 3f, 3g, 4a, 4b)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 15, and 23.

### Question:

## 18.

(6 points) You are projecting ultimate claims as of December 31, 2020 using the paid development method and are given the following data:

Accident Year	Paid Claims (000)							
	12	24	36	48	60	72	84	96
2013	162	517	866	1,171	1,402	1,573	1,716	1,824
2014	171	523	875	1,142	1,372	1,565	1,712	
2015	182	518	876	1,169	1,424	1,610		
2016	190	543	923	1,219	1,460			
2017	198	540	1,082	1,391				
2018	205	560	968					
2019	211	573						
2020	224							

Accident Year	12-24	24-36	36-48	48-60	60-72	72-84	84-96
2013	3.191	1.675	1.352	1.197	1.122	1.091	1.063
2014	3.058	1.673	1.305	1.201	1.141	1.094	
2015	2.846	1.691	1.334	1.218	1.131		
2016	2.858	1.700	1.321	1.198			
2017	2.727	2.004	1.286				
2018	2.732	1.729					
2019	2.716						

Accident year 2017 includes a large claim of 150,000 paid and closed on March 15, 2019. The claim was unusual, and a similar claim is not likely to occur.

- (a) *(1 point)* Select age-to-age development factors for all periods excluding the tail factor. Justify your selections.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

<b>Accident Year</b>	<b>Projected Ultimate Claims from Reported Development Method (000)</b>
2013	1,975
2014	1,974
2015	2,032
2016	2,078
2017	2,234
2018	2,216
2019	2,261
2020	2,295
<b>Total</b>	<b>17,065</b>

- (b) *(1.5 points)* Derive a paid tail factor using Boor's algebraic method.

*Provide the response for this part in the Excel spreadsheet.*

Subsequently, the Chief Actuary provides you with an alternative tail factor of 1.072 based on industry benchmark data.

- (c) *(1 point)* Calculate ultimate claims using the paid development method and the tail factor of 1.072.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for estimating ULAE:

- Selected ultimate claims for each accident year are based on the results from the reported development method shown above (and not the paid development method).
- Actual reported claims as of December 31, 2020 are 14,660,000.

- The selected ratio of calendar year paid unallocated loss adjustment expenses (ULAE) to paid claims is 8%.
- (d) (1 point) Calculate the unpaid ULAE as of December 31, 2020 using the classical paid-to-paid method and a multiplier of 50%.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1 point) Describe the Kittel refinement to the classical paid-to-paid method and the weakness it is designed to address.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (0.5 points) Describe the Mango and Allen smoothing adjustment.

*Provide the response for this part in the Excel spreadsheet.*



## GIRR Spring 2022 Question 2 (LOs 1d, 2a, 3c, 3d)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11 and 14.

### Question:

**2.**

(7 points) You are given the following claim information evaluated as of December 31, 2021.

Accident Year	Reported Claims (000)			
	12	24	36	48
2018	1,196	1,525	1,638	1,723
2019	1,269	1,607	1,908	
2020	1,294	1,707		
2021	1,451			

Accident Year	Reported Counts			
	12	24	36	48
2018	230	250	260	265
2019	235	255	265	
2020	231	251		
2021	234			

You are also informed that the following six claim transactions were not captured in the triangles due to a system error.

Trans #	Claim ID	Transaction Date	Transaction Description	Occurrence Date	Case Estimate (000)	Indemnity Payment (000)	ALAE Payment (000)
1	1020	May 17, 2019	Open new claim file	Apr. 27, 2018	10	5	
2	1377	Nov. 3, 2019	Open & close new claim file	Sep. 15, 2019		50	25
3	1944	Jan. 2, 2021	Close reported claim file	Sep. 15, 2019	-25	10	5
4	2135	Feb. 28, 2021	Change in case estimate	Jan. 6, 2020	65		
5	2260	Apr. 24, 2021	Open new claim file	Feb. 3, 2018	20		
6	2260	June 5, 2021	Close reported claim file	Feb. 3, 2018	-20		20

- (a) (4 points) Update both development triangles shown above to include the claim transactions not captured due to the system error.

*The response for this part is to be provided in the Excel spreadsheet.*

- (b) (0.5 points) Determine calendar year 2021 reported claims.

*The response for this part is to be provided in the Excel spreadsheet.*

Accident year 2021 paid claims and ALAE evaluated as of December 31, 2021, were 800,000.

- (c) (0.5 points) Determine case reserves as of December 31, 2021, for accident year 2021 only.

*The response for this part is to be provided in the Excel spreadsheet.*

You are subsequently given a variety of corrected claim and count triangles and have been asked to conduct investigative tests.

- (d) (1 point) Describe the investigative tests you would recommend using for the following independent situations:
- (i) The claim department implemented a new definition of claims to distinguish between reported incidents that are valid claims and incidents not covered under the insurance policy.
  - (ii) The claim department implemented a new initiative to increase their use of partial settlements.

*The response for this part is to be provided in the Excel spreadsheet.*

During investigative testing, you observe an increase in average reported claims, with changes greater than the rate of trend going down each column (from accident year to accident year). However, the reported counts are stable.

- (e) (1 point) Provide two examples of company operational changes that could cause an increase in average reported claims without affecting reported counts.

*The response for this part is to be provided in the Excel spreadsheet.*

### GIRR Spring 2022 Question 8 (LOs 3c, 3d, 3e, 3g)

#### Learning Outcomes:

- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 14 and 20.

#### Question:

**8.**

(7 points) You are given the following information:

Accident Year	Reported Claims					
	12	24	36	48	60	72
2016	30,847,710	36,970,980	39,804,500	49,934,760	50,877,310	43,481,120
2017	34,029,400	38,856,540	45,646,070	51,501,360	46,739,030	
2018	38,734,090	40,177,840	47,328,140	47,597,670		
2019	39,000,910	39,002,570	40,849,280			
2020	41,845,080	39,427,380				
2021	42,482,430					

Accident Year	Paid Claims					
	12	24	36	48	60	72
2016	10,450,640	17,578,750	24,478,180	28,746,870	31,182,590	37,359,990
2017	10,463,190	18,205,500	24,401,580	30,144,600	36,751,040	
2018	10,407,100	18,712,370	26,582,760	35,904,160		
2019	10,849,930	20,766,690	33,573,290			
2020	11,502,420	23,964,040				
2021	12,921,930					

<b>Accident Year</b>	<b>Reported Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2016	3,272	3,548	3,546	3,733	3,726	3,735
2017	3,275	3,513	3,608	3,693	3,722	
2018	3,391	3,470	3,610	3,671		
2019	3,271	3,417	3,576			
2020	3,344	3,477				
2021	3,290					

<b>Accident Year</b>	<b>Closed Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2016	1,993	2,497	2,881	2,922	3,021	3,548
2017	1,879	2,456	2,726	2,921	3,414	
2018	1,801	2,425	2,796	3,307		
2019	1,780	2,579	3,328			
2020	1,803	2,863				
2021	1,968					

<b>Accident Year</b>	<b>Selected Ultimate Counts</b>
2016	3,735
2017	3,731
2018	3,691
2019	3,707
2020	3,707
2021	3,693

- The claims department has noted that starting in 2021, they increased case estimates and increased the rate of claims settlement.
- The annual claim severity trend is 5%.

There are several diagnostic tests that can be used to confirm that the case estimates have increased.

- (a) (1.5 points) Verify that the case estimates have increased for this line of business using one diagnostic test.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1 point) Describe a different diagnostic test from the test performed in part (a) that may indicate that case estimates have increased for this line of business.

*Provide the response for this part in the Excel spreadsheet.*

The disposal rates can be evaluated to determine if the rate of claims settlement has increased.

- (c) (1.5 points) Evaluate the disposal rates for this line of business to confirm that the rate of claims settlement has increased.

*Provide the response for this part in the Excel spreadsheet.*

- (d) (0.5 points) Recommend disposal rates for each maturity age. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (2.5 points) Calculate the adjusted case estimate triangle for this line of business, adjusting for changes in both case estimates and settlement rates. Justify any selections you make.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Spring 2022 Question 15 (LOs 3e, 3g)****Learning Outcomes:**

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 18 and 19.

**Question:****15.***(6 points)*

- (a) *(0.5 points)* Describe one situation in which the Cape Cod method might be preferred over the Bornhuetter Ferguson method.

ANSWER:
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- (b) *(0.5 points)* Describe one situation in which the Generalized Cape Cod method might be preferred over the Cape Cod method.

ANSWER:
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You are asked to project ultimate claims evaluated as of December 31, 2021, using the Cape Cod method. You are given the following information:

<b>Accident Year</b>	<b>Earned Premiums (000)</b>	<b>Reported Claims as of Dec 31, 2021 (000)</b>	<b>Reported Cumulative Development Factors</b>
2013	29,614	15,795	1.011
2014	27,371	14,119	1.028
2015	27,077	17,998	1.049
2016	28,792	17,630	1.090
2017	30,307	16,178	1.159
2018	29,053	15,699	1.305
2019	26,785	14,231	1.709
2020	25,618	7,963	2.399
2021	27,616	4,910	3.999
<b>Total</b>	<b>252,233</b>	<b>124,522</b>	

- All policies are annual, and they are written and earned evenly throughout the year.
- The annual claim trend is 2%.
- An unusual large claim of 3 million is reported in AY 2019. A similar sized claim is not expected to happen again.
- Rate change history:
  - A rate change of -2% was effective January 1, 2015.
  - A rate change of 4% was effective July 1, 2021.

(c) (2 points) Calculate the adjusted expected claim ratio.

*Provide the response for this part in the Excel spreadsheet.*

(d) (1.5 points) Calculate projected ultimate claims for all accident years.

*Provide the response for this part in the Excel spreadsheet.*

(e) (1.5 points) Calculate expected claims for accident year 2021 using the Generalized Cape Cod approach and a decay factor of 80%.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Spring 2022 Question 18 (LOs 3h, 3i, 3j)****Learning Outcomes:**

- (3h) Explain the effect of changing conditions on the projection methods cited in (3e).
- (3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 21 and 22.

**Question:****18.**

(4 points) When conditions are changing, actuaries sometimes need to substitute one type of data for another type of data that is not affected by the change.

You currently use accident year claim and count development triangles to estimate ultimate claims. However, other policy and claim data are available.

- (a) (2 points) Describe a data substitution that you would make in your analysis to mitigate the problem for each of the following independent scenarios.
  - (i) There is a change in policy limits between successive policy years.
  - (ii) Exposure growth during the past two years has caused a distortion in recent development factors due to significant shifts in the average accident date within each accident year.
  - (iii) A tort reform change two years ago reduced the expected severity of many newly reported claims.
  - (iv) There has been a change in the definition of claim count you typically use for diagnostics.

ANSWER:
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The company you are working for has experienced a recent shift in mix of business within its commercial multi-peril line of business. The severity of liability claims is increasing faster than



property claims. However, the company only captures aggregate claim data on a combined property/liability basis.

- (b) *(1 point)* Describe the effect you expect this shift to have on an accident year claim triangle using reported claims.

ANSWER:

- (c) *(1 point)* Describe an approach to estimating ultimate claims for this business.

ANSWER:

## GIRR Fall 2022 Question 6 (LOs 3g, 3j, 6b, 6c, 6d)

### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).
- (6b) Identify the different types of rate regulatory approaches for general insurance.
- (6c) Describe the purpose of base rates and rating factors and explain how they are used to determine an insured's premium.
- (6d) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 17, 18, 19, 21, 23, and 27.

### Question:

## 6.

(12 points) You are estimating ultimate claims for a long-tailed line of business, and are given the following information:

Accident Year	Earned Exposures	Projected Ultimate Based on Reported Claims Development Method		
		Counts	Claims	Severity
2015	11,090	1,230	5,348,724	4,349
2016	11,250	1,270	5,926,222	4,666
2017	11,460	1,305	6,528,246	5,002
2018	11,770	1,349	7,227,370	5,358
2019	12,070	1,381	8,120,976	5,881
2020	12,360	1,447	9,136,918	6,314
2021	12,480	1,480	9,678,673	6,540
<b>Total</b>	<b>82,480</b>	<b>9,462</b>	<b>51,967,129</b>	

- The annual claim frequency trend is 1%.
- The annual claim severity trend is 6.5%.

- (a) (3 points) Calculate ultimate claims using the development-based frequency-severity method.

*Provide the response for this part in the Excel spreadsheet.*

Diagnostic testing revealed that this line of business has had strengthening of case estimates in calendar year 2021. You are provided with the following additional information:

Accident Year	Reported Claims						
	12	24	36	48	60	72	84
2015	1,906,608	2,666,402	3,459,325	4,177,978	4,782,824	5,202,046	5,274,875
2016	2,023,029	2,921,757	3,795,342	4,577,229	5,158,981	5,763,708	
2017	2,207,357	3,082,180	4,057,723	4,924,637	5,759,272		
2018	2,389,192	3,427,092	4,397,500	5,558,325			
2019	2,550,446	3,683,042	5,107,412				
2020	2,695,059	4,364,690					
2021	3,175,077						

Accident Year	Paid Claims						
	12	24	36	48	60	72	84
2015	734,782	1,253,583	1,905,611	2,640,076	3,434,180	4,178,154	4,637,751
2016	767,982	1,372,261	2,087,061	2,927,979	3,704,517	4,546,408	
2017	799,315	1,350,784	2,259,191	3,126,494	4,007,167		
2018	899,087	1,635,498	2,443,217	3,379,326			
2019	968,418	1,736,844	2,639,562				
2020	1,026,656	1,937,498					
2021	1,082,487						

Accident Year	Reported Counts						
	12	24	36	48	60	72	84
2015	732	865	996	1,095	1,166	1,214	1,222
2016	752	902	1,023	1,125	1,200	1,253	
2017	780	921	1,041	1,167	1,235		
2018	804	961	1,083	1,201			
2019	813	975	1,110				
2020	835	1,024					
2021	875						

Accident Year	Closed Counts						
	12	24	36	48	60	72	84
2015	336	545	730	879	998	1,094	1,138
2016	346	575	747	902	1,027	1,129	
2017	356	575	760	936	1,056		
2018	368	611	794	964			
2019	369	618	807				
2020	380	648					
2021	400						

- (b) (2 points) Construct the reported claims triangle adjusted for the change in case adequacy.

*Provide the response for this part in the Excel spreadsheet.*

You are provided with the following average ultimate reported severities, adjusted for the change in case adequacy:

Accident Year	Ultimate Reported Severities
2015	4,316.59
2016	4,561.67
2017	4,813.61
2018	5,066.25
2019	5,441.62
2020	5,802.31
2021	5,990.39

- (c) (1.5 points) Recommend the revised annual claim severity trend. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (d) (1 point) Explain why you might expect the answer to part (c) to be lower than the original annual severity trend of 6.5%.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (0.5 points) Calculate ultimate claims using the ultimate counts provided and ultimate reported severities adjusted for the change in case adequacy.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (2 points) Calculate expected claims for all accident years using the expected method and your recommended annual claim severity trend from part (c). Justify any selections.

*Provide the response for this part in the Excel spreadsheet.*

- (g) (1 point) Calculate ultimate claims for all accident years using the Bornhuetter Ferguson method.

*Provide the response for this part in the Excel spreadsheet.*

You projected ultimate claims using several methods above.

- (h) (1 point) Recommend the selected ultimate claims for accident year 2021 for this line of business. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Fall 2022 Question 7 (LOs 1j, 3c, 3d)

#### Learning Outcomes:

- (1j) Describe qualitative information required for actuarial work.
- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 5 and 14.

#### Question:

**7.**

(4 points) You are given the following information for an investigative analysis:

Accident Year	Reported Claim Frequency							
	12	24	36	48	60	72	84	96
2014	0.017	0.018	0.019	0.019	0.019	0.019	0.019	0.019
2015	0.018	0.019	0.019	0.019	0.019	0.018	0.018	
2016	0.017	0.018	0.018	0.018	0.018	0.018		
2017	0.018	0.019	0.020	0.020	0.019			
2018	0.015	0.016	0.017	0.018				
2019	0.015	0.015	0.016					
2020	0.014	0.015						
2021	0.013							

You noticed that the claim frequency has been decreasing since accident year 2018.

- (a) (1 point) Describe two operational changes that could have caused this decrease.

ANSWER:

- (b) (0.5 points) Describe one external environmental change that could have caused this decrease.

ANSWER:

You are given the following diagnostic triangle for a different line of business:

Accident Year	Ratios of Paid Claims to Reported Claims							
	12	24	36	48	60	72	84	96
2014	0.205	0.363	0.454	0.575	0.670	0.829	0.902	0.960
2015	0.187	0.357	0.425	0.570	0.667	0.813	0.868	
2016	0.213	0.367	0.442	0.559	0.656	0.772		
2017	0.198	0.359	0.438	0.551	0.614			
2018	0.196	0.373	0.447	0.490				
2019	0.190	0.365	0.375					
2020	0.203	0.295						
2021	0.150							

- (c) (0.5 points) Identify a change in pattern in this triangle.

ANSWER:

- (d) (1 point) Describe two possible operational changes that could have caused the pattern change identified in part (b).

ANSWER:

- (e) (1 point) Describe an additional test to further investigate the change in pattern identified in part (b).

ANSWER:

**GIRR Fall 2022 Question 10 (LOs 3j)****Learning Outcomes:**

(3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 22.

**Question:**

**10.** (4 points) You are the reserving actuary for a workers' compensation book of business with the following characteristics:

- Exposures have decreased over the last ten years.
- Pure premiums have increased in recent years. Rates have not kept up with these increases.
- The frequency trend is stable.
- A new claims department manager was hired July 1, 2021. An initiative to strengthen case adjuster claim estimates was implemented by the new manager.

You are estimating ultimate claims by accident year evaluated as of December 31, 2021. You are considering several different methods for projecting ultimate claims for the two most recent accident years.

- (a) (3 points) Describe two weaknesses in selecting each of the following methods to estimate ultimate claims for these accident years.
- (i) Development Method using reported data.
  - (ii) Generalized Cape Cod Method using reported data.

ANSWER:
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- (b) (1 point) Evaluate the appropriateness of selecting the Expected Method using reported pure premium data to estimate ultimate claims for the two most recent accident years.

ANSWER:
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### GIRR Fall 2022 Question 13 (LOs 3h, 3i)

#### Learning Outcomes:

- (3h) Explain the effect of changing conditions on the projection methods cited in (3e).
- (3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 21.

#### Question:

## 13.

(4 points) You are analyzing the reported development triangle for a liability line of business. The business consists of policies from country Alpha and country Beta. The claims development patterns are assumed to be similar for both countries. Claim amounts from country Beta policies are converted from country Beta currency to country Alpha currency. The analysis is on a combined basis from the two countries because there is an insufficient volume of data for stable development factors from country Beta. The reported triangle used in the analysis includes accident years (AYs) 2014 to 2021. Also, the company's financial reporting is entirely in Alpha currency.

The currency exchange rate is generally fixed and adjusted infrequently. The following table shows the currency exchange rates:

Date	Beta Currency (= 1.00 Alpha Currency)
Jan. 1, 2013 to Dec. 31, 2018	1.02
Jan. 1, 2019 to Dec. 31, 2020	1.15
Jan. 1, 2021 to present	1.30

- Claim payments are converted at the rate in effect when the payment is made.
- Case estimates are converted at the rate in effect at each calendar year-end.
- Premiums are converted at the rate in effect when the policy is written or renewed.

You are given the following additional information:

	Country Alpha	Country Beta
Policy distribution	90%	10%
Expected claims ratio	65%	60%

- The policy distribution is relatively stable over time.

- The claim frequency is similar in both countries.
- The claim frequency trend is zero in both countries.
- Claim severity and severity trend is higher in country Beta than in country Alpha.
- Premium trend is assumed to match claim trend in each country.

You are applying the following projection methods with no special adjustments:

- Development method on reported claims
- Bornhuetter Ferguson method on reported claims with an expected claim ratio of 64.5%

- (a) *(1.5 points)* Critique each of the two methods used for the analysis. Your critique should indicate any potential bias in the methods.

ANSWER:

- (b) *(1.5 points)* Propose an alternative approach or method for analyzing this data that should produce more accurate results. Justify your proposal.

ANSWER:

- (c) *(1 point)* Describe how your responses to parts (a) and (b) would be affected if this were a short-tail line rather than a liability line.

ANSWER:

## GIRR Fall 2022 Question 15 (LOs 3d, 3e, 3g)

### Learning Outcomes:

- (3d) Analyze development triangles for investigative testing.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 15 and 16.

### Question:

## 15.

(6 points) You are analyzing ultimate claims for a long-tailed line of business, and are given the following information:

Accident Year	Earned Exposures
2014	15,262
2015	15,567
2016	15,878
2017	16,354
2018	16,845
2019	17,687
2020	19,456
2021	24,320

Accident Year	Cumulative Paid Claims							
	12	24	36	48	60	72	84	96
2014	311,663	795,722	1,524,180	1,990,256	2,519,542	2,855,100	3,024,598	3,150,859
2015	352,341	930,301	1,580,111	2,104,607	2,700,873	3,066,239	3,334,361	
2016	328,658	1,005,033	1,875,126	2,382,118	2,941,424	3,340,680		
2017	365,949	1,062,531	1,891,013	2,706,041	3,211,463			
2018	484,892	1,196,440	2,104,325	3,005,560				
2019	520,095	1,227,907	2,385,228					
2020	535,233	1,491,676						
2021	766,038							

Accident Year	Paid Claims Age-to-Age Development Factors							
	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-Ult.
2014	2.553	1.915	1.306	1.266	1.133	1.059	1.042	
2015	2.640	1.698	1.332	1.283	1.135	1.087		
2016	3.058	1.866	1.270	1.235	1.136			
2017	2.903	1.780	1.431	1.187				
2018	2.467	1.759	1.428					
2019	2.361	1.943						
2020	2.787							
<b>Selected</b>	<b>2.681</b>	<b>1.827</b>	<b>1.353</b>	<b>1.243</b>	<b>1.135</b>	<b>1.073</b>	<b>1.042</b>	<b>1.000</b>

The selected age-to-age development factors were recommended by your colleague as the simple average of all years.

- (a) (0.5 points) Estimate ultimate claims using paid claims and your colleague's selected age-to-age factors.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (0.5 points) State two concerns with your colleague's selected age-to-age factors.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Explain your rationale for each of the concerns identified in part (b).

*Provide the response for this part in the Excel spreadsheet.*

- (d) (1 point) Recommend alternative selected age-to-age factors for the following. Justify your recommendations.

(i) 12-24

(ii) 36-48

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information, where the selected age-to-age development factors were also recommended by your colleague as the simple average of all years.

Accident Year	Reported Claims							
	12	24	36	48	60	72	84	96
2014	1,088,401	1,741,208	2,337,117	2,631,768	2,873,302	3,049,220	3,131,069	3,161,268
2015	1,161,528	1,901,037	2,526,912	2,874,782	3,135,434	3,337,066	3,454,115	
2016	1,274,210	2,056,524	2,786,565	3,137,931	3,421,518	3,684,648		
2017	1,351,653	2,242,800	3,042,803	3,409,629	3,787,476			
2018	1,545,679	2,512,220	3,394,929	3,878,344				
2019	1,785,869	2,834,493	3,997,935					
2020	2,050,810	3,596,409						
2021	3,028,985							

Accident Year	Reported Claims Age-to-Age Development Factors							
	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-Ult.
2014	1.600	1.342	1.126	1.092	1.061	1.027	1.010	
2015	1.637	1.329	1.138	1.091	1.064	1.035		
2016	1.614	1.355	1.126	1.090	1.077			
2017	1.659	1.357	1.121	1.111				
2018	1.625	1.351	1.142					
2019	1.587	1.410						
2020	1.754							
<b>Selected</b>	<b>1.639</b>	<b>1.357</b>	<b>1.131</b>	<b>1.096</b>	<b>1.067</b>	<b>1.031</b>	<b>1.010</b>	<b>1.010</b>

- (e) (0.5 points) Estimate ultimate claims using reported claims and your colleague's selected age-to-age factors.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (1 point) Provide two reasons why the ultimate claims from part (e) are higher than the ultimate claims from part (a).

*Provide the response for this part in the Excel spreadsheet.*

Your colleague has noted that the latest diagonal of the reported age-to-age development factors triangle has increased significantly and has concluded that there has been an increase in the rate of claim settlement.

- (g) (1.5 points) Evaluate your colleague's conclusion.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2022 Question 17 (LOs 3e, 3f, 3g, 3j)

### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 15, 19, and 22.

### Question:

## 17.

(7 points)

- (a) (0.5 points) Provide two reasons an actuary may want to estimate ultimate ALAE separate from ultimate indemnity.

*Provide the response for this part in the Excel spreadsheet.*

You are asked to project ultimate ALAE evaluated as of December 31, 2021 using the Cape Cod method. You are given the following information:

Accident Year	Earned Exposures	Reported ALAE as of Dec. 31, 2021	Reported ALAE Cumulative Development Factors
2014	24,282	3,617	1.000
2015	25,414	4,159	1.011
2016	26,264	2,256	1.053
2017	26,950	2,410	1.114
2018	28,044	2,051	1.234
2019	29,110	2,672	1.411
2020	29,880	4,900	1.922
2021	30,606	2,699	3.574
<b>Total</b>	<b>220,550</b>	<b>24,764</b>	

- The annual frequency trend is  $-1.5\%$ .

- The annual severity trend is 4.0%.
- Tort reform resulted in an estimated claim decrease of 10% for all claims occurring on or after July 1, 2019.

- (b) (2.5 points) Calculate the adjusted expected pure premium for ALAE (i.e., ALAE cost per exposure) by accident year and in total using the Cape Cod method.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Comment on whether or not the results from part (b) are consistent with the key assumption of the Cape Cod method.

*Provide the response for this part in the Excel spreadsheet.*

- (d) (1.5 points) Calculate the projected ultimate ALAE by accident year using the Cape Cod method.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1 point) Compare actual ALAE as of December 31, 2021 to expected ALAE from the Cape Cod method.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (0.5 points) Assess the actual versus expected results from part (e).

*Provide the response for this part in the Excel spreadsheet.*

- (g) (0.5 points) Describe a scenario where an actuary would likely choose to apply the Generalized Cape Cod method over the Cape Cod method.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Spring 2023 Question 3 (LOs 3e, 3g)****Learning Outcomes:**

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 15.

**Question:****3.**

(5 points) You are estimating ultimate claims as of December 31, 2022 for reserving purposes.

- (a) (0.5 points) State the two key assumptions of the development method.

ANSWER:

- (b) (0.5 points) Describe an advantage of using paid claims instead of reported claims when applying the development method.

ANSWER:

- (c) (0.5 points) Describe an advantage of using reported claims instead of paid claims when applying the development method.

ANSWER:

- (d) (0.5 points) Describe one way you might account for the presence of large claims in the data when applying the development method.

ANSWER:



- (e) (1 point) Describe two ways you might account for limited credibility of the data when applying the development method.

ANSWER:

You are given the following:

Accident Year	Cumulative Paid Claims						
	12	24	36	48	60	72	84
2016	380,408	889,802	1,317,812	1,721,331	2,096,297	2,375,430	2,487,315
2017	450,310	869,371	1,402,540	1,868,637	2,216,571	2,507,208	
2018	348,866	965,278	1,457,682	1,919,642	2,328,436		
2019	367,455	1,019,276	1,546,088	2,091,115			
2020	455,227	1,033,085	1,650,625				
2021	516,038	1,140,537					
2022	408,139						

Accident Year	Projected Ultimate Claims from Reported Development Method
2016	2,513,084
2017	2,665,698
2018	2,809,772
2019	3,033,731
2020	3,200,828
2021	3,372,842
2022	3,500,773

- (f) (2 points) Calculate projected ultimate claims for all accident years using the paid development method.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2023 Question 6 (LOs 3e, 3g)

### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 19.

### Question:

## 6.

(5 points) You are estimating ultimate claims as of December 31, 2022 using the Cape Cod method.

- (a) (0.5 points) Describe why the Cape Cod method may not be appropriate for coverages such as property or automobile collision.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following for a liability line of business:

Accident Year	On-Level Earned Premiums	Paid Claims	Paid Cumulative Development Factors
2017	14,304,922	8,573,426	1.048
2018	14,662,414	8,699,818	1.097
2019	14,826,526	7,732,920	1.326
2020	15,064,165	5,857,706	1.847
2021	15,448,284	3,561,183	3.146
2022	15,630,481	1,395,852	9.473

- The annual claim trend is 5.0%.
- Tort reform reduced claim costs by 20% for all accidents occurring on or after April 1, 2020.

- (b) (3.5 points) Calculate projected ultimate claims using the Cape Cod method applied to paid claims.

*Provide the response for this part in the Excel spreadsheet.*

Projected ultimate claims using the Cape Cod method applied to **reported** claims are significantly less than those calculated in part (b).

- (c) (1 point) Describe two situations that could result in such a difference in Cape Cod projections.

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Spring 2023 Question 7 (LOs 3i, 3j)

#### Learning Outcomes:

- (3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 21.

#### Question:

**7.**

(4 points) You are considering various methods to estimate claim liabilities for accident year 2022 as of December 31, 2022.

Recommend a different estimation method to use with each of the following four independent books of business. Justify your recommendations.

- (i) A long-tailed book where the case estimates were strengthened in 2018.
- (ii) A book that has unstable development patterns and experience that has been improving.
- (iii) A quickly growing book of business that has only been writing business for three years.
- (iv) A medium-tailed book of business where the policy limit was increased from 2 million to 3 million, effective January 1, 2019.

ANSWER:
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## GIRR Spring 2023 Question 11 (LOs 3e, 3g)

### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 20.

### Question:

## 11.

(4 points) You are estimating ultimate claims for a line of business as of December 31, 2022 and are given the following:

Accident Year	Closed Counts						Ultimate Counts
	12	24	36	48	60	72	
2017	399	730	1,007	1,215	1,359	1,365	1,371
2018	417	763	1,063	1,278	1,318		1,330
2019	449	811	1,084	1,213			1,315
2020	459	836	1,077				1,373
2021	498	826					1,421
2022	459						1,413

- Ultimate counts were based on the development method.
- The annual claim severity trend is 5.0%.
- The annual claim frequency trend is 0.2%.

The claims department manager has advised you that there is currently a delay in claims processing.

- (a) (0.5 points) Identify two possible reasons for a delay in claims processing.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1 point) Calculate the disposal ratio triangle for this line of business.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Interpret the results from part (b).

*Provide the response for this part in the Excel spreadsheet.*

You have decided to use a Berquist-Sherman approach to adjust for changing settlement rates. The average paid claim varies only by accident year trend. You are given the following:

Average Paid Claim for Calendar Year 2022					
12	24	36	48	60	72
4,400	5,400	5,785	5,982	6,000	6,125

- (d) (2 points) Calculate the adjusted paid claims triangle.

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Spring 2023 Question 13 (LOs 3c, 3d)

#### Learning Outcomes:

- (3c) Identify the types of development triangles that can be used for investigative testing.  
 (3d) Analyze development triangles for investigative testing.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 14.

#### Question:

## 13.

(5 points) You are estimating ultimate claims for a medium-tailed line of business evaluated as of December 31, 2022. Your reserving software produces the following preliminary estimates based on a simple application of the development method:

Accident Year	Reported Claims						Ultimate Claims
	12	24	36	48	60	72	
2017	4,490,119	6,618,441	8,018,024	9,424,347	9,996,330	10,121,653	10,248,547
2018	4,892,866	6,982,903	8,630,338	10,114,249	10,671,269		10,940,516
2019	5,116,047	7,389,572	9,267,893	10,572,454			11,466,607
2020	5,687,200	8,006,857	10,230,447				12,900,933
2021	6,277,173	9,059,236					14,220,841
2022	6,920,495						15,636,155

Accident Year	Paid Claims						Ultimate Claims
	12	24	36	48	60	72	
2017	1,950,824	4,523,911	6,506,781	8,594,540	9,886,911	10,121,653	10,361,968
2018	2,077,925	4,668,120	7,007,477	9,239,820	10,671,269		11,184,014
2019	2,061,272	4,882,698	7,493,669	10,572,454			12,771,843
2020	2,431,961	5,348,691	8,813,923				14,375,085
2021	2,726,683	6,334,322					15,811,681
2022	2,996,405						17,138,313

Accident Year	Reported Counts						Ultimate Counts
	12	24	36	48	60	72	
2017	1,193	1,488	1,670	1,850	1,921	1,935	1,949
2018	1,204	1,523	1,701	1,864	1,941		1,969
2019	1,229	1,515	1,738	1,874			1,977
2020	1,236	1,554	1,753				2,023
2021	1,278	1,576					2,053
2022	1,273						2,068

Accident Year	Closed Counts						Ultimate Counts
	12	24	36	48	60	72	
2017	616	1,070	1,401	1,715	1,910	1,935	1,960
2018	614	1,096	1,427	1,729	1,941		1,992
2019	623	1,086	1,463	1,874			2,151
2020	627	1,117	1,566				2,227
2021	648	1,211					2,307
2022	696						2,365

The annual claim severity trend for this line of business is 6.2%.

As part of your claims analysis, you are conducting various investigative tests for evaluating potential changes in case reserve adequacy and/or claim settlement patterns.

- (a) (2.5 points) Analyze this data for evidence of a change in case reserve adequacy, using two different investigative tests. Justify your conclusion.

*Provide the response for this part in the Excel spreadsheet.*

Your colleague reviewed the triangle of reported claim ratios for this line of business. The most recent diagonal showed a significant increase and your colleague concluded that this is clear evidence of an increase in case outstanding adequacy.

- (b) (0.5 points) Critique your colleague's conclusion.

*Provide the response for this part in the Excel spreadsheet.*

The ratios of paid to reported claims is one investigative test used to determine if there is evidence of a change in claim settlement patterns.

- (c) (0.5 points) Describe why an increase in the most recent diagonal of the ratios of paid to reported claims triangle may not give a clear indication of such a change.

*Provide the response for this part in the Excel spreadsheet.*



- (d) (1.5 points) Analyze this data for evidence of a change in claim settlement patterns, using an investigative test other than the test described in part (c). Justify your conclusion.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2023 Question 14 (LOs 3g, 5c, 5d)

### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16 and 26.

### Question:

## 14.

(6 points) You are estimating ultimate claims as of December 31, 2022 using the development-based frequency-severity method. You are given the following:

Accident Year	Earned Exposures	Ultimate Counts Based on Development Method	Ultimate Severity Based on Development Method
2017	11,434	1,235	4,104
2018	11,635	1,247	4,384
2019	11,681	1,249	4,751
2020	11,821	1,260	5,066
2021	12,044	1,256	5,531
2022	12,240	1,301	5,897

- The annual claim severity trend is 7.5%.
- The earned exposures are not inflation sensitive.

- (a) (1.5 points) Recommend an annual claim frequency trend to use for the development-based frequency-severity method. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (3.5 points) Estimate ultimate claims for all accident years using the development-based frequency-severity method.

*Provide the response for this part in the Excel spreadsheet.*

There are times when projections from the frequency-severity method are preferred over the development method when used as inputs to the expected method.

- (c) (1 point) Describe two scenarios when projections from the frequency-severity method are preferred.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2023 Question 1 (LOs 1d, 2a, 3d)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 11, and 14.

### Question:

**1.**

(6 points) An insurer began writing policies in 2019. You are given the following:

Accident Year	Reported Claims (000)			
	12	24	36	48
2019	1,148	1,783	2,526	3,410
2020	3,427	4,893	6,847	
2021	5,710	12,170		
2022	8,035			

Accident Year	Paid Claims (000)			
	12	24	36	48
2019	138	466	882	1,425
2020	413	1,269	3,148	
2021	689	4,140		
2022	1,286			

It was subsequently discovered that the following claims and their transactions were not captured in the triangles.

Claim ID	Occurrence Date
100	Oct. 11, 2019
200	Jan. 5, 2020
300	Feb. 28, 2021

Trans #	Claim ID	Transaction Date	Transaction Description	Change in Case Estimate (000)	Payment (000)
1	200	Feb. 7, 2020	Open new claim file	17	
2	100	May 12, 2020	Open new claim file	5	
3	300	Mar. 8, 2021	Open new claim file	29	
4	100	Jul. 22, 2021	Payment & change in case estimate	–5	6
5	200	Nov. 13, 2021	Payment & change in case estimate	–13	6
6	300	Jun. 4, 2022	Payment		11

- (a) (3 points) Update both triangles to include the missing transactions.
- (b) (1 point) Identify an anomaly in the triangle of ratios of paid claims to reported claims based on the corrected triangles from part (a).
- (c) (1 point) Describe two operational changes that could have caused the anomaly you identified in part (b).

You are given the following carried IBNR reserves:

IBNR Reserves (000)	
Dec 31, 2019	4,591
Dec 31, 2020	17,722
Dec 31, 2021	38,476
Dec 31, 2022	61,299

- (d) (1 point) Calculate incurred claims for calendar year 2021.

## GIRR Fall 2023 Question 2 (LOs 3j)

### Learning Outcomes:

(3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 22.

### Question:

- 2.** (5 points) You are given the following estimates of ultimate claims as of December 31, 2022 using various projection methods for paid and reported datasets for ABC Insurance:

Accident Year (AY)	Paid Claims	Estimated Ultimate Claims Derived from Paid Claims			
		Development Method	Frequency-Severity Method	Expected Method	Bornhuetter Ferguson Method
2016	4,061,301	4,213,797	3,713,314	3,621,490	4,192,361
2017	3,886,797	4,184,164	3,962,745	<b>3,785,648</b>	4,155,841
2018	3,473,991	4,362,003	4,194,937	4,031,681	4,294,757
2019	2,634,801	4,567,645	4,428,939	4,369,286	4,483,708
2020	1,668,537	4,583,998	4,706,684	4,614,726	<b>4,603,541</b>
2021	841,930	4,747,208	5,046,721	4,938,526	4,904,595
2022	234,974	4,861,561	5,600,346	5,553,008	5,519,588
<b>Total</b>	<b>16,802,331</b>	<b>31,520,376</b>	<b>31,653,686</b>	<b>30,914,365</b>	<b>32,154,391</b>

Accident Year (AY)	Reported Claims	Estimated Ultimate Claims Derived from Reported Claims			
		Development Method	Frequency-Severity Method	Expected Method	Bornhuetter Ferguson Method
2016	4,286,393	4,408,940	4,521,400	4,507,837	4,411,689
2017	4,481,291	4,741,193	4,824,445	4,712,173	4,739,602
2018	4,206,123	5,012,214	5,107,961	5,018,421	5,013,213
2019	3,595,110	5,437,466	5,396,261	5,438,653	5,437,869
2020	2,701,167	5,733,690	5,731,620	5,744,164	5,739,229
2021	1,772,745	6,159,764	6,145,839	6,147,213	6,150,825
2022	944,060	<b>6,654,576</b>	6,820,458	6,912,087	6,875,555
<b>Total</b>	<b>21,986,889</b>	<b>38,147,843</b>	<b>38,547,984</b>	<b>38,480,548</b>	<b>38,367,982</b>

- The data used in estimating ultimate claims has not been adjusted for any changing conditions in the book of business.
  - Investigative testing indicates that the change in average case outstanding has increased and the change is consistent with claim trend over the historical period.
  - Investigative testing also indicates that the claim settlement rate has decreased significantly in the most recent calendar year.
- (a) (3 points) Evaluate the reasonableness of each of the following methods and datasets for estimating ABC Insurance's ultimate claims:
- (i) Expected method based on paid claims for AY 2017
  - (ii) Bornhuetter Ferguson method based on paid claims for AY 2020
  - (iii) Reported development method for AY 2022

ANSWER:

- (b) (1 point) Recommend ultimate claims from a method and dataset for AY 2021. Justify your recommendation.

ANSWER:

You have adjusted the data to account for any changing conditions and recalculated the ultimate claims estimates.

- (c) (1 point) Evaluate the reasonableness of the AY 2021 ultimate claims estimate using the paid development method after adjustment.

ANSWER:

**GIRR Fall 2023 Question 5 (LOs 3g)****Learning Outcomes:**

(3g) Estimate ultimate values using the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 19.

**Question:****5.**

*Provide the response for this question in the Excel spreadsheet.*

(4 points) You are estimating IBNR as of December 31, 2022, using the Cape Cod method. You are given the following:

Accident Year	On-Level Earned Premiums	Reported Claims	Reported Cumulative Development Factors
2019	15,700	8,200	1.10
2020	15,200	6,200	1.50
2021	15,800	3,500	2.20
2022	16,300	1,500	4.00

- The annual claim trend is 3%.
- A recent court decision has resulted in an estimated claim increase of 10% for all accidents on occurring or after January 1, 2021.

- (a) (3.5 points) Calculate the IBNR for all accident years using the Cape Cod method.
- (b) (0.5 points) Calculate the accident year 2021 IBNR using the Generalized Cape Cod method and a decay factor of 0%.



**GIRR Fall 2023 Question 7 (LOs 3h, 3i)****Learning Outcomes:**

- (3h) Explain the effect of changing conditions on the projection methods cited in (3e).
- (3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 21.

**Question:****7.**

(4 points) You are estimating unpaid claims for lines of business where conditions have been changing.

- (a) (1 point) Explain whether the Bornhuetter Ferguson method or Cape Cod method is more responsive to a deterioration in claims experience.

ANSWER:

A recent court decision has resulted in increased claim payments on private passenger automobile policies effective July 1, 2020.

- (b) (1 point) Describe how this change affects the reported claims development triangle evaluated as of December 31, 2022, assuming the following:
  - (i) The court decision affects only new claims.
  - (ii) The court decision affects new and open claims.

ANSWER:

- (i)

- (ii)

- (c) *(1 point)* Describe why the Cape Cod method could be appropriate when estimating claims under scenario (b)(i) above.

ANSWER:

- (d) *(1 point)* Describe why a Berquist-Sherman data adjustment could be appropriate when estimating claims under scenario (b)(ii) above.

ANSWER:

### GIRR Fall 2023 Question 8 (LOs 3g, 5c, 5d, 5e)

#### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16 and 26.

#### Question:

**8.**

*Provide the response for this question in the Excel spreadsheet.*

(4 points) The two most common models for determining trend rates are linear and exponential.

- (a) (0.5 points) Explain why a linear trend model may not be appropriate when trend is decreasing.

You are given the following:

Accident Year	Earned Exposures	Ultimate Counts	Indicated Claim Frequency
2016	15,859	1,454	9.17%
2017	16,140	1,452	9.00%
2018	16,265	1,457	8.96%
2019	16,319	1,453	8.90%
2020	16,536	1,442	8.72%
2021	16,928	1,464	8.65%
2022	16,842	1,475	8.76%

Indicated annual trend, using an exponential model	
All years	−0.86%
AY2017-AY2022	−0.74%
AY2016-AY2021	−1.11%

- (b) *(0.5 points)* Recommend an annual claim frequency trend to use for this line of business. Justify your recommendation.

You are also given the following:

Accident Year	Ultimate Severity
2016	3,750
2017	3,993
2018	4,230
2019	4,489
2020	4,679
2021	5,048
2022	5,409

- The annual severity trend is 6.0%.
  - Ultimate counts and ultimate severity were determined based on the development method.
- (c) *(3 points)* Calculate projected ultimate claims using the development-based frequency-severity method and your recommended annual claim frequency trend.

### GIRR Fall 2023 Question 10 (LOs 3e, 3g)

#### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 17 and 18.

#### Question:

**10.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are estimating ultimate claims.

- (a) (0.5 points) Describe two situations where the expected method is most often used when estimating ultimate claims.
- (b) (0.5 points) Describe the primary assumption of the expected method.

You are given the following as of December 31, 2022.

Accident Year (AY)	Reported Claims (000)					Projected Ultimate Claims (000) Based on Development Method
	12	24	36	48	60	
2018	6,750	8,295	9,780	10,670	10,990	11,753
2019	7,375	9,268	10,843	11,808		13,006
2020	8,000	10,240	12,083			14,507
2021	8,625	11,213				15,836
2022	9,250					16,544

<b>Calendar Year</b>	<b>Earned Premiums (000)</b>	<b>Earned Exposures (000)</b>	<b>Premium On Level Factors</b>
2018	14,750	195	1.103
2019	15,895	205	1.098
2020	17,400	225	1.060
2021	18,705	235	1.034
2022	20,010	236	1.000

The annual trend rate for claim ratios and pure premiums is 3%.

- (c) *(1.5 points)* Calculate the expected claim ratios for each year at the 2022 cost level using reported claims.
- (d) *(0.5 points)* Calculate the pure premiums for each year at the 2022 cost level using reported claims.
- (e) *(2 points)* Calculate the accident year 2021 ultimate claims using the Bornhuetter Ferguson method and:
  - (i) A selected expected claim ratio of 82% at the 2022 cost level
  - (ii) A selected pure premium of 69 at the 2022 cost level

### GIRR Fall 2023 Question 13 (LOs 3e, 3f, 3g)

#### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 15.

#### Question:

**13.**

*Provide the response for this question in the Excel spreadsheet.*

(4 points) You are given the following:

Accident Year	Reported Claims (000)						
	12	24	36	48	60	72	84
2016	1,826	2,742	2,948	3,174	3,239	3,248	3,248
2017	2,296	3,656	3,928	4,230	4,458	4,506	
2018	3,064	4,932	5,465	6,104	6,373		
2019	2,327	3,675	4,522	5,124			
2020	2,691	4,495	4,924				
2021	2,497	5,025					
2022	3,740						

Accident Year	Age-to-Age Factors					
	12-24	24-36	36-48	48-60	60-72	72-84
Volume-weighted average (all years)	1.668	1.117	1.105	1.042	1.007	1.000

- There is no development beyond 84 months.
- The reported claims history includes two large claims.
- Large claim #1 occurred on July 1, 2019 and was reported on January 20, 2021. The initial case estimate was 500,000.

- Large claim #2 occurred on September 10, 2021 and was reported on March 2, 2022. The initial case estimate was 1.0 million.
- These large claims have not had any payments made or adjustments to case estimates as of December 31, 2022.

Your colleague recommends using the volume-weighted average of all years for age-to-age development factors.

- (a) *(0.5 points)* Identify a potential problem with your colleague's recommendation.
- (b) *(0.5 points)* Describe an alternative approach to your colleague's recommendation.
- (c) *(2.5 points)* Estimate total ultimate claims based on the development method and your alternative from part (b).
- (d) *(0.5 points)* Describe how you would adjust for the large claims when estimating ultimate claims based on the paid development method for this line of business.



## GIRR Fall 2023 Question 14 (LOs 3c, 3d)

### Learning Outcomes:

- (3c) Identify the types of development triangles that can be used for investigative testing.
- (3d) Analyze development triangles for investigative testing.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 14 and 20.

### Question:

**14.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are analyzing a triangle of average reported claims. There are several actions that could result in shifts in reported claim patterns. One example is a new approach to setting case estimate amounts.

- (a) (1 point) Identify two other examples of actions that could result in shifts in a reported claim pattern.

You are given the following:

Accident Year	Reported Claims					
	12	24	36	48	60	72
2017	3,258,495	4,632,313	5,665,417	6,660,535	7,372,368	7,702,277
2018	3,556,049	4,925,302	6,252,176	7,431,788	8,060,259	
2019	3,798,926	5,378,090	6,921,131	8,051,684		
2020	4,174,496	6,013,059	7,664,425			
2021	4,854,244	6,611,842				
2022	5,320,155					

<b>Accident Year</b>	<b>Paid Claims</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	1,227,967	2,870,190	4,218,215	5,649,515	6,801,540	7,532,219
2018	1,254,169	2,975,612	4,720,518	6,197,891	7,435,993	
2019	1,406,648	3,267,932	5,029,042	6,714,834		
2020	1,575,637	3,453,821	5,616,379			
2021	1,667,172	3,913,397				
2022	1,754,839					

<b>Accident Year</b>	<b>Reported Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	705	864	996	1,080	1,147	1,185
2018	733	883	1,018	1,112	1,181	
2019	734	900	1,028	1,148		
2020	756	928	1,077			
2021	773	947				
2022	789					

<b>Accident Year</b>	<b>Closed Counts</b>					
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>
2017	310	571	780	938	1,077	1,179
2018	327	581	797	967	1,109	
2019	323	587	802	1,000		
2020	334	605	845			
2021	353	622				
2022	352					

- The annual claim severity trend is 6.3%.

Your colleague has assumed that case reserve adequacy was strengthened in calendar year 2021.

- (b) (1.5 points) Verify your colleague's assumption.

Your colleague recommends using the calendar year 2021 diagonal to adjust for a change in case reserve adequacy.

- (c) (0.5 points) Critique your colleague's recommendation.
- (d) (2 points) Construct a reported claims triangle adjusted for the change in case adequacy, basing the adjustments on the calendar year 2022 diagonal.

## GIRR Spring 2024 Question 2 (LOs 3e, 3g)

### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 15.

### Question:

**2.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are estimating ultimate claims as of December 31, 2023 for a line of business that has seasonality.

Accident Half-Year	Reported Claims							
	6	12	18	24	30	36	42	48
2020-1	1,778,236	1,817,664	1,906,195	1,918,947	1,938,911	1,949,451	1,951,269	1,951,269
2020-2	1,801,831	1,896,710	1,942,431	1,969,627	1,990,982	2,002,627	2,004,998	
2021-1	1,930,879	1,983,793	2,069,155	2,084,933	2,109,125	2,121,231		
2021-2	1,944,003	2,034,385	2,091,282	2,125,691	2,146,588			
2022-1	2,075,131	2,126,932	2,205,071	2,220,455				
2022-2	2,137,034	2,253,530	2,273,987					
2023-1	2,243,409	2,283,355						
2023-2	2,451,221							

There is no development after 48 months.

- (a) (2.5 points) Calculate the ultimate claims for accident year 2023 using the development method. Justify your selections.
- (b) (1 point) Calculate the accident year 2023 expected reported claims from December 31, 2023 to June 30, 2024.

Some lines of business require a tail factor.

- (c) *(0.5 points)* Describe one disadvantage of the Bondy method.
- (d) *(1 point)* State one advantage and one disadvantage of Boor's algebraic method.

**GIRR Spring 2024 Question 4 (LOs 3e, 3f)****Learning Outcomes:**

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 17.

**Question:****4.***(4 points)*

- (a) *(0.5 points)* Provide one reason why the expected method is preferred over the development method when estimating ultimate claims for a new line of business.

ANSWER:

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

ANSWER:

You are estimating ultimate claims as of December 31, 2023, using the expected method. You have estimated trended on-level claim ratios at 2023 cost levels for all accident years.

- (c) *(1 point)* Provide two reasons why the trended on-level claim ratio for accident year 2023 might be excluded when selecting the 2023 cost level expected claim ratio.

ANSWER:

- (d) (2 points) Explain the steps you would follow to apply the expected method to estimate ultimate salvage received for a collision line of business.

ANSWER:

### GIRR Spring 2024 Question 7 (LOs 1d, 3e, 3f, 3g)

#### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 15, 17, 18.

#### Question:

**7.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are estimating IBNR for a line of business using the following information:

Accident Year (AY)	Historical Earned Premiums	Premium On-Level Factor	Cumulative Paid Claims	Case Estimates
2021	10,119,409	1.034	5,155,384	457,851
2022	10,552,425	1.020	3,785,833	896,859
2023	10,850,455	1.000	2,247,631	1,306,801

Reported Claim Development Factors by Development Months					
12-24	24-36	36-48	48-60	60-72	72-Ult.
1.445	1.271	1.154	1.073	1.014	1.000

- The expected claim ratio at the 2023 cost level is 76.0%.
- The annual claim ratio trend is 6.1%.
- The annual premium trend is 0%.

- (a) (3.5 points) Calculate the IBNR for each AY as of December 31, 2023 using:
- (i) the Development method,
  - (ii) the Bornhuetter Ferguson method, and
  - (iii) two iterations of the Benktander method.
- (b) (1 point) Explain if this business is performing better or worse than expected for AY 2023 using the methods above.

One of the weaknesses of the Benktander method is that there is no clear guidance with respect to the appropriate number of iterations to perform.

- (c) (0.5 points) Identify one other weakness of the Benktander method.



**GIRR Spring 2024 Question 9 (LOs 3e, 3j)****Learning Outcomes:**

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 19 and 22.

**Question:****9.***(3 points)*

- (a) *(1 point)* Describe two differences between the Cape Cod method and the Generalized Cape Cod method for estimating ultimate claims.

ANSWER:

The Cape Cod method is similar to the Bornhuetter Ferguson method in that it is a blend of the development and expected methods.

- (b) *(1 point)* Describe two major differences between the Bornhuetter Ferguson and Cape Cod methods.

ANSWER:

- (c) *(1 point)* Describe two advantages that blended methods provide when evaluating and selecting estimates of ultimate claims.

ANSWER:

## GIRR Spring 2024 Question 10 (LOs 3d, 3e, 3g)

### Learning Outcomes:

- (3d) Analyze development triangles for investigative testing.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 14 and 20.

### Question:

## 10.

*Provide the response for this question in the Excel spreadsheet.*

(7 points) You are estimating ultimate claims for a line of business as of December 31, 2023. Your reserving software produces the following preliminary estimates based on age-to-age development factors.

Accident Year	Reported Claims						Ultimate Claims
	12	24	36	48	60	72	
2018	2,547,815	3,882,690	4,892,823	5,569,866	5,949,436	6,457,536	7,009,030
2019	2,838,865	4,127,622	5,006,184	5,807,333	6,766,801		7,971,966
2020	2,937,668	4,227,315	5,435,742	6,403,965			8,424,818
2021	3,135,121	4,466,810	5,821,531				8,875,100
2022	3,231,963	4,537,564					8,754,568
2023	3,311,902						9,259,675

Accident Year	Cumulative Paid Claims						Ultimate Claims
	12	24	36	48	60	72	
2018	1,473,977	2,934,650	4,236,143	5,227,761	5,923,948	6,457,536	7,039,187
2019	1,706,744	3,161,169	4,325,672	5,447,559	6,761,362		8,034,251
2020	1,733,016	3,228,227	4,689,331	6,256,636			8,826,037
2021	1,851,625	3,385,403	5,483,690				9,869,855
2022	1,838,698	3,759,628					9,954,417
2023	2,081,240						10,557,046

Accident Year	Reported Counts						Ultimate Counts
	12	24	36	48	60	72	
2018	886	1,138	1,298	1,392	1,457	1,471	1,485
2019	899	1,134	1,275	1,392	1,464		1,492
2020	893	1,128	1,297	1,402			1,499
2021	909	1,117	1,299				1,503
2022	908	1,113					1,474
2023	899						1,491

Accident Year	Closed Counts						Ultimate Counts
	12	24	36	48	60	72	
2018	574	862	1,070	1,210	1,319	1,471	1,641
2019	589	862	1,048	1,209	1,436		1,786
2020	581	862	1,066	1,331			1,885
2021	593	847	1,199				2,000
2022	587	928					1,977
2023	626						1,990

- This line of business was stable prior to 2023.
- New procedures for processing and settling claims were introduced in 2023.
- Ultimate estimates shown above are based on simple development methods.

- (a) (2 points) Perform two diagnostic tests to confirm that there was a change in claim settlement patterns in 2023.

The annual claim severity trend is 5%.

- (b) (1 point) Perform one diagnostic test to determine whether there was a change in case adequacy in 2023.

You have decided to use Berquist-Sherman adjustments to allow for changes in the claim settlement rates. Your analysis indicates that there is a simple relationship between cumulative paid claims and cumulative closed counts for all accident and development years. The ratio of cumulative paid claims to cumulative closed counts is 4,400.

- (c) (2 points) Calculate the adjusted paid claims triangle.
- (d) (0.5 points) Describe an alternative approach that could be used for determining ratios of paid claims to cumulative closed counts.
- (e) (0.5 points) Describe a possible problem with the alternative approach identified in part (d).

Your colleague recommends using the Berquist-Sherman approach that adjusts for both a change in case adequacy and a change in claim settlement patterns for this line of business.

- (f) (1 point) Critique your colleague's recommendation.

### GIRR Spring 2024 Question 11 (LOs 3h, 3i)

#### Learning Outcomes:

- (3h) Explain the effect of changing conditions on the projection methods cited in (e)
- (3i) Assess the appropriateness of the projection methods cited in (e) in varying circumstances

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 21.

#### Question:

## 11.

(4 points) You are estimating unpaid claims for lines of business where conditions have been changing.

A legislative reform limiting claim payments was implemented effective July 1, 2020.

- (a) (1 point) Describe how this reform would affect the reported claims development triangle evaluated as of December 31, 2023, assuming the following:
  - (i) The reform affected only new claims.
  - (ii) The reform affected new and open claims.

ANSWER:

- (b) (1 point) Describe why the expected method could be well-suited to estimate claims under scenario (a)(i) above.

ANSWER:

- (c) (1 point) Describe why a Berquist-Sherman data adjustment could be well-suited to estimate claims under scenario (a)(ii) above.

ANSWER:

- (d) *(0.5 points)* Describe whether this reform would affect indemnity, ALAE, ULAE, or some combination.

ANSWER:

- (e) *(0.5 points)* Describe whether this reform would affect paid data, reported data, or both paid and reported data.

ANSWER:

## GIRR Spring 2024 Question 12 (LOs 3g, 5c, 5d)

### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16 and 26.

### Question:

**12.**

*Provide the response for this question in the Excel spreadsheet.*

(7 points) You are estimating ultimate claims for a line of business as of December 31, 2023 using the development-based frequency-severity method.

- (a) (1 point) Describe two options to consider when experience is not fully credible for trending.

You are given the following additional information:

Accident Year	Earned Exposures	Projected Ultimate Counts Based on	
		Closed Counts	Reported Counts
2018	16,451	1,641	1,485
2019	16,557	1,786	1,492
2020	16,815	1,885	1,499
2021	16,915	2,000	1,503
2022	17,147	1,977	1,474
2023	17,461	1,990	1,491

- This line of business was stable prior to 2023, when new claims processing and settlement policies were introduced in 2023.
  - Ultimate estimates shown above are based on simple development methods.
- (b) (1.5 points) Recommend the annual claim frequency trend to use for this line of business. Justify your recommendation.

- (c) *(1.5 points)* Calculate the ultimate counts using the development-based frequency-severity method with your selected frequency trend from part (b). Justify any selections.

You are given the following additional information:

<b>Accident Year</b>	<b>Projected Ultimate Severity Based on</b>	
	<b>Paid Severity</b>	<b>Reported Severity</b>
2018	4,390	4,719
2019	4,602	5,342
2020	4,789	5,618
2021	5,085	5,857
2022	5,196	5,923
2023	5,456	6,168

The annual claim severity trend is 5%. The selected trend rate should recognize economic trend.

- (d) *(0.5 points)* State one other influence that the trend rate should also recognize.
- (e) *(2.5 points)* Calculate the ultimate claims using the development-based frequency-severity method. Justify any selections.

## GIRR Fall 2024 Question 2 (LOs 3e, 3f, 3g)

### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 15 and 17.

### Question:

**2.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are estimating ultimate claims as of December 31, 2023 using the expected method.

- (a) (0.5 points) Describe one advantage of using the pure premium approach rather than the claim ratio approach when using the expected method.

You are given:

Accident Year	Earned Exposures	Earned Premiums	Premium On-Level Factors	Actual Paid Claims as of Dec. 31, 2023	Cumulative Paid Development Factors
2017	78,945	52,155,000	1.067	25,428,000	1.565
2018	78,248	53,621,000	1.029	22,854,000	1.701
2019	77,701	53,900,000	1.016	20,810,000	1.927
2020	75,377	54,236,000	0.980	18,966,000	2.262
2021	77,739	55,984,000	0.999	15,127,000	2.809
2022	76,371	56,409,000	1.025	11,397,000	3.831
2023	75,070	56,834,000	1.000	7,237,000	6.369
<b>Total</b>	<b>539,452</b>	<b>383,139,000</b>		<b>121,819,000</b>	

- The annual claim ratio trend is 3%.



- (b) *(0.5 points)* Provide one reason why the expected method might be preferred over the development method in this scenario for analyzing accident year 2023 claims.
- (c) *(3 points)* Calculate the expected claims for accident year 2023 using the expected method with the following approaches:
  - (i) Claim ratio
  - (ii) Pure premium
- (d) *(1 point)* Estimate accident year 2023 claims expected to be paid between December 31, 2023 and December 31, 2024 using your results from part (c)(ii).

**GIRR Fall 2024 Question 7 (LOs 3h, 3i, 3j)****Learning Outcomes:**

- (3h) Explain the effect of changing conditions on the projection methods cited in (3e).
- (3i) Assess the appropriateness of the projection methods cited in (3e) in varying circumstances.
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 21 and 22.

**Question:****7.***(4 points)*

- (a) *(0.5 points)* Provide two reasons why actuaries use multiple methods to estimate ultimate claims.

ANSWER:

- (b) *(0.5 points)* Provide two areas in which an actuary can exercise professional judgement in estimating ultimate claims, other than the selection of methods.

ANSWER:

You are reviewing the ultimate claims estimates for XYZ Insurance as of December 31, 2023.

XYZ's portfolio had been stable for several years, but experienced the following changes in recent years, which will affect actual ultimate claims:

- An improvement in claim ratio from the historical average of 70% to 65%,
- A 30% decrease in exposures, and
- A 20% acceleration in claims reported by the end of the first year.

- (c) *(3 points)* Explain how effective each of the following projection methods will be in responding to the recent changes at XYZ:

- (i) Paid development method

- (ii) Expected method

(iii) Reported Bornhuetter Ferguson method

ANSWER:

(i)

(ii)

(iii)

## GIRR Fall 2024 Question 10 (LOs 2a, 3e, 3g)

### Learning Outcomes:

- (2a) Create development triangles of claims and counts from detailed claim transaction data.
- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 16 and 22.

### Question:

**10.**

*Provide the response for this question in the Excel spreadsheet.*

(7 points) General liability claims may have a long lag between the occurrence date and the report date.

- (a) (0.5 points) Provide an example of another line of business that often has a long lag between the occurrence date and the report date.
- (b) (0.5 points) Provide an example of a line of business where claim files are commonly reopened.

You are given:

Accident Year	Cumulative Paid Claims					
	12	24	36	48	60	72
2018	1,518,006	3,284,534	4,838,338	6,146,551	6,945,034	7,149,672
2019	1,582,770	3,552,084	5,075,462	6,140,083	7,043,201	
2020	1,573,601	3,607,985	4,923,578	6,208,567		
2021	1,608,502	3,404,322	4,897,059			
2022	1,448,977	3,339,496				
2023	1,791,306					

A legislative change became effective July 1, 2021, reducing claim costs 20% for all claims paid on or after this date.

- (c) (2 points) Construct a revised cumulative paid claims triangle adjusted for the legislative change.

You are given:

<b>Accident Year</b>	<b>Projected Earned Exposures</b>	<b>Projected Ultimate Claims</b>
2024	10,600	7,105,054
2025	10,710	7,694,043

- The annual claim frequency trend is expected to be  $-0.3\%$ .
- The annual claim severity trend is expected to be  $7.5\%$ .
- The 2023 cost level claim frequency is  $10.6\%$ .
- The 2023 cost level severity is 5,900.

- (d) (1 point) Verify the projected ultimate claims for accident years 2024 and 2025.

The ultimate claims for all accident years are estimated as:

<b>Accident Year</b>	<b>Projected Ultimate Claims</b>
2018	7,149,672
2019	7,289,724
2020	7,484,846
2021	7,571,028
2022	7,534,985
2023	9,222,361
2024	7,105,054
2025	7,694,043

- (e) (3 points) Calculate the claims expected to be paid in calendar years 2024 and 2025, using the results from part (c).

## GIRR Fall 2024 Question 12 (LOs 3f, 3g, 3j)

### Learning Outcomes:

- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 15, 18, 19, and 22.

Actuarial Standards of Practice, Actuarial Standards Board of the American Academy of Actuaries, No. 25, Credibility Procedures, 2013.

### Question:

**12.**

*Provide the response for this question in the Excel spreadsheet.*

(7 points) You are given the following information for estimating ultimate claims:

Accident Year	Reported Claims				
	12	24	36	48	60
2019	540,061	575,731	648,087	683,622	702,734
2020	554,275	591,019	665,056	701,405	
2021	567,907	656,134	731,837		
2022	581,936	621,002			
2023	596,836				

Calendar Year	Earned Premiums
2019	1,000,000
2020	1,040,000
2021	1,082,000
2022	1,125,000
2023	1,170,000

- This was a new book of business in 2019.
- A rate change of  $-5\%$  was effective January 1, 2022. There were no other rate changes.
- The annual claim ratio trend is  $-2\%$ .

- An unusual large claim of 50,000 occurred in accident year 2021. The claim was first reported in September 2022 and the claim estimate has not changed.
  - The original Bondy method is used to estimate a tail factor at 60 months.
  - The expected claim ratio based on industry data is 65% for all accident years. However, management is uncertain that industry data is representative of this book of business.
- 
- (a) *(1.5 points)* Calculate projected ultimate claims for all accident years using the development method.
  - (b) *(0.5 points)* Critique the appropriateness of selecting the development method for this line of business.
  - (c) *(1 point)* Calculate projected ultimate claims for all accident years using the Bornhuetter Ferguson method.
  - (d) *(0.5 points)* Critique the appropriateness of selecting the Bornhuetter Ferguson method for this line of business.
  - (e) *(3 points)* Calculate projected ultimate claims for all accident years using the Cape Cod method.
  - (f) *(0.5 points)* Critique the appropriateness of selecting the Cape Cod method for this line of business.

### GIRR Fall 2024 Question 13 (LOs 3e, 3g)

#### Learning Outcomes:

- (3e) Describe the key assumptions underlying the following projection methods: development method, frequency-severity methods, expected method, Bornhuetter Ferguson method, Benktander method, Cape Cod method, Generalized Cape Cod, and Berquist-Sherman adjustments to the development method.
- (3g) Estimate ultimate values using the methods cited in (3e).

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16 and 20.

#### Question:

**13.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are estimating ultimate claims using a frequency-severity method, and are given:

Accident Year	Earned Exposures	Reported Claims as of Dec. 31, 2023	Projected Ultimate Based on Development Method	
			Claims	Counts
2017	4,082	5,002,004	5,002,004	174
2018	4,248	5,420,340	5,451,477	182
2019	4,274	5,649,182	5,729,118	184
2020	4,437	6,034,903	6,218,509	192
2021	4,438	6,167,181	6,510,280	193
2022	4,668	5,673,216	7,159,008	204
2023	4,706	2,889,081	7,850,014	217

- The annual severity trend is 4.0%.
- A court ruling expanded policy coverage for claims occurring on or after January 1, 2023.
- The court ruling increased claim frequency by 5% but had no effect on claim severity.
- The earned exposures are not sensitive to inflation.

- (a) (1 point) Recommend an annual claim frequency trend.



- (b) (3 points) Calculate the projected ultimate claims for all accident years using the development-based frequency-severity method.

Other projection methods use triangles of closed count ratios.

- (c) (0.5 points) Describe how to calculate the *proportion of closed counts* triangle when using the frequency-severity closure method.
- (d) (0.5 points) Describe how to calculate the triangle of *disposal ratios* when using the Berquist-Sherman adjustment for changing settlement rates.

## GI 101 – LEARNING OBJECTIVE 4

### 4. Topic: Financial Reporting

The candidate will understand financial reporting of claim liabilities with respect to unpaid unallocated loss adjustment expenses.

### GIRR Fall 2020 Question 15 (LOs 1d, 1i, 4b, 4c)

#### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (1i) Describe how and why data are segregated and aggregate.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 4, and 23.

#### Question:

**15.** (4 points) You are estimating unpaid ULAE.

- (a) (0.5 points) Describe one way a reinsurer might assess the reasonableness of an estimate of unpaid ULAE.

ANSWER:

You are given the following information for an insurance company:

Calendar Year	Earned Exposures	Paid ULAE	Ratio of ULAE to Claims	
			Classical Paid	Kittel Refinement
2017	7,430	810,000	7.4%	7.5%
2018	7,890	850,000	7.5%	7.3%
2019	8,310	880,000	7.6%	7.1%

- The Kittel refinement reflects the average of actual paid and reported claims.
- (b) (0.5 points) Recommend one of the two approaches from the table above to use in estimating unpaid ULAE. Justify your recommendation.

ANSWER:

You are given the following additional information:

	As of December 31, 2019
Case Estimates	3,510,000
IBNR	1,600,000

- Approximately 80% of IBNR is a provision for development on known claims.
- Approximately 25% of claim department expenses relate to opening a claim file and 75% relate to maintaining and closing a claim file.

- (c) (1.5 points) Estimate unpaid ULAE as of December 31, 2019 using the approach you selected in part (b).

*The response for part (c) is to be provided in the Excel spreadsheet.*

Unpaid ULAE as of December 31, 2018 was 270,000.

- (d) (0.5 points) Determine calendar year 2019 incurred ULAE.

*The response for part (d) is to be provided in the Excel spreadsheet.*

You work for an insurance company that writes only auto insurance. The company's practice is to set up zero case estimates for ALAE because ALAE for the company is relatively small and stable.

Your colleague recommends estimating unpaid ALAE using the same paid-to-paid approach as ULAE because there are no ALAE case estimates, the experience is stable, and auto insurance is the only line of business.

- (e) (1 point) Critique your colleague's recommendation.

ANSWER:

### GIRR Spring 2021 Question 3 (LOs 3g, 4a, 4b, 4c, 5b, 5c, 5d, 5e)

#### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.
- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16, 23, and 26.

#### Question:

### 3.

(7 points) You are estimating ultimate claims using the development-based frequency-severity method, and are given the following information:

Accident Year	Earned Exposures	Projected Ultimate Based on Development Method		
		Counts	Claims	Severity
2015	25,200	2,088	9,028,629	4,324
2016	26,700	2,194	9,779,132	4,458
2017	25,300	2,063	9,477,060	4,594
2018	24,500	1,983	9,378,997	4,733
2019	23,900	1,933	8,988,618	4,724
2020	24,200	1,709	7,810,625	4,749
<b>Total</b>	<b>149,800</b>	<b>11,970</b>	<b>54,463,061</b>	

You have noticed that the ultimate severity from the development method is not equal to the development method ultimate claims divided by the development method ultimate counts in this case.

- (a) (0.5 points) Explain why this may happen when using the development-based frequency-severity method.

ANSWER:

- (b) (2.5 points) Recommend a claim frequency at the accident year 2020 cost level. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Calculate ultimate claims using the development-based frequency-severity method and the recommended claim frequency from part (b).

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for calculating unpaid ULAE for this line of business:

	12	24	36	48	60	72
Cumulative paid claims development factors by maturity age (months)	11.245	2.017	1.228	1.063	1.010	1.000

Calendar Year	Paid ULAE
2017	738,905
2018	851,350
2019	883,245
2020	879,224
<b>Total</b>	<b>3,352,724</b>

- Ultimate claims are selected from the development-based frequency-severity method.
- You are using the classical paid method with a Mango-Allen smoothing adjustment to estimate unpaid ULAE.
- Approximately 25% of claim department expenses relate to opening a claim file and 75% relate to maintaining and closing a claim file.
- The total case estimate is 4,351,459.
- The total IBNR is 11,117,813.

- (d) (1.5 points) Calculate the expected claims paid for calendar years 2017 through 2020.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1 point) Recommend a ULAE ratio using the classical paid-to-paid method with the Mango-Allen smoothing adjustment. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (0.5 points) Calculate the unpaid ULAE.

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Spring 2021 Question 4 (LOs 3i, 4a)

#### Learning Outcomes:

- (3i) Assess the appropriateness of the projection methods cited in (e) in varying circumstances.
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 22 and 23.

#### Question:

**4.**

(5 points) You are an insurance company actuary reviewing year-end reserves for a line of business with the following characteristics:

- The coverage is long-tailed.
- There are five years of company experience available including exposure, premium, rate changes, paid and reported claims, closed and reported claim counts, and paid ULAE.
- Business has been growing steadily over the last five years.
- The annual claim trend is 2%.
- Tort reform was implemented two years ago.
- Industry experience is available for a comparable coverage.

- (a) (1 point) Explain why the development method may not be appropriate for estimating unpaid claims for this coverage.

ANSWER:

- (b) (2 points) Recommend an appropriate method for estimating unpaid claims for this coverage. Justify your recommendation.

ANSWER:

- (c) (1 point) Explain why the classical paid-to-paid method may not be appropriate for estimating unpaid ULAE for this coverage.

ANSWER:



- (d) *(1 point)* Recommend an appropriate method for estimating unpaid ULAE for this coverage. Justify your recommendation.

ANSWER:

## GIRR Fall 2021 Question 18 (LOs 1d, 3f, 3g, 4a, 4b)

### Learning Outcomes:

- (1d) Understand the components of ultimate values.
- (3f) Demonstrate knowledge of good practice related to projecting ultimate values.
- (3g) Estimate ultimate values using the methods cited in (3e).
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 3, 15, and 23.

### Question:

## 18.

(6 points) You are projecting ultimate claims as of December 31, 2020 using the paid development method and are given the following data:

Accident Year	Paid Claims (000)							
	12	24	36	48	60	72	84	96
2013	162	517	866	1,171	1,402	1,573	1,716	1,824
2014	171	523	875	1,142	1,372	1,565	1,712	
2015	182	518	876	1,169	1,424	1,610		
2016	190	543	923	1,219	1,460			
2017	198	540	1,082	1,391				
2018	205	560	968					
2019	211	573						
2020	224							

Accident Year	12-24	24-36	36-48	48-60	60-72	72-84	84-96
2013	3.191	1.675	1.352	1.197	1.122	1.091	1.063
2014	3.058	1.673	1.305	1.201	1.141	1.094	
2015	2.846	1.691	1.334	1.218	1.131		
2016	2.858	1.700	1.321	1.198			
2017	2.727	2.004	1.286				
2018	2.732	1.729					
2019	2.716						

Accident year 2017 includes a large claim of 150,000 paid and closed on March 15, 2019. The claim was unusual, and a similar claim is not likely to occur.

- (a) *(1 point)* Select age-to-age development factors for all periods excluding the tail factor. Justify your selections.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

<b>Accident Year</b>	<b>Projected Ultimate Claims from Reported Development Method (000)</b>
2013	1,975
2014	1,974
2015	2,032
2016	2,078
2017	2,234
2018	2,216
2019	2,261
2020	2,295
<b>Total</b>	<b>17,065</b>

- (b) *(1.5 points)* Derive a paid tail factor using Boor's algebraic method.

*Provide the response for this part in the Excel spreadsheet.*

Subsequently, the Chief Actuary provides you with an alternative tail factor of 1.072 based on industry benchmark data.

- (c) *(1 point)* Calculate ultimate claims using the paid development method and the tail factor of 1.072.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for estimating ULAE:

- Selected ultimate claims for each accident year are based on the results from the reported development method shown above (and not the paid development method).
- Actual reported claims as of December 31, 2020 are 14,660,000.

- The selected ratio of calendar year paid unallocated loss adjustment expenses (ULAE) to paid claims is 8%.
- (d) (1 point) Calculate the unpaid ULAE as of December 31, 2020 using the classical paid-to-paid method and a multiplier of 50%.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1 point) Describe the Kittel refinement to the classical paid-to-paid method and the weakness it is designed to address.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (0.5 points) Describe the Mango and Allen smoothing adjustment.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2022 Question 12 (LOs 4b, 4c)

### Learning Outcomes:

- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 23.

### Question:

## 12.

(4 points) You are given the following information for estimating unpaid ULAE as of December 31, 2021.

Calendar Year	Exposures	Paid ULAE	Actual Claims		Expected Claims	
			Paid	Reported	Paid	Reported
2018	575,000	16,172,450	176,261,530	176,998,480	181,712,920	179,693,890
2019	592,250	16,807,540	195,338,130	194,011,760	188,100,130	190,637,250
2020	621,860	17,831,120	187,853,340	199,988,960	195,680,570	206,174,180
2021	652,960	19,284,360	197,358,720	211,828,510	205,582,000	222,977,380
<b>Total</b>	<b>2,442,070</b>	<b>70,095,470</b>	<b>756,811,720</b>	<b>782,827,710</b>	<b>771,075,620</b>	<b>799,482,700</b>

	As of Dec. 31, 2021
Case Reserves	95,171,300
IBNER Reserves	43,591,100
IBNYR Reserves	26,803,900
<b>Total</b>	<b>165,566,300</b>

- Claims for this coverage are typically low-frequency and high-severity.
- Calendar year 2019 includes an unusual large claim of 11 million which has been settled.
- 30% of claim department expenses relate to opening a claim file and 70% relate to maintaining and closing a claim file.

- (a) (1.5 points) Estimate unpaid ULAE as of December 31, 2021, using the classical paid-to-paid method with a simple four-year average of historical experience, and a pure IBNR refinement.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1.5 points) Estimate unpaid ULAE as of December 31, 2021 using the Kittel refinement with the Mango and Allen smoothing adjustment, a simple four-year average of historical experience, and a pure IBNR refinement.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Critique the appropriateness of each result from (a) and (b).

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2022 Question 12 (LOs 4a, 4b, 4c)

### Learning Outcomes:

- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 23.

### Question:

## 12.

(5 points) You are estimating unpaid unallocated loss adjustment expenses (ULAE) as of December 31, 2021 using the Wendy Johnson count-based method, and are given the following weights for three different claim types:

Newly Reported Counts	25%
Open Counts	55%
Closed Counts	20%

Selected claim count weights are typically based on special studies.

- (a) (0.5 points) Describe one such special study.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

Accident Year	Incremental Reported Counts					
	12	24	36	48	60	72
2016	1,033	28	26	1	0	0
2017	1,081	32	16	0	0	
2018	1,122	59	8	0		
2019	828	41	25			
2020	799	34				
2021	806					

Accident Year	Incremental Closed Counts					
	12	24	36	48	60	72
2016	636	210	87	21	4	1
2017	650	263	64	10	0	
2018	694	274	71	12		
2019	521	222	69			
2020	511	210				
2021	530					

Calendar Year	Paid ULAE
2018	718,960
2019	738,400
2020	746,800
2021	787,600

- The annual claim trend is 2%.

- (b) (3 points) Recommend an average ULAE per weighted count. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following projected reported and closed claim counts as of December 31, 2021:

Calendar Year	Newly Reported Counts	Closed Counts
2022	208	528
2023	69	350
2024	5	150
2025	0	108
2026	0	25

- (c) (1.5 points) Calculate estimated unpaid ULAE as of December 31, 2021.

*Provide the response for this part in the Excel spreadsheet.*



## GIRR Spring 2023 Question 9 (LOs 4a, 4b, 4c)

### Learning Outcomes:

- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 23.

### Question:

## 9.

(5 points) You are estimating unpaid ULAE as of December 31, 2022 for a line of business that has experienced significant inflation over the past five years. You are given the following:

Report Year	Earned Exposures	Estimated Ultimate Claims
2017	23,286	8,297,960
2018	23,595	9,230,643
2019	23,886	10,390,684
2020	24,423	11,357,111
2021	24,490	12,811,927
2022	25,103	14,531,428

Maturity Age in months	Reported Age-to-Ultimate Development Factors
12	2.306
24	1.479
36	1.137
48	1.023
60	1.000

<b>Calendar Year</b>	<b>Paid ULAE</b>	<b>Expected Paid Claims</b>	<b>Expected Reported Claims</b>
2019	725,000	8,950,624	9,323,021
2020	825,176	9,921,833	10,304,355
2021	935,423	11,058,159	?
2022	1,062,610	12,393,344	?

- (a) (1 point) Explain why the classical paid-to-paid method may not be appropriate for estimating unpaid ULAE in this case.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (2.5 points) Calculate the ULAE ratio for each year using the Mango and Allen smoothing adjustment based on paid and reported claims data.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Recommend a ULAE ratio to use for this line of business. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are provided with the following additional information:

- 40% of ULAE is associated with opening a claim file and 60% relates to maintaining and closing a claim file
- IBNR is 13,974,912
- Case estimate is 4,965,557

- (d) (1 point) Calculate unpaid ULAE as of December 31, 2022 using the recommended ratio from part (c).

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Fall 2023 Question 4 (LOs 4b)

#### Learning Outcomes:

(4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 23.

#### Question:

**4.**

(5 points) You are estimating unpaid ULAE as of December 31, 2022 using the Wendy Johnson count-based method. You are given the following. Forecasted incremental reported counts are highlighted with a shaded background.

Accident Year (AY)	Incremental Reported Counts							Ultimate Counts
	12	24	36	48	60	72	84	
2017	401	111	78	69	47	26	42	774
2018	410	103	95	68	39	45	23	783
2019	410	114	94	67	47	47	24	803
2020	410	120	95	67	50	51	25	818
2021	425	111	95	66	49	49	25	820
2022	434	120	96	66	50	50	25	841

Selected Ratios of Reported Counts to Ultimate Counts						
12	24	36	48	60	72	84
0.510	0.654	0.770	0.850	0.910	0.970	1.000

- (a) (1 point) Verify that the forecasted incremental reported count for AY 2021 at 36 months is 95.

You are given the following additional information:

<b>Accident Year</b>	<b>Incremental Closed Counts</b>						
	<b>12</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>	<b>72</b>	<b>84</b>
2017	138	166	132	122	99	73	44
2018	141	160	154	119	92	73	44
2019	141	171	148	123	99	75	46
2020	141	177	149	127	101	77	46
2021	146	170	154	126	101	77	46
2022	149	177	158	129	102	79	47

<b>Calendar Year</b>	<b>Paid ULAE</b>	<b>Newly Reported Counts</b>	<b>Open Counts</b>	<b>Closed Counts</b>
2020	640,000	796	786	792
2021	675,000	819	802	803
2022	692,000	814	816	800

Use the following weights for the three types of claim counts:

Newly reported counts	25%
Open counts	65%
Closed counts	10%

- The past annual expense trend rate through 2023 is 2%.
  - The future annual expense trend rate after 2023 is 3%.
- (b) (4 points) Estimate unpaid ULAE as of December 31, 2022 using a simple three-year average of historical experience.

## GIRR Spring 2024 Question 8 (LOs 4a, 4b, 4c)

### Learning Outcomes:

- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 23.

### Question:

**8.**

*Provide the response for this question in the Excel spreadsheet.*

(6 points) According to Mango and Allen, one reason the classical paid-to-paid method produces a conservative estimate of unpaid ULAE is that the cost of ULAE per thousand dollars of claims is a decreasing function of the average claim size.

- (a) (1 point) Provide another reason why the classical paid-to-paid method overstates unpaid ULAE, even in a steady state environment.
- (b) (1 point) Describe two situations where the Mango and Allen smoothing adjustment is particularly valuable in producing a more reasonable estimate of unpaid ULAE.

Insurer STL started writing Professional Liability business on January 1, 2019.  
You are given the following:

Report Year	Estimated Ultimate Claims
2019	5,331,195
2020	4,622,596
2021	5,116,924
2022	5,524,846
2023	6,060,412

<b>Maturity Age in Months</b>	<b>Reported Age-to- Ultimate Factors</b>
12	3.505
24	2.020
36	1.765
48	1.420
60	1.165

<b>Calendar Year</b>	<b>Paid ULAE</b>	<b>Expected Paid Claims</b>
2019	278,480	991,462
2020	323,800	1,170,742
2021	369,200	1,573,118
2022	448,080	2,346,706
2023	675,994	3,297,712

- (c) (3 points) Calculate the ULAE ratio for each year using the Mango and Allen smoothing adjustment based on paid and reported claim data.
- (d) (0.5 points) Recommend a ULAE ratio to use for this line of business. Justify your recommendation.

You are provided with the following additional information:

- 30% of ULAE is associated with opening a claim file, while 70% relates to maintaining and closing a claim file
  - Total claim liabilities are 5,750,000
  - Case estimates for existing reported claims are 3,250,000
- (e) (0.5 points) Calculate unpaid ULAE as of December 31, 2023 using the recommended ratio from part (d).

## GIRR Fall 2024 Question 9 (LOs 4a, 4b)

### Learning Outcomes:

- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 23.

### Question:

**9.**

*Provide the response for this question in the Excel spreadsheet.*

(7 points)

- (a) (0.5 points) Describe why unallocated loss adjustment expenses (ULAE) are usually analyzed on a calendar year basis.
- (b) (0.5 points) Describe a weakness of the classical paid-to-paid method that the Kittel refinement is intended to address.

Count-based ULAE methods resolve two major drawbacks of ratio-based ULAE methods.

- (c) (1 point) Describe these two major drawbacks.

You are given the following information for estimating unpaid ULAE as of December 31, 2023:

Calendar Year	Paid Claims	Paid ULAE
2021	30,400,000	1,489,600
2022	31,698,113	1,680,000
2023	28,000,000	1,596,000

	As of Dec. 31, 2023
Case Estimates	19,507,585
IBNER	7,861,668
IBNYR	4,812,040

- Approximately 25% of claim department expenses relate to opening a claim file and 75% relate to maintaining and closing a claim file.

(d) (1.5 points) Estimate unpaid ULAE as of December 31, 2023 using the classical paid-to-paid method.

You are given the following additional information to estimate unpaid ULAE using the Wendy Johnson count-based method.

Calendar Year	Historical ULAE Counts		
	Newly Reported	Open	Closed
2021	2,325	1,336	2,370
2022	2,550	1,391	2,495
2023	2,528	1,402	2,517

Calendar Year	Projected ULAE Counts		
	Newly Reported	Open	Closed
2024	1,067	1,044	1,425
2025	122	323	843
2026	-	-	323

	Claim Count Weights
Newly reported counts	30%
Open counts	50%
Closed counts	20%

- Historical annual expense trend through 2023 has been 0%.
  - Prospective annual expense trend after 2023 is expected to be 2%.
- (e) (1 point) Demonstrate that the projected open counts for calendar years 2024, 2025, and 2026 are calculated correctly based on newly reported claims and closed claims.
- (f) (2.5 points) Estimate unpaid ULAE as of December 31, 2023 using the Wendy Johnson method.



## GI 101 – LEARNING OBJECTIVE 5

### 5. Topic: Trending

The candidate will understand trending procedures as applied to ultimate claims, exposures and premiums.

## GIRR Fall 2020 Question 16 (LOs 2d, 5b, 5e, 6g)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 26, 27, and 32.

### Question:

- 16.** (7 points) You are conducting a ratemaking analysis for an automobile line of business and are given the following information:

Rate Change History	
Effective Date of Rate Change	Rate Change %
July 1, 2015	8.0%
January 1, 2017	10.0%
January 1, 2019	5.0%

- Premiums are written and earned evenly throughout the year.
  - All policies are written for 12-month policy terms.
  - In addition to the above rate changes, there was a regulation change where all premiums in force on July 1, 2017 were required to be reduced by 20%.
- (a) (2 points) Calculate premium on-level factors for accident years 2015-2019 to use for ratemaking purposes.

*The response for part (a) is to be provided in the Excel spreadsheet.*

You are given the following additional information:

<b>Accident Year</b>	<b>Earned Premiums</b>	<b>Ultimate Claims</b>
2015	11,755,570	8,130,150
2016	11,864,520	7,970,110
2017	12,406,530	7,781,380
2018	12,492,860	8,001,680
2019	12,394,530	7,995,960

- The annual premium trend is 1%.
- The annual pure premium trend is 4%.
- The new rates will be effective November 1, 2020 through October 31, 2021.
- The historical data is considered fully credible for ratemaking purposes.
- The regulation change which reduced premiums also reduced claim costs by 20% for all accidents occurring on or after July 1, 2017.

(b) (2.5 points) Calculate the trended on-level claim ratios for each accident year.

*The response for part (b) is to be provided in the Excel spreadsheet.*

(c) (1 point) Recommend a trended claim ratio to use for ratemaking. Justify your recommendation.

*The response for part (c) is to be provided in the Excel spreadsheet.*

You are given the following additional information:

The ratio of ULAE to claims is 10%.

- The ratio of fixed expenses to premiums at current rates is 6%.
- The ratio of variable expenses to premiums is 19%.
- The ratio of profit and contingencies to premiums is 5%.

(d) (0.5 points) Calculate the indicated rate change.

*The response for part (d) is to be provided in the Excel spreadsheet.*

The purpose of the legislative change effective July 1, 2017 was to reduce increases in premiums arising from poor industry claims experience. As a result, management questions your required increase of 5% in 2019.

(e) (1 point) Explain why an indicated rate increase of 5% is not necessarily indicative of deteriorating experience.

ANSWER:

## GIRR Fall 2020 Question 20 (LOs 5a, 5b, 5c, 5d, 5e)

### Learning Outcomes:

- (5a) Identify and describe the influences of portfolio changes on claim frequency and severity.
- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 27.

### Question:

## 20.

(5 points) You are trending earned premiums for ratemaking purposes and are given the following information:

Experience Period	Earned Exposures by Policy Limit			
	500,000	1,000,000	1,500,000	2,000,000
2014	5,056	4,424	3,476	2,844
2015	5,010	4,843	3,841	3,006
2016	4,816	4,816	4,128	3,440
2017	4,200	4,872	4,032	3,696
2018	3,588	4,524	3,900	3,588
2019	3,108	4,292	3,848	3,552

	Increased Limits Factors by Policy Limit			
	500,000	1,000,000	1,500,000	2,000,000
In effect prior to Nov. 1, 2020	0.82	1.00	1.15	1.27
In effect starting Nov. 1, 2020	0.85	1.00	1.13	1.24

- (a) (1.5 points) Calculate the annual premium trend due to the shift in policy limits for each year.

*The response for part (a) is to be provided in the Excel spreadsheet.*

- (b) (1 point) Recommend the annual premium trend due to the shift in policy limits to use for ratemaking. Justify your recommendation.

*The response for part (b) is to be provided in the Excel spreadsheet.*

A deductible analysis resulted in an annual trend of  $-0.4\%$  due to a shift in deductibles.

- (c) (1.5 points) Explain why the annual premium trend due to a shift in policy limits tends to be positive while the annual premium trend due to a shift in deductibles tends to be negative.

ANSWER:

You are given the following additional information:

- Calendar year 2017 on-level earned premium is 17,808,000.
- The new rates will be effective March 1, 2021 through February 28, 2022.
- All policies are written for 6-month policy terms.

- (d) (1 point) Calculate the calendar year 2017 on-level earned premium trended for ratemaking purposes.

*The response for part (d) is to be provided in the Excel spreadsheet.*

### GIRR Spring 2021 Question 3 (LOs 3g, 4a, 4b, 4c, 5b, 5c, 5d, 5e)

#### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (4a) Describe the key assumptions underlying ratio and count-based methods for estimating unpaid unallocated loss adjustment expenses.
- (4b) Estimate unpaid unallocated loss adjustment expenses using ratio and count-based methods.
- (4c) Evaluate and justify selections of unpaid unallocated loss adjustment expenses based on ratio and count-based methods.
- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16, 23, and 26.

#### Question:

### 3.

(7 points) You are estimating ultimate claims using the development-based frequency-severity method, and are given the following information:

Accident Year	Earned Exposures	Projected Ultimate Based on Development Method		
		Counts	Claims	Severity
2015	25,200	2,088	9,028,629	4,324
2016	26,700	2,194	9,779,132	4,458
2017	25,300	2,063	9,477,060	4,594
2018	24,500	1,983	9,378,997	4,733
2019	23,900	1,933	8,988,618	4,724
2020	24,200	1,709	7,810,625	4,749
<b>Total</b>	<b>149,800</b>	<b>11,970</b>	<b>54,463,061</b>	

You have noticed that the ultimate severity from the development method is not equal to the development method ultimate claims divided by the development method ultimate counts in this case.

- (a) (0.5 points) Explain why this may happen when using the development-based frequency-severity method.

ANSWER:

- (b) (2.5 points) Recommend a claim frequency at the accident year 2020 cost level. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Calculate ultimate claims using the development-based frequency-severity method and the recommended claim frequency from part (b).

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for calculating unpaid ULAE for this line of business:

	12	24	36	48	60	72
Cumulative paid claims development factors by maturity age (months)	11.245	2.017	1.228	1.063	1.010	1.000

Calendar Year	Paid ULAE
2017	738,905
2018	851,350
2019	883,245
2020	879,224
<b>Total</b>	<b>3,352,724</b>

- Ultimate claims are selected from the development-based frequency-severity method.
- You are using the classical paid method with a Mango-Allen smoothing adjustment to estimate unpaid ULAE.
- Approximately 25% of claim department expenses relate to opening a claim file and 75% relate to maintaining and closing a claim file.
- The total case estimate is 4,351,459.
- The total IBNR is 11,117,813.

- (d) (1.5 points) Calculate the expected claims paid for calendar years 2017 through 2020.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (1 point) Recommend a ULAE ratio using the classical paid-to-paid method with the Mango-Allen smoothing adjustment. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (0.5 points) Calculate the unpaid ULAE.

*Provide the response for this part in the Excel spreadsheet.*



## GIRR Spring 2021 Question 12 (LOs 5b, 5c, 5d, 5e, 6g, 6h)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27 and 32.

### Question:

## 12.

(6 points) You are given the following information:

Calendar Year	Written Exposures	Earned Exposures	On-Level Written Premiums	On-Level Earned Premiums
2011	12,150	12,082	6,561,000	6,427,624
2012	12,393	12,332	6,772,527	6,652,473
2013	12,889	12,765	7,123,878	6,979,015
2014	13,920	13,662	7,795,279	7,565,041
2015	14,616	14,442	8,363,476	8,175,282
2016	14,762	14,726	8,555,141	8,441,915
2017	14,319	14,430	8,409,605	8,378,940
2018	13,460	13,675	7,990,486	8,034,240
2019	13,191	13,258	7,928,680	7,888,949
2020	13,851	13,686	8,428,619	8,248,676

- (a) (2 points) Recommend the annual premium trend to use for ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- New rates will be effective August 1, 2021 for six months.
- All policies are written as 12-month policies.

<b>Accident Year</b>	<b>Trended Ultimate Claims</b>
2016	6,837,098
2017	6,467,985
2018	5,847,762
2019	5,734,244
2020	5,674,781

- (b) (1.5 points) Calculate the trended claim ratio for each accident year.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Recommend a trended claim ratio to use for ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- The annual pure premium trend is 5%.
- The complement of credibility is derived using the data from the last ratemaking analysis.
- The last ratemaking analysis was for policies effective January 1, 2021 through June 30, 2021, where
  - the indicated rate change was 4%,
  - the approved rate change was 2%, and
  - the permissible claim ratio was 55%.

- (d) (1 point) Calculate the claim ratio to use for the complement of credibility.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- The ratio of fixed expenses to premiums at current rates including ULAE is 15%.
- The ratio of variable expenses to premiums is 11%.
- The ratio of profit and contingencies to premiums is 4%.
- The credibility assigned to the experience claim ratio is 77%.

- (e) (1 point) Calculate the indicated rate change.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Fall 2021 Question 4 (LOs 5b, 5e, 6d, 6e, 6g)****Learning Outcomes:**

- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6d) Calculate loadings for catastrophes and large claims.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27, 31, and 32.

**Question:****4.**

(4 points) XYZ insurer is thinking of offering an earthquake endorsement to its basic homeowners policy. You are given the following information:

- Using July 1, 2020 in-force policies, expected claims from the earthquake catastrophe model are 225,000 based on an October 1, 2020 cost level.
- Earned house years for accident year 2020 are 15,000.
- The annual exposure trend is 3.5%.
- The annual severity trend is 7%.
- New rates are to be effective July 1, 2022 for one year with all policies written as 12-month policies.

- (a) (2 points) Calculate the pure premium for the earthquake endorsement.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for the earthquake endorsement:

- The fixed cost per policy is 5.
- The variable expense to premium ratio is 10%.
- The risk load is 25% of premium.

- (b) (0.5 points) Calculate the premium for the earthquake endorsement.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following information for the basic homeowners coverage:

Accident Year	Basic Homeowners (excluding optional earthquake endorsement)	
	On Level Earned Premium	Ultimate Claims
2018	15,500,000	9,000,000
2019	16,250,000	8,000,000
2020	17,000,000	8,200,000

- The current rate level is 1,050.
- The annual premium trend is 2%.
- The permissible claim ratio is 57%.

- (c) (1 point) Calculate the indicated rate for the basic homeowners coverage. Justify any selections.

*Provide the response for this part in the Excel spreadsheet.*

Since the earthquake coverage is an optional endorsement, management proposes that there should not be any fixed and variable expense charged to this optional coverage.

- (d) (0.5 points) State whether you agree with management's proposal. Justify your response.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2021 Question 5 (LOs 5b, 5c)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 27.

### Question:

**5.**

(5 points)

- (a) (1 point) Provide two circumstances in which exposure and premium trend adjustments need to be considered for a ratemaking analysis.

ANSWER:

ABC Insurer has been offering mileage discounts to its automobile insurance policyholders who drive below a certain mileage each year. You are given the following information:

Calendar Year	Earned Proportion of Automobile Policyholders with	
	5% Discount	10% Discount
2016	5.2%	9.3%
2017	5.0%	10.0%
2018	4.5%	11.0%
2019	4.5%	12.0%
2020	6.5%	25.0%

- Policyholders who drive more than 5,000 miles per year and less than 7,500 miles per year qualify for a 5% discount.
- Policyholders who drive less than 5,000 miles per year qualify for a 10% discount.
- Due to the pandemic in 2020, there was a significant one-time decrease in the distance driven by many policyholders.
- Policies are annual and written and earned evenly throughout the year.

- (b) (1.5 points) Calculate and select the annual premium trend due to the change in discount level. Justify your selection.

*Provide the response for this part in the Excel spreadsheet.*

You are conducting a premium trend analysis for rates to be effective on February 1, 2022, for one year and are given the following additional information:

- The annual premium trend due to change in discount level is expected to be  $-0.2\%$  post 2020.
  - The annual trend due to changes in policy limits is  $0.75\%$ .
- (c) (2.5 points) Calculate the premium trend factor to be used for 2018 using earned premium for the trending analysis and incorporating the annual trend selected in part (b).

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2022 Question 16 (LOs 5b, 5c, 5d, 5e)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 27.

### Question:

## 16.

(5 points) You are calculating the 2021 earned premiums to use in ratemaking for an automobile line of business, and are given the following information:

Vehicle Rate Group	Rating Differentials		Calendar Year Earned Exposures by Group				
	Prior to July 1, 2021	Effective July 1, 2021	2017	2018	2019	2020	2021
1	0.930	0.934	4,605	4,406	4,165	3,888	3,782
2	0.952	0.952	4,974	4,956	4,889	4,772	4,683
3	0.976	0.976	4,421	4,222	4,527	4,772	5,404
4	1.000	1.000	3,500	3,488	3,803	4,242	5,043
5	1.024	1.025	2,947	3,121	3,259	3,535	3,963
6	1.048	1.052	2,026	2,754	2,897	3,181	3,422
7	1.072	1.080	1,289	1,836	1,992	2,297	2,702
8	1.092	1.105	737	918	1,268	1,414	1,801
<b>Total</b>			<b>24,499</b>	<b>25,701</b>	<b>26,800</b>	<b>28,101</b>	<b>30,800</b>

- The 2021 calendar year earned premiums at current rate levels are 25,256,000.
- The new rates will be effective October 1, 2022, for one year.
- Two-thirds of the policies are written for annual terms and one-third of the policies are written for six-month terms.
- All policies are written and earned evenly throughout the year.



- (a) (1 point) Calculate the percentage increase in premiums that occurred from the rating differentials change on July 1, 2021.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (2 points) Recommend the annual premium trend rate to use for ratemaking for this line of business. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (2 points) Calculate the calendar year 2021 earned premiums to use for ratemaking.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2022 Question 17 (LOs 5b, 5e, 6d, 6e, 6g, 6h)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6d) Calculate loadings for catastrophes and large claims.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27, 31, and 32.

### Question:

## 17.

(4 points) You are performing a ratemaking analysis for a homeowners book of business. As part of the analysis, you are including a loading for wildfire claims.

You are given the following information:

Accident Year	Earned Exposures	Ultimate Wildfire Counts	Ultimate Wildfire Claims
2015	11,200	0	0
2016	11,850	0	0
2017	12,500	1	1,500,000
2018	13,750	0	0
2019	15,000	1	1,120,000
2020	16,250	0	0
2021	17,500	1	500,000

- New rates are to be effective September 1, 2022, for one year, with all policies written as 12-month policies.
- The annual wildfire claim severity trend is 3%.
- The credibility assigned to wildfire claims for this homeowners book of business is 20%. The complement of credibility is assigned to the industry figures.
- A study of industry results with data as of year-end 2020 indicates a trended ultimate pure premium for wildfire claims of 50, with an average accident date of July 1, 2020.

- (a) (2.5 points) Calculate the ultimate pure premium for wildfire claims to be used as a loading in the homeowners premiums.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- The annual non-wildfire claim severity trend is 4%.
  - The annual premium trend is 2.5%.
  - Variable expenses are 20% of premiums.
  - Fixed expenses are 70 per policy.
  - Profit and contingencies are 5% of premium.
  - The experience claim ratio for non-wildfire claims as of July 1, 2021, is 67%.
  - The calendar year 2021 on-level earned premiums are 21,507,500.
- (b) (1.5 points) Calculate the indicated total premium for the homeowners coverage, including a loading for wildfire claims.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2022 Question 6 (LOs 3g, 3j, 6b, 6c, 6d)

### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (3j) Evaluate and justify selections of ultimate values based on the methods cited in (3e).
- (6b) Identify the different types of rate regulatory approaches for general insurance.
- (6c) Describe the purpose of base rates and rating factors and explain how they are used to determine an insured's premium.
- (6d) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 17, 18, 19, 21, 23, and 27.

### Question:

## 6.

(12 points) You are estimating ultimate claims for a long-tailed line of business, and are given the following information:

Accident Year	Earned Exposures	Projected Ultimate Based on Reported Claims Development Method		
		Counts	Claims	Severity
2015	11,090	1,230	5,348,724	4,349
2016	11,250	1,270	5,926,222	4,666
2017	11,460	1,305	6,528,246	5,002
2018	11,770	1,349	7,227,370	5,358
2019	12,070	1,381	8,120,976	5,881
2020	12,360	1,447	9,136,918	6,314
2021	12,480	1,480	9,678,673	6,540
<b>Total</b>	<b>82,480</b>	<b>9,462</b>	<b>51,967,129</b>	

- The annual claim frequency trend is 1%.
- The annual claim severity trend is 6.5%.

- (a) (3 points) Calculate ultimate claims using the development-based frequency-severity method.

*Provide the response for this part in the Excel spreadsheet.*

Diagnostic testing revealed that this line of business has had strengthening of case estimates in calendar year 2021. You are provided with the following additional information:

Accident Year	Reported Claims						
	12	24	36	48	60	72	84
2015	1,906,608	2,666,402	3,459,325	4,177,978	4,782,824	5,202,046	5,274,875
2016	2,023,029	2,921,757	3,795,342	4,577,229	5,158,981	5,763,708	
2017	2,207,357	3,082,180	4,057,723	4,924,637	5,759,272		
2018	2,389,192	3,427,092	4,397,500	5,558,325			
2019	2,550,446	3,683,042	5,107,412				
2020	2,695,059	4,364,690					
2021	3,175,077						

Accident Year	Paid Claims						
	12	24	36	48	60	72	84
2015	734,782	1,253,583	1,905,611	2,640,076	3,434,180	4,178,154	4,637,751
2016	767,982	1,372,261	2,087,061	2,927,979	3,704,517	4,546,408	
2017	799,315	1,350,784	2,259,191	3,126,494	4,007,167		
2018	899,087	1,635,498	2,443,217	3,379,326			
2019	968,418	1,736,844	2,639,562				
2020	1,026,656	1,937,498					
2021	1,082,487						

Accident Year	Reported Counts						
	12	24	36	48	60	72	84
2015	732	865	996	1,095	1,166	1,214	1,222
2016	752	902	1,023	1,125	1,200	1,253	
2017	780	921	1,041	1,167	1,235		
2018	804	961	1,083	1,201			
2019	813	975	1,110				
2020	835	1,024					
2021	875						

Accident Year	Closed Counts						
	12	24	36	48	60	72	84
2015	336	545	730	879	998	1,094	1,138
2016	346	575	747	902	1,027	1,129	
2017	356	575	760	936	1,056		
2018	368	611	794	964			
2019	369	618	807				
2020	380	648					
2021	400						

- (b) (2 points) Construct the reported claims triangle adjusted for the change in case adequacy.

*Provide the response for this part in the Excel spreadsheet.*

You are provided with the following average ultimate reported severities, adjusted for the change in case adequacy:

Accident Year	Ultimate Reported Severities
2015	4,316.59
2016	4,561.67
2017	4,813.61
2018	5,066.25
2019	5,441.62
2020	5,802.31
2021	5,990.39

- (c) (1.5 points) Recommend the revised annual claim severity trend. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (d) (1 point) Explain why you might expect the answer to part (c) to be lower than the original annual severity trend of 6.5%.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (0.5 points) Calculate ultimate claims using the ultimate counts provided and ultimate reported severities adjusted for the change in case adequacy.

*Provide the response for this part in the Excel spreadsheet.*

- (f) (2 points) Calculate expected claims for all accident years using the expected method and your recommended annual claim severity trend from part (c). Justify any selections.

*Provide the response for this part in the Excel spreadsheet.*

- (g) (1 point) Calculate ultimate claims for all accident years using the Bornhuetter Ferguson method.

*Provide the response for this part in the Excel spreadsheet.*

You projected ultimate claims using several methods above.

- (h) (1 point) Recommend the selected ultimate claims for accident year 2021 for this line of business. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Fall 2022 Question 14 (LOs 5b, 5c, 5d, 5e, 6e, 6g, 6h)****Learning Outcomes:**

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26, 31, and 32.

**Question:****14.**

(6 points) You are performing a ratemaking analysis of a homeowners book of business for State Q. As part of the analysis, you are reviewing loadings for catastrophes and large claims.

- (a) (0.5 points) Describe one way that large claims are differentiated from catastrophe claims when insurers are estimating loadings for ratemaking purposes.

You are given the following State Q ultimate pure premium for non-hurricane weather excluding hail (referred to as weather claims below) per 100 earned house years (EHY):

Accident Year	Pure Premium per 100 EHY
2010	5,280
2011	5,770
2012	6,330
2013	6,200
2014	6,920
2015	7,140
2016	7,560
2017	8,300
2018	8,460



<b>Accident Year</b>	<b>Pure Premium per 100 EHY</b>
2019	8,850
2020	9,400
2021	9,940

- The new rates are to be effective August 1, 2023 for one year.
- All policies are written for 12-month policy terms.

- (b) (1 point) Recommend the annual pure premium trend for weather claims. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1.5 points) Recommend the trended ultimate pure premium for weather claims per 100 EHY to use in ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

<b>State Q Property excluding Weather Claims</b>						
<b>Accident Year</b>	<b>Earned House Years</b>	<b>Earned Premiums</b>	<b>Earned Premiums at Current Rate Level</b>	<b>Trended Earned Premiums at Current Rate Level</b>	<b>Trended Ultimate Claims</b>	<b>Accident Year Weights</b>
2019	16,080	10,537,200	11,064,120	12,545,160	7,130,200	25%
2020	16,560	11,330,400	11,606,760	12,777,120	7,449,200	30%
2021	16,860	11,802,000	11,802,000	12,613,560	6,824,400	45%
<b>Total</b>	<b>49,500</b>	<b>33,669,600</b>	<b>34,472,880</b>	<b>37,935,840</b>	<b>21,403,800</b>	<b>100%</b>

- The full credibility standard is 80,000 EHY.
- The square root rule is used for partial credibility.
- The trended adjusted country-wide ultimate claim ratio (including ULAE) is 70%.
- The ULAE to claim ratio is 12%.
- The selected fixed expenses are 5% of premiums.
- The selected variable expenses are 15% of premiums.
- The selected profit and contingencies are 4% of premiums.

- (d) (3 points) Calculate the indicated rate level change, including a loading for weather claims.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2022 Question 16 (LOs 5b, 5c, 5d, 5e)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 27.

### Question:

## 16.

(4 points) You are analyzing premium trend to use in a ratemaking analysis based on the following quarterly exposure and premium data:

Experience Period Calendar Quarter Ending	Written Exposures	Actual Written Premiums	On-Level Written Premiums
2018-1	5,229	2,443,276	2,700,678
2018-2	5,354	2,549,138	2,817,692
2018-3	5,568	2,676,306	2,958,258
2018-4	5,754	2,775,206	3,067,577
2019-1	5,931	2,918,640	3,234,297
2019-2	6,065	2,965,409	3,286,125
2019-3	6,327	3,177,321	3,520,955
2019-4	6,450	3,239,327	3,589,668
2020-1	6,697	3,502,765	3,738,994
2020-2	6,904	3,653,803	3,900,218
2020-3	7,119	3,858,738	4,118,974
2020-4	7,224	3,903,207	4,166,442
2021-1	7,520	4,255,243	4,432,677
2021-2	7,709	4,416,103	4,600,245
2021-3	7,920	4,555,392	4,745,342
2021-4	8,205	4,772,726	4,971,738
2022-1	8,422	5,114,877	5,140,873
2022-2	8,757	5,411,129	5,438,630

(a) (2 points) Calculate the quarterly change in average written premiums using:

- (i) Change in quarter-to-quarter averages
- (ii) Change in rolling 4-quarter volume-weighted averages

*Provide the response for this part in the Excel spreadsheet.*

(b) (1 point) Recommend the annual premium trend. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- First quarter 2022 on-level earned premiums are 5,136,000.
- New rates will be effective April 1, 2023, for one year.
- All policies are written for annual terms and are written and earned evenly throughout the year.

(c) (1 point) Calculate the first quarter 2022 on-level earned premiums trended to the future rating period.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2023 Question 5 (LOs 5b, 5c, 5d, 5e, 6g)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27 and 32.

### Question:

## 5.

(8 points) You are trending earned premiums for ratemaking purposes and are given the following:

Experience Period	Earned Exposures by Policy Limits			
	500,000	1,000,000	1,500,000	2,000,000
2015	7,553	5,440	4,200	2,460
2016	7,504	5,511	4,320	2,574
2017	7,297	5,573	4,410	2,673
2018	7,218	5,536	4,501	2,806
2019	7,091	5,546	4,549	2,978
2020	7,011	5,598	4,675	3,125
2021	6,879	5,688	4,720	3,257
2022	6,906	5,685	4,758	3,403
Current Increased Limits Factors	0.85	1.00	1.13	1.24

- (a) (2 points) Recommend the annual premium trend due to the shift in policy limits to use for ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- New rates are to be effective September 1, 2023 for one year.
- Premiums are written evenly throughout the year.
- Premiums are earned evenly throughout the policy term.
- Prior to January 1, 2020, all policies were written for 12-month terms.
- Since January 1, 2020, 75% of all policies have been written for 12-month terms and 25% of all policies have been written for 6-month terms.
- The annual trend due to a shift in deductibles is  $-0.1\%$
- The annual claim severity trend is  $6\%$ .
- The annual claim frequency trend is  $-1.2\%$ .
- The ratio of ULAE to claims is  $7\%$ .
- The ratio of fixed expenses to premiums at current rates is  $5\%$ .
- The ratio of variable expenses to premiums is  $23\%$ .
- The ratio of profit and contingencies to premiums is  $4\%$ .

Accident Year	Earned Premiums	Premium On-Level Factors	Ultimate Claims
2018	15,804,847	1.064	8,703,669
2019	15,333,428	1.106	9,184,011
2020	15,526,085	1.104	9,602,493
2021	16,625,910	1.049	10,401,614
2022	17,102,494	1.026	11,309,041

- (b) (4 points) Calculate the indicated rate level change for this line of business using a claims ratio approach. Justify any selection(s).

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Describe one reason why an indicated rate change using a pure premium approach may not result in the same result as part (b).

*Provide the response for this part in the Excel spreadsheet.*

Your colleague calculated the indicated rate change for this line of business to be  $6\%$ . The company's management decided to increase rates by  $3\%$ .

- (d) (1 point) Calculate the profit and contingencies to premium ratio implied by a  $3\%$  rate increase using your colleague's indicated rate change.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (0.5 points) State two actions the company can take that could help achieve the target profit, given the 3% rate increase.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2023 Question 8 (LOs 5a, 5b, 5e, 6c, 6d)

### Learning Outcomes:

- (5a) Identify and describe the influences of portfolio changes on claim frequency and severity.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6c) Explain the requirements for loadings for catastrophes and large claims in ratemaking.
- (6d) Calculate loadings for catastrophes and large claims.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26, 27, and 31.

### Question:

## 8.

(4 points) You are estimating an earthquake catastrophe loading to use in a ratemaking analysis that was determined from a catastrophe model. You are given the following:

Modeled expected earthquake claims	450,000
Date of modeled expected claims cost level	July 1, 2022
Date of in-force exposures reflected in catastrophe model	February 1, 2022
Calendar year 2022 trended earned premium at current rate level	15,450,000
Annual exposure trend	1%
Annual claim severity trend	6%
Effective date of new rates	October 1, 2023

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 earthquake claims to calculate the catastrophe loading for ratemaking.

*Provide the response for this part in the Excel spreadsheet.*

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

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Describe an additional step or approach that would increase your confidence in the estimate of expected earthquake claims.

*Provide the response for this part in the Excel spreadsheet.*

Claims following a catastrophe are often subject to demand surge.

- (d) (0.5 points) Describe how you would consider the effect of a demand surge in the calculation of the catastrophe loading for ratemaking.

*Provide the response for this part in the Excel spreadsheet.*



## GIRR Spring 2023 Question 14 (LOs 3g, 5c, 5d)

### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16 and 26.

### Question:

## 14.

(6 points) You are estimating ultimate claims as of December 31, 2022 using the development-based frequency-severity method. You are given the following:

Accident Year	Earned Exposures	Ultimate Counts Based on Development Method	Ultimate Severity Based on Development Method
2017	11,434	1,235	4,104
2018	11,635	1,247	4,384
2019	11,681	1,249	4,751
2020	11,821	1,260	5,066
2021	12,044	1,256	5,531
2022	12,240	1,301	5,897

- The annual claim severity trend is 7.5%.
- The earned exposures are not inflation sensitive.

- (a) (1.5 points) Recommend an annual claim frequency trend to use for the development-based frequency-severity method. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (3.5 points) Estimate ultimate claims for all accident years using the development-based frequency-severity method.

*Provide the response for this part in the Excel spreadsheet.*

There are times when projections from the frequency-severity method are preferred over the development method when used as inputs to the expected method.

- (c) (1 point) Describe two scenarios when projections from the frequency-severity method are preferred.

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Fall 2023 Question 3 (LOs 5b, 5e, 6d)

#### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6d) Calculate loadings for catastrophes and large claims.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26 and 31.

#### Question:

**3.**

*Provide the response for this question in the Excel spreadsheet.*

(4 points) You are determining a loading for large claims on a homeowners book of business for a ratemaking exercise.

- (a) (0.5 points) State two reasons for using a large claim loading approach when estimating ultimate claims at total limits for ratemaking.

You are given the following:

Accident Year	Selected Ultimate Claims at 500,000 Limit	Selected Ultimate Claims at Total Limits
2019	9,850,000	12,108,000
2020	10,365,000	12,658,000
2021	11,275,000	15,334,000
2022	12,385,000	14,357,000

- New rates are effective October 1, 2023 for one year.
- All policies are written for 6-month policy terms.
- The annual severity trend at 500,000 limit is 5%.
- The annual severity trend at total limits is 7%.
- The indicated large claims loading for 500,000 to total limits is 1.28 for the prospective rating period.
- The experience for this homeowners book of business is considered fully credible.

- (b) *(2 points)* Calculate the large claim loadings at 500,000 limit, adjusted to the cost level for each accident year.
- (c) *(0.5 points)* Calculate ultimate claims at total limits for each accident year using selected ultimate claims at a 500,000 limit and the large claim loadings from part (b).
- (d) *(1 point)* Describe how the calculations in part (b) are affected when the experience is less than fully credible.

**GIRR Fall 2023 Question 6 (LOs 5c)****Learning Outcomes:**

- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 27.

**Question:****6.**

(3 points) You are conducting an exposure and premium trend analysis for ratemaking purposes.

- (a) (0.5 points) Describe why you would adjust actual historical premiums to current rate levels before analyzing premium trend.

ANSWER:

- (b) (0.5 points) Describe an advantage of using written premiums instead of earned premiums for a premium trend analysis.

ANSWER:

- (c) (0.5 points) Describe why an adjustment for inflation is required if premiums are based on inflation-sensitive exposures.

ANSWER:

- (d) (0.5 points) Describe why an increasing proportion of insureds replacing their old vehicles with new vehicles might affect premium trend factors.

ANSWER:

- (e) (1 point) Describe how a premium trend analysis for an insurer's book of business is different from a premium trend analysis for a self-insurer.

ANSWER:

### GIRR Fall 2023 Question 8 (LOs 3g, 5c, 5d, 5e)

#### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16 and 26.

#### Question:

**8.**

*Provide the response for this question in the Excel spreadsheet.*

(4 points) The two most common models for determining trend rates are linear and exponential.

- (a) (0.5 points) Explain why a linear trend model may not be appropriate when trend is decreasing.

You are given the following:

Accident Year	Earned Exposures	Ultimate Counts	Indicated Claim Frequency
2016	15,859	1,454	9.17%
2017	16,140	1,452	9.00%
2018	16,265	1,457	8.96%
2019	16,319	1,453	8.90%
2020	16,536	1,442	8.72%
2021	16,928	1,464	8.65%
2022	16,842	1,475	8.76%

Indicated annual trend, using an exponential model	
All years	−0.86%
AY2017-AY2022	−0.74%
AY2016-AY2021	−1.11%

- (b) (0.5 points) Recommend an annual claim frequency trend to use for this line of business. Justify your recommendation.

You are also given the following:

Accident Year	Ultimate Severity
2016	3,750
2017	3,993
2018	4,230
2019	4,489
2020	4,679
2021	5,048
2022	5,409

- The annual severity trend is 6.0%.
  - Ultimate counts and ultimate severity were determined based on the development method.
- (c) (3 points) Calculate projected ultimate claims using the development-based frequency-severity method and your recommended annual claim frequency trend.

## GIRR Fall 2023 Question 11 (LOs 5b, 5c, 5d, 5e, 6a)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27 and 30.

### Question:

## 11.

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are analyzing expenses for ratemaking. The trend in fixed expenses is often analyzed separately from the trend in average premiums.

- (a) (0.5 points) Identify why a separate trending procedure for fixed expenses may not be required when analyzed on a per-exposure basis.

You are given the following:

Calendar Year	Fixed Expenses	Earned Premiums	Earned Premiums at Current Rates
2016	461,512	5,177,046	6,750,220
2017	493,686	5,615,887	7,026,059
2018	530,358	6,172,433	7,435,117
2019	571,399	6,749,414	7,835,156
2020	622,827	7,607,009	8,295,015
2021	665,497	8,102,719	8,667,071
2022	725,652	8,760,790	9,164,015

- New rates are effective November 1, 2023 for one year.
- All policies are written for 12-month policy terms.



- Premiums are written evenly throughout the year.
  - Premiums are earned and fixed expenses are incurred evenly throughout the policy term.
- (b) (2 points) Recommend an annual fixed expense trend. Justify your recommendation.
- (c) (2.5 points) Recommend a fixed expense ratio to be used in ratemaking. Justify your recommendation.

## GIRR Fall 2023 Question 12 (LOs 5b, 5c, 5d, 5e, 6g, 6h)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26 and 32.

Actuarial Standards of Practice, Actuarial Standards Board of the American Academy of Actuaries, No. 25, Credibility Procedures, 2013.

### Question:

**12.**

*Provide the response for this question in the Excel spreadsheet.*

(6 points) You are conducting a ratemaking analysis and are given the following:

Accident Year	Earned Exposures	Earned Premiums at Current Rate Level	Ultimate Counts	Ultimate Claims
2018	10,146	9,400,897	862	13,085,953
2019	10,127	9,537,898	869	14,011,147
2020	10,298	9,901,002	875	14,968,858
2021	10,291	10,263,291	852	15,499,745
2022	10,573	10,713,349	883	18,068,228

- The historical annual claim frequency trend was –1.0%.
- The annual claim frequency trend is expected to increase to 1.0% for all accidents occurring after December 31, 2022.
- The historical annual claim severity trend was 6.0% and is not expected to change in the future.
- The new rates are effective March 1, 2024 for one year.

- All policies are written for 12-month policy terms.
- The full credibility standard is 4,654 ultimate counts.
- The square root rule is used for partial credibility.

- (a) (2 points) Calculate the trended pure premiums for each accident year.
- (b) (1 point) Recommend a trended pure premium. Justify your recommendation.

You are also given the following:

- The complement of credibility is derived using the average pure premium underlying the current rates adjusted to the cost level of the forecast period of the new rates.
- The current rates are based on the prior ratemaking analysis that was applied to policies effective July 1, 2022 through June 30, 2023, with average pure premium of 1,700.

- (c) (1 point) Calculate the pure premium to use for the complement of credibility.

You are also given the following:

- Fixed expenses per exposure are 125.
- The ratio of ULAE to claims is 4%.
- The ratio of variable expenses to premiums is 18%.
- The ratio of profit and contingencies to premiums is 5%.

- (d) (1.5 points) Calculate the credibility-weighted indicated rate.

An alternative for the complement of credibility is to use a pure premium based on industry experience.

- (e) (0.5 points) Identify one adjustment that is necessary when relying on a complement of credibility that is a pure premium based on industry experience.

**GIRR Spring 2024 Question 3 (LOs 5b, 5c, 5e)****Learning Outcomes:**

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5e) Calculate trend factors for claims and exposures.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 27.

**Question:****3.***Provide the response for this question in the Excel spreadsheet.*

(4 points) You are analyzing premium trend on a large book of business for a ratemaking exercise.

- (a) (0.5 points) Explain the purpose of quantifying the effect of shifts in the mix of exposures and rating characteristics on the premium during the experience period.

Based on an analysis of the historical premium for this book of business, the annual premium trend has been 1.5% prior to January 1, 2024. You are expecting a significant change in the economic environment and have therefore selected an annual trend of 3.0% for all policies written on or after January 1, 2024. All policies are six-month policies, written evenly throughout each year. The new rates will be in effect starting October 1, 2024 for one year.

- (b) (1.5 points) Calculate the 2020 premium trend factor to be used to adjust 2020 earned premiums for the ratemaking exercise.
- (c) (1 point) Explain how the premium trend factors would be affected by the following:
  - (i) An increasing proportion of insureds choosing a lower policy limit at the beginning of 2024
  - (ii) An increasing proportion of insureds choosing a higher deductible at the beginning of 2024
- (d) (1 point) Describe why the trending periods would be different in the part (b) calculation if this trending analysis is done for a self-insurer.

## GIRR Spring 2024 Question 5 (LOs 1d, 1f, 3g, and 3j)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6f) Explain the requirements for loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate loadings for catastrophes and large claims.
- (6h) Apply loadings for catastrophes and large claims in ratemaking.
- (6j) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6k) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 26, 31, and 32.

### Question:

**5.**

*Provide the response for this question in the Excel spreadsheet.*

(11 points) You are conducting a ratemaking analysis for a line of business in state S with the following information:

- The new rates are to be effective September 1, 2024, through August 31, 2025.
- All policies are written for 6-month policy terms.
- The annual frequency trend is  $-1\%$ .
- The annual severity trend is  $5\%$ .

You are also given the following state S claims data for non-hurricane weather excluding hail:

Accident Year	Ultimate	
	Frequency per 100 earned house years (EHY)	Severity
2014	2.02	4,100
2015	0.39	3,500
2016	1.99	2,900
2017	0.10	4,400
2018	1.99	2,800
2019	0.80	4,200

Accident Year	Ultimate	
	Frequency per 100 earned house years (EHY)	Severity
2020	0.63	2,600
2021	2.73	3,600
2022	0.56	2,100
2023	1.69	3,100

- (a) (2 points) Calculate the trended ultimate non-hurricane weather excluding hail pure premium per 100 EHY for all years.
- (b) (0.5 points) Recommend the trended ultimate non-hurricane weather excluding hail pure premium per 100 EHY to use in determining a weather loading. Justify your recommendation.

You are given the following additional information:

- Calendar year 2023 earned premiums at current rate level are 13,089,711.
  - Calendar year 2023 EHY are 17,931.
  - State S is part of region R.
  - The trended ultimate pure premium per 100 EHY for region R is 4,000.
  - The credibility that relates to the non-hurricane weather excluding hail loading for state S is 70%.
- (c) (1 point) Calculate the non-hurricane weather excluding hail loading percentage to use for ratemaking.

Actuaries can have flexibility in choosing the number of years to include in the experience period for ratemaking purposes.

- (d) (1 point) Identify two considerations when choosing the number of years and/or the weights to assign to each of the years.

You are given the following data:

<b>Accident Year</b>	<b>Earned Exposures</b>	<b>Ultimate Counts</b>	<b>Historical Earned Premiums</b>	<b>Ultimate Claims</b>
2019	20,675	1,070	13,510,549	8,709,600
2020	19,937	1,075	13,268,660	8,673,608
2021	17,061	1,074	11,739,370	7,919,295
2022	17,992	1,141	12,638,750	8,605,528
2023	17,931	1,087	13,089,711	9,489,317

The full credibility standard is 3,654 ultimate counts.

- (e) (1 point) Recommend the number of years to include when estimating the weighted average trended claim ratio for the indicated rate change. Justify your recommendation.
- (f) (1 point) Recommend the weights to assign to each year when estimating the weighted average trended claim ratio for the indicated rate change. Justify your recommendation.

You are given the following additional information:

- Rate change history:
    - A rate change of +3% was effective July 1, 2020
    - A rate change of +4% was effective July 1, 2022
  - Premiums are written and earned evenly throughout the year.
  - The annual premium trend is 0%.
  - The ratio of ULAE to claims is 5%.
  - The ratio of fixed expenses to premiums at current rates is 3%.
  - The ratio of variable expenses to premiums is 12%.
  - The ratio of profit and contingencies to premiums is 4%.
- (g) (4.5 points) Calculate the indicated rate change for this line of business.

## GIRR Spring 2024 Question 12 (LOs 3g, 5c, 5d)

### Learning Outcomes:

- (3g) Estimate ultimate values using the methods cited in (3e).
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 16 and 26.

### Question:

**12.**

*Provide the response for this question in the Excel spreadsheet.*

(7 points) You are estimating ultimate claims for a line of business as of December 31, 2023 using the development-based frequency-severity method.

- (a) (1 point) Describe two options to consider when experience is not fully credible for trending.

You are given the following additional information:

Accident Year	Earned Exposures	Projected Ultimate Counts Based on	
		Closed Counts	Reported Counts
2018	16,451	1,641	1,485
2019	16,557	1,786	1,492
2020	16,815	1,885	1,499
2021	16,915	2,000	1,503
2022	17,147	1,977	1,474
2023	17,461	1,990	1,491

- This line of business was stable prior to 2023, when new claims processing and settlement policies were introduced in 2023.
  - Ultimate estimates shown above are based on simple development methods.
- (b) (1.5 points) Recommend the annual claim frequency trend to use for this line of business. Justify your recommendation.



- (c) *(1.5 points)* Calculate the ultimate counts using the development-based frequency-severity method with your selected frequency trend from part (b). Justify any selections.

You are given the following additional information:

<b>Accident Year</b>	<b>Projected Ultimate Severity Based on</b>	
	<b>Paid Severity</b>	<b>Reported Severity</b>
2018	4,390	4,719
2019	4,602	5,342
2020	4,789	5,618
2021	5,085	5,857
2022	5,196	5,923
2023	5,456	6,168

The annual claim severity trend is 5%. The selected trend rate should recognize economic trend.

- (d) *(0.5 points)* State one other influence that the trend rate should also recognize.
- (e) *(2.5 points)* Calculate the ultimate claims using the development-based frequency-severity method. Justify any selections.

**GIRR Fall 2024 Question 8 (LOs 5e)****Learning Outcomes:**

(5e) Calculate trend factors for claims and exposures.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 26.

**Question:****8.***Provide the response for this question in the Excel spreadsheet.*

(4 points) You are estimating claim trend by fitting historical data using exponential regression.

- (a) (0.5 points) Describe one reason for relying on a longer period of time when trending a long-tailed line of business.
- (b) (0.5 points) Provide an example where a longer period of time may not be appropriate for trending a long-tailed line of business.
- (c) (1 point) State two considerations when selecting which data points to include in trending procedures.

You are given the following for a ratemaking exercise:

- 40% of all written policies are expected to be twelve-month policies.
- 60% of all written policies are expected to be six-month policies.
- The accident year 2022 trend period for 12-month policies is 45 months.
- The exponential regression best fit lines, where  $t$  is half years:

- Claim severity:  $s = 42,000e^{0.045t}$
- Claim frequency:  $f = 0.015e^{-0.007t}$

- (d) (2 points) Calculate the pure premium trend factor for accident year 2022.

## GIRR Fall 2024 Question 11 (LOs 2d, 5b, 5e)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13 and 27.

### Question:

**11.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) Your company started writing a new line of business on March 1, 2022. You are conducting a ratemaking analysis for this line of business and are given the following:

<b>Historical Rate Changes Since March 1, 2022</b>	
<b>Effective Date of Rate Change</b>	<b>Rate Change</b>
September 1, 2022	5%
January 1, 2024	7%

- The first policy was issued March 1, 2022.
- Premiums are written evenly throughout the year.
- Premiums are earned evenly throughout the policy term.
- All policies were written for 12-month terms.
- There have been no rate changes since January 1, 2024.
- New rates will be effective April 1, 2025, for one year.
- The annual premium trend is  $-0.5\%$ .

You are adjusting historical earned premiums to the future rating period.

- (a) (3 points) Calculate the on-level premium factors for calendar year 2022 and 2023.
- (b) (2 points) Calculate premium trend factors for calendar year 2022 and 2023.

## GI 101 – LEARNING OBJECTIVE 6

### 6. Topic: Ratemaking

The candidate will understand how to apply the fundamental ratemaking techniques of general insurance.

## GIRR Fall 2020 Question 5 (LOs 6a)

### Learning Outcomes:

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

### Question:

- 5.** (4 points) You are conducting an expense analysis to be used in ratemaking for a line of business, and are given the following information:

Calendar Year	Earned Premiums	Earned Premiums at Current Rate Level	Fixed Expenses
2014	4,526,480	5,850,000	172,580
2015	4,830,080	6,166,130	186,220
2016	5,279,580	6,451,780	200,650
2017	5,542,320	6,658,360	214,400
2018	6,139,740	6,901,520	231,200
2019	6,873,650	7,231,270	253,090

This line of business has historically used an annual fixed expense trend of 3%, which has been based on a publicly-available cost index.

- (a) (1 point) Calculate the historical trend in fixed expenses.

*The response for part (a) is to be provided in the Excel spreadsheet.*

- (b) (0.5 points) Assess the reasonableness of using the publicly-available cost index for this line of business in comparison to using the historical trend in fixed expenses.

ANSWER:

- (c) (0.5 points) Recommend the annual fixed expense trend. Justify your recommendation.

ANSWER:

You are given the following additional information:

- New rates will be effective April 1, 2021 for one year.
  - All policies are written as 12-month policies.
  - The annual premium trend is 0%.
- (d) (2 points) Calculate the fixed expense ratio to be used in ratemaking, using a simple average from calendar years 2017, 2018 and 2019.

*The response for part (d) is to be provided in the Excel spreadsheet.*

### GIRR Fall 2020 Question 13 (LOs 6c, 6d)

#### Learning Outcomes:

- (6c) Explain the requirements for loadings for catastrophes and large claims in ratemaking.  
 (6d) Calculate loadings for catastrophes and large claims.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

#### Question:

**13.** (5 points) You are determining a loading for large claims on a homeowners line of business.

- (a) (0.5 points) Explain why actuaries typically conduct separate analyses of property and liability claims for homeowners insurance when determining a loading for large claims.

ANSWER:

You are estimating ultimate property claims to be used in a ratemaking analysis for State Q, and are given the following information:

Accident Year	Selected Ultimate Claims at 1 Million Limit (000)	Selected Ultimate Claims at Total Limits (000)
2016	7,420	7,950
2017	7,800	8,150
2018	8,500	8,690
2019	9,150	9,320

Selections	1 Million Limit	Total Limits
State Q Severity Trend	4.0%	5.0%
State Q Credibility	60%	50%
Countrywide Severity Trend	5.0%	6.0%

- The claims experience of State Q is not fully credible for calculating trend.
- Rates are effective April 1, 2021 for one year.
- All policies are written for 12-month policy terms.

You are given the following loadings for large claims for the 500,000 to 1 million limit:

Accident Year	500,000 to 1 Million Limit
2016	1.182
2017	1.185
2018	1.270
2019	1.285

- (b) (3 points) Calculate the loadings for 500,000 to total limits for each accident year.

*The response for part (b) is to be provided in the Excel spreadsheet.*

- (c) (0.5 points) Recommend a loading for 500,000 to total limits for ratemaking purposes. Justify your recommendation.

ANSWER:

- (d) (1 point) Explain why severity trend is used for the part (b) calculation instead of pure premium trend.

ANSWER:



## GIRR Fall 2020 Question 16 (LOs 2d, 5b, 5e, 6g)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 26, 27, and 32.

### Question:

- 16.** (7 points) You are conducting a ratemaking analysis for an automobile line of business and are given the following information:

Rate Change History	
Effective Date of Rate Change	Rate Change %
July 1, 2015	8.0%
January 1, 2017	10.0%
January 1, 2019	5.0%

- Premiums are written and earned evenly throughout the year.
  - All policies are written for 12-month policy terms.
  - In addition to the above rate changes, there was a regulation change where all premiums in force on July 1, 2017 were required to be reduced by 20%.
- (a) (2 points) Calculate premium on-level factors for accident years 2015-2019 to use for ratemaking purposes.

*The response for part (a) is to be provided in the Excel spreadsheet.*

You are given the following additional information:

<b>Accident Year</b>	<b>Earned Premiums</b>	<b>Ultimate Claims</b>
2015	11,755,570	8,130,150
2016	11,864,520	7,970,110
2017	12,406,530	7,781,380
2018	12,492,860	8,001,680
2019	12,394,530	7,995,960

- The annual premium trend is 1%.
- The annual pure premium trend is 4%.
- The new rates will be effective November 1, 2020 through October 31, 2021.
- The historical data is considered fully credible for ratemaking purposes.
- The regulation change which reduced premiums also reduced claim costs by 20% for all accidents occurring on or after July 1, 2017.

(b) (2.5 points) Calculate the trended on-level claim ratios for each accident year.

*The response for part (b) is to be provided in the Excel spreadsheet.*

(c) (1 point) Recommend a trended claim ratio to use for ratemaking. Justify your recommendation.

*The response for part (c) is to be provided in the Excel spreadsheet.*

You are given the following additional information:

- The ratio of ULAE to claims is 10%.
- The ratio of fixed expenses to premiums at current rates is 6%.
- The ratio of variable expenses to premiums is 19%.
- The ratio of profit and contingencies to premiums is 5%.

(d) (0.5 points) Calculate the indicated rate change.

*The response for part (d) is to be provided in the Excel spreadsheet.*

The purpose of the legislative change effective July 1, 2017 was to reduce increases in premiums arising from poor industry claims experience. As a result, management questions your required increase of 5% in 2019.

(e) (1 point) Explain why an indicated rate increase of 5% is not necessarily indicative of deteriorating experience.

ANSWER:

## GIRR Spring 2021 Question 12 (LOs 5b, 5c, 5d, 5e, 6g, 6h)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27 and 32.

### Question:

## 12.

(6 points) You are given the following information:

Calendar Year	Written Exposures	Earned Exposures	On-Level Written Premiums	On-Level Earned Premiums
2011	12,150	12,082	6,561,000	6,427,624
2012	12,393	12,332	6,772,527	6,652,473
2013	12,889	12,765	7,123,878	6,979,015
2014	13,920	13,662	7,795,279	7,565,041
2015	14,616	14,442	8,363,476	8,175,282
2016	14,762	14,726	8,555,141	8,441,915
2017	14,319	14,430	8,409,605	8,378,940
2018	13,460	13,675	7,990,486	8,034,240
2019	13,191	13,258	7,928,680	7,888,949
2020	13,851	13,686	8,428,619	8,248,676

- (a) (2 points) Recommend the annual premium trend to use for ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- New rates will be effective August 1, 2021 for six months.
- All policies are written as 12-month policies.

<b>Accident Year</b>	<b>Trended Ultimate Claims</b>
2016	6,837,098
2017	6,467,985
2018	5,847,762
2019	5,734,244
2020	5,674,781

- (b) (1.5 points) Calculate the trended claim ratio for each accident year.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Recommend a trended claim ratio to use for ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- The annual pure premium trend is 5%.
- The complement of credibility is derived using the data from the last ratemaking analysis.
- The last ratemaking analysis was for policies effective January 1, 2021 through June 30, 2021, where
  - the indicated rate change was 4%,
  - the approved rate change was 2%, and
  - the permissible claim ratio was 55%.

- (d) (1 point) Calculate the claim ratio to use for the complement of credibility.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- The ratio of fixed expenses to premiums at current rates including ULAE is 15%.
- The ratio of variable expenses to premiums is 11%.
- The ratio of profit and contingencies to premiums is 4%.
- The credibility assigned to the experience claim ratio is 77%.

- (e) (1 point) Calculate the indicated rate change.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2021 Question 16 (LOs 6c, 6d)

### Learning Outcomes:

- (6c) Explain the requirements for loadings for catastrophes and large claims in ratemaking.
- (6d) Calculate loadings for catastrophes and large claims.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26 and 31.

### Question:

## 16.

(5 points) You are estimating ultimate property claims in State X for ratemaking purposes using a large claims loading approach.

You are given the following information:

Accident Year	Selected Ultimate Claims at Alternative Limits (000)		
	250,000	500,000	Total Limits
2013	3,990	4,560	4,560
2014	3,988	3,988	3,988
2015	3,846	5,198	5,370
2016	4,301	6,367	6,829
2017	4,545	6,489	6,489
2018	4,256	4,256	4,256
2019	4,840	7,164	7,779
2020	5,038	7,349	7,349

Selected Severity Trend at Alternative Limits (000)		
250,000	500,000	Total Limits
4.5%	5.0%	5.7%

- The new rates are to be effective February 1, 2022 through January 31, 2023.
- All policies are written for 12-month policy terms.

You are given the following loadings for large claims in State X, which were calculated using experience from accident years 2013 to 2020:

	<b>Loadings for Large Claims</b>		
	<b>250,000 to 500,000</b>	<b>250,000 to Total Limits</b>	<b>500,000 to Total Limits</b>
All-years average	1.323	1.404	1.059

- (a) (2 points) Demonstrate that the all-years simple average of the loadings for large claims were calculated correctly in the table above.

*Provide the response for this part in the Excel spreadsheet.*

A credibility procedure was used to select the State X loadings for large claims at a 250,000 limit and a 500,000 limit using the following assumptions:

- State X credibility is 50% for claims from 250,000 to 500,000, and 20% for claims from 500,000 to total limits.
  - The countrywide loadings for large claims are 1.53 for claims from 250,000 to 500,000, and 1.05 for claims from 500,000 to total limits.
  - The loading for large claims from 250,000 to total limits is derived from the loadings for large claims from 250,000 to 500,000, and 500,000 to total limits.
- (b) (2 points) Calculate the ultimate claims at total limits for each accident year from 2016 to 2020, using selected ultimate claims at the following limits:
- (i) 250,000
  - (ii) 500,000

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1 point) Explain why a loading for catastrophe claims might still be appropriate for the State X property business ratemaking despite including a loading for large claims.

ANSWER:

## GIRR Spring 2021 Question 18 (LOs 6a)

### Learning Outcomes:

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

### Question:

## 18.

(4 points) You are given the following information for a line of business:

Calendar Year	General and Other Acquisition Expenses	Commission Expenses	Premium Taxes, Licenses and Fees	Direct Written Premiums	Direct Earned Premiums
2017	232,300	290,400	67,760	2,420,000	2,370,000
2018	249,500	303,600	70,840	2,530,000	2,470,000
2019	253,200	320,400	74,760	2,670,000	2,610,000
2020	258,500	352,800	82,320	2,940,000	2,810,000

- Calendar year 2021 budgeted earned premiums are 2,936,450.
- Calendar year 2021 budgeted general and other acquisition expenses are 293,645.
- The percent of general and other acquisition expenses that are fixed is 30%.

- (a) (3 points) Recommend a fixed and a variable expense ratio to use for ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (0.5 points) Identify a potential distortion to a ratemaking analysis when selecting a fixed expense percentage that is applied to a projected average premium.

ANSWER:

- (c) (0.5 points) Recommend a solution to the potential distortion identified in part (b).

ANSWER:



**GIRR Fall 2021 Question 4 (LOs 5b, 5e, 6d, 6e, 6g)****Learning Outcomes:**

- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6d) Calculate loadings for catastrophes and large claims.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27, 31, and 32.

**Question:****4.**

(4 points) XYZ insurer is thinking of offering an earthquake endorsement to its basic homeowners policy. You are given the following information:

- Using July 1, 2020 in-force policies, expected claims from the earthquake catastrophe model are 225,000 based on an October 1, 2020 cost level.
- Earned house years for accident year 2020 are 15,000.
- The annual exposure trend is 3.5%.
- The annual severity trend is 7%.
- New rates are to be effective July 1, 2022 for one year with all policies written as 12-month policies.

- (a) (2 points) Calculate the pure premium for the earthquake endorsement.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information for the earthquake endorsement:

- The fixed cost per policy is 5.
- The variable expense to premium ratio is 10%.
- The risk load is 25% of premium.

- (b) (0.5 points) Calculate the premium for the earthquake endorsement.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following information for the basic homeowners coverage:

Accident Year	Basic Homeowners (excluding optional earthquake endorsement)	
	On Level Earned Premium	Ultimate Claims
2018	15,500,000	9,000,000
2019	16,250,000	8,000,000
2020	17,000,000	8,200,000

- The current rate level is 1,050.
- The annual premium trend is 2%.
- The permissible claim ratio is 57%.

- (c) (1 point) Calculate the indicated rate for the basic homeowners coverage. Justify any selections.

*Provide the response for this part in the Excel spreadsheet.*

Since the earthquake coverage is an optional endorsement, management proposes that there should not be any fixed and variable expense charged to this optional coverage.

- (d) (0.5 points) State whether you agree with management's proposal. Justify your response.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2021 Question 15 (LOs 6g)

### Learning Outcomes:

- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 32.

### Question:

## 15.

(5 points) You are conducting a ratemaking analysis for a line of business for new rates to be effective January 1, 2022, and are given the following information:

Calendar year 2020 earned premium	8,100,000
Calendar year 2020 earned exposures	11,000
Premium on-level factor	1.030
Premium trend factor	1.007
Experience claims ratio trended to the future rating period	78%
ULAE as a percent of claims	9%
Fixed expenses as a percent of premium	5%
Annual fixed expense trend	0%
Variable expenses as a percent of premium	10%
Target profit as a percent of premium	5%

- (a) (1.5 points) Demonstrate that the indicated rate change using the pure premium approach is 5.9%.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- Management approves a 4% rate increase for this line of business.
- No further rate changes are expected.
- The annual severity trend is 1.5%.
- The annual frequency trend is 0.5%.
- The annual premium trend is 0.4%.

- (b) (3.5 points) Calculate the forecasted profit per policy for policies written in 2022, 2023, 2024 and 2025.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Fall 2021 Question 20 (LOs 6a)

### Learning Outcomes:

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

### Question:

## 20.

(4 points) You are conducting a ratemaking analysis and are given the following information:

Calendar Year	Earned Exposures	Direct Written Premium	Direct Earned Premiums	Total Commission Expenses and Premium Taxes	General Expenses
2018	32,500	8,800,000	8,700,000	1,400,000	1,355,000
2019	33,700	9,600,000	9,400,000	1,520,000	1,450,000
2020	35,100	10,200,000	9,900,000	1,620,000	1,490,000

- 25% of general expenses are fixed expenses.
- Unallocated loss adjustment expenses have been 6% of claims for each of the past three years and are expected to increase to 8% for the next five years due to a system update that will cost 1,200,000 to implement.
- The earned exposures in the future rating period are projected to be 37,000.

- (a) (1.5 points) Calculate the total variable expense ratio for each calendar year.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1 point) Recommend the total variable expense ratio to use in ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1.5 points) Recommend the fixed expense per exposure to use in ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

**GIRR Spring 2022 Question 10 (LOs 6a)****Learning Outcomes:**

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

**Question:****10.***(5 points)*

- (a) *(2.5 points)* Describe the five major categories of expenses that are considered in a ratemaking analysis as defined by U.S. Standards.

ANSWER:

- (b) *(1 point)* Describe two different ways for an insurer to incorporate non-proportional reinsurance in a ratemaking analysis.

ANSWER:

- (c) *(0.5 points)* Describe the purpose of a residual market mechanism.

ANSWER:

- (d) *(1 point)* Describe each of the following as used in U.S. workers compensation ratemaking:

- (i) An expense constant
- (ii) A premium discount plan

ANSWER:

## GIRR Spring 2022 Question 17 (LOs 5b, 5e, 6d, 6e, 6g, 6h)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6d) Calculate loadings for catastrophes and large claims.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27, 31, and 32.

### Question:

## 17.

(4 points) You are performing a ratemaking analysis for a homeowners book of business. As part of the analysis, you are including a loading for wildfire claims.

You are given the following information:

Accident Year	Earned Exposures	Ultimate Wildfire Counts	Ultimate Wildfire Claims
2015	11,200	0	0
2016	11,850	0	0
2017	12,500	1	1,500,000
2018	13,750	0	0
2019	15,000	1	1,120,000
2020	16,250	0	0
2021	17,500	1	500,000

- New rates are to be effective September 1, 2022, for one year, with all policies written as 12-month policies.
- The annual wildfire claim severity trend is 3%.
- The credibility assigned to wildfire claims for this homeowners book of business is 20%. The complement of credibility is assigned to the industry figures.
- A study of industry results with data as of year-end 2020 indicates a trended ultimate pure premium for wildfire claims of 50, with an average accident date of July 1, 2020.

- (a) (2.5 points) Calculate the ultimate pure premium for wildfire claims to be used as a loading in the homeowners premiums.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- The annual non-wildfire claim severity trend is 4%.
  - The annual premium trend is 2.5%.
  - Variable expenses are 20% of premiums.
  - Fixed expenses are 70 per policy.
  - Profit and contingencies are 5% of premium.
  - The experience claim ratio for non-wildfire claims as of July 1, 2021, is 67%.
  - The calendar year 2021 on-level earned premiums are 21,507,500.
- (b) (1.5 points) Calculate the indicated total premium for the homeowners coverage, including a loading for wildfire claims.

*Provide the response for this part in the Excel spreadsheet.*



### GIRR Fall 2022 Question 5 (LOs 6a)

#### Learning Outcomes:

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

#### Question:

## 5.

(4 points) You are conducting an expense analysis to be used in ratemaking for a line of business, and are given the following information:

Calendar Year	Earned Premiums	Earned Premiums at Current Rate Level	Fixed Expenses
2016	13,525,260	17,480,000	543,630
2017	14,287,260	18,239,240	586,640
2018	15,646,150	19,120,010	634,770
2019	16,642,150	19,993,320	684,470
2020	18,527,760	20,826,540	734,250
2021	20,737,090	21,816,000	792,360

- (a) (1 point) Calculate the historical annual trend in fixed expenses.

*The response for this part is to be provided in the Excel spreadsheet.*

- (b) (0.5 points) Recommend the annual fixed expense trend. Justify your recommendation.

*The response for this part is to be provided in the Excel spreadsheet.*

You are given the following additional information:

- New rates will be effective June 1, 2023 for one year.
  - All policies are written as 12-month policies.
  - The annual premium trend is 1%.
- (c) (2.5 points) Calculate the fixed expense ratio to be used in ratemaking, using a simple average from calendar years 2019, 2020 and 2021.

<i>The response for this part is to be provided in the Excel spreadsheet.</i>
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**GIRR Fall 2022 Question 14 (LOs 5b, 5c, 5d, 5e, 6e, 6g, 6h)****Learning Outcomes:**

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

**Source References:**

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26, 31, and 32.

**Question:****14.**

(6 points) You are performing a ratemaking analysis of a homeowners book of business for State Q. As part of the analysis, you are reviewing loadings for catastrophes and large claims.

- (a) (0.5 points) Describe one way that large claims are differentiated from catastrophe claims when insurers are estimating loadings for ratemaking purposes.

You are given the following State Q ultimate pure premium for non-hurricane weather excluding hail (referred to as weather claims below) per 100 earned house years (EHY):

Accident Year	Pure Premium per 100 EHY
2010	5,280
2011	5,770
2012	6,330
2013	6,200
2014	6,920
2015	7,140
2016	7,560
2017	8,300
2018	8,460

<b>Accident Year</b>	<b>Pure Premium per 100 EHY</b>
2019	8,850
2020	9,400
2021	9,940

- The new rates are to be effective August 1, 2023 for one year.
- All policies are written for 12-month policy terms.

- (b) (1 point) Recommend the annual pure premium trend for weather claims. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (c) (1.5 points) Recommend the trended ultimate pure premium for weather claims per 100 EHY to use in ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

<b>State Q Property excluding Weather Claims</b>						
<b>Accident Year</b>	<b>Earned House Years</b>	<b>Earned Premiums</b>	<b>Earned Premiums at Current Rate Level</b>	<b>Trended Earned Premiums at Current Rate Level</b>	<b>Trended Ultimate Claims</b>	<b>Accident Year Weights</b>
2019	16,080	10,537,200	11,064,120	12,545,160	7,130,200	25%
2020	16,560	11,330,400	11,606,760	12,777,120	7,449,200	30%
2021	16,860	11,802,000	11,802,000	12,613,560	6,824,400	45%
<b>Total</b>	<b>49,500</b>	<b>33,669,600</b>	<b>34,472,880</b>	<b>37,935,840</b>	<b>21,403,800</b>	<b>100%</b>

- The full credibility standard is 80,000 EHY.
- The square root rule is used for partial credibility.
- The trended adjusted country-wide ultimate claim ratio (including ULAE) is 70%.
- The ULAE to claim ratio is 12%.
- The selected fixed expenses are 5% of premiums.
- The selected variable expenses are 15% of premiums.
- The selected profit and contingencies are 4% of premiums.

- (d) (3 points) Calculate the indicated rate level change, including a loading for weather claims.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2023 Question 4 (LOs 6a)

### Learning Outcomes:

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

### Question:

**4.**

(4 points) You are conducting an analysis of expenses for ratemaking purposes and are given the following:

Calendar Year	Earned Exposures	Direct Written Premiums	Direct Earned Premiums	Total Commission Expenses and Premium Taxes	General Expenses
2019	8,700	7,447,430	7,377,050	670,269	243,420
2020	9,150	7,895,360	7,846,640	710,582	253,065
2021	9,340	8,112,390	8,090,270	730,115	260,640
2022	9,240	8,097,340	8,083,570	728,761	268,436
2023 Budget	9,120	8,050,000	8,048,900	724,500	285,000

- Fixed expenses are 25% of general expenses.
- An unbudgeted system update will cost 2,500,000 to implement in 2023, and the cost will be spread over four years.

- (a) (2.5 points) Recommend the total variable expense ratio to use in ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

- (b) (1.5 points) Recommend the fixed expense per exposure to use in ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

## GIRR Spring 2023 Question 5 (LOs 5b, 5c, 5d, 5e, 6g)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27 and 32.

### Question:

## 5.

(8 points) You are trending earned premiums for ratemaking purposes and are given the following:

Experience Period	Earned Exposures by Policy Limits			
	500,000	1,000,000	1,500,000	2,000,000
2015	7,553	5,440	4,200	2,460
2016	7,504	5,511	4,320	2,574
2017	7,297	5,573	4,410	2,673
2018	7,218	5,536	4,501	2,806
2019	7,091	5,546	4,549	2,978
2020	7,011	5,598	4,675	3,125
2021	6,879	5,688	4,720	3,257
2022	6,906	5,685	4,758	3,403
Current Increased Limits Factors	0.85	1.00	1.13	1.24

- (a) (2 points) Recommend the annual premium trend due to the shift in policy limits to use for ratemaking. Justify your recommendation.

*Provide the response for this part in the Excel spreadsheet.*

You are given the following additional information:

- New rates are to be effective September 1, 2023 for one year.
- Premiums are written evenly throughout the year.
- Premiums are earned evenly throughout the policy term.
- Prior to January 1, 2020, all policies were written for 12-month terms.
- Since January 1, 2020, 75% of all policies have been written for 12-month terms and 25% of all policies have been written for 6-month terms.
- The annual trend due to a shift in deductibles is  $-0.1\%$
- The annual claim severity trend is  $6\%$ .
- The annual claim frequency trend is  $-1.2\%$ .
- The ratio of ULAE to claims is  $7\%$ .
- The ratio of fixed expenses to premiums at current rates is  $5\%$ .
- The ratio of variable expenses to premiums is  $23\%$ .
- The ratio of profit and contingencies to premiums is  $4\%$ .

Accident Year	Earned Premiums	Premium On-Level Factors	Ultimate Claims
2018	15,804,847	1.064	8,703,669
2019	15,333,428	1.106	9,184,011
2020	15,526,085	1.104	9,602,493
2021	16,625,910	1.049	10,401,614
2022	17,102,494	1.026	11,309,041

- (b) (4 points) Calculate the indicated rate level change for this line of business using a claims ratio approach. Justify any selection(s).

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Describe one reason why an indicated rate change using a pure premium approach may not result in the same result as part (b).

*Provide the response for this part in the Excel spreadsheet.*

Your colleague calculated the indicated rate change for this line of business to be  $6\%$ . The company's management decided to increase rates by  $3\%$ .

- (d) (1 point) Calculate the profit and contingencies to premium ratio implied by a  $3\%$  rate increase using your colleague's indicated rate change.

*Provide the response for this part in the Excel spreadsheet.*

- (e) (0.5 points) State two actions the company can take that could help achieve the target profit, given the 3% rate increase.

*Provide the response for this part in the Excel spreadsheet.*



## GIRR Spring 2023 Question 8 (LOs 5a, 5b, 5e, 6c, 6d)

### Learning Outcomes:

- (5a) Identify and describe the influences of portfolio changes on claim frequency and severity.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6c) Explain the requirements for loadings for catastrophes and large claims in ratemaking.
- (6d) Calculate loadings for catastrophes and large claims.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26, 27, and 31.

### Question:

## 8.

(4 points) You are estimating an earthquake catastrophe loading to use in a ratemaking analysis that was determined from a catastrophe model. You are given the following:

Modeled expected earthquake claims	450,000
Date of modeled expected claims cost level	July 1, 2022
Date of in-force exposures reflected in catastrophe model	February 1, 2022
Calendar year 2022 trended earned premium at current rate level	15,450,000
Annual exposure trend	1%
Annual claim severity trend	6%
Effective date of new rates	October 1, 2023

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 earthquake claims to calculate the catastrophe loading for ratemaking.

*Provide the response for this part in the Excel spreadsheet.*

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

*Provide the response for this part in the Excel spreadsheet.*

- (c) (0.5 points) Describe an additional step or approach that would increase your confidence in the estimate of expected earthquake claims.

*Provide the response for this part in the Excel spreadsheet.*

Claims following a catastrophe are often subject to demand surge.

- (d) (0.5 points) Describe how you would consider the effect of a demand surge in the calculation of the catastrophe loading for ratemaking.

*Provide the response for this part in the Excel spreadsheet.*

### GIRR Fall 2023 Question 3 (LOs 5b, 5e, 6d)

#### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6d) Calculate loadings for catastrophes and large claims.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26 and 31.

#### Question:

**3.**

*Provide the response for this question in the Excel spreadsheet.*

(4 points) You are determining a loading for large claims on a homeowners book of business for a ratemaking exercise.

- (a) (0.5 points) State two reasons for using a large claim loading approach when estimating ultimate claims at total limits for ratemaking.

You are given the following:

Accident Year	Selected Ultimate Claims at 500,000 Limit	Selected Ultimate Claims at Total Limits
2019	9,850,000	12,108,000
2020	10,365,000	12,658,000
2021	11,275,000	15,334,000
2022	12,385,000	14,357,000

- New rates are effective October 1, 2023 for one year.
- All policies are written for 6-month policy terms.
- The annual severity trend at 500,000 limit is 5%.
- The annual severity trend at total limits is 7%.
- The indicated large claims loading for 500,000 to total limits is 1.28 for the prospective rating period.
- The experience for this homeowners book of business is considered fully credible.

- (b) *(2 points)* Calculate the large claim loadings at 500,000 limit, adjusted to the cost level for each accident year.
- (c) *(0.5 points)* Calculate ultimate claims at total limits for each accident year using selected ultimate claims at a 500,000 limit and the large claim loadings from part (b).
- (d) *(1 point)* Describe how the calculations in part (b) are affected when the experience is less than fully credible.

## GIRR Fall 2023 Question 11 (LOs 5b, 5c, 5d, 5e, 6a)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 27 and 30.

### Question:

## 11.

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are analyzing expenses for ratemaking. The trend in fixed expenses is often analyzed separately from the trend in average premiums.

- (a) (0.5 points) Identify why a separate trending procedure for fixed expenses may not be required when analyzed on a per-exposure basis.

You are given the following:

Calendar Year	Fixed Expenses	Earned Premiums	Earned Premiums at Current Rates
2016	461,512	5,177,046	6,750,220
2017	493,686	5,615,887	7,026,059
2018	530,358	6,172,433	7,435,117
2019	571,399	6,749,414	7,835,156
2020	622,827	7,607,009	8,295,015
2021	665,497	8,102,719	8,667,071
2022	725,652	8,760,790	9,164,015

- New rates are effective November 1, 2023 for one year.
- All policies are written for 12-month policy terms.

- Premiums are written evenly throughout the year.
  - Premiums are earned and fixed expenses are incurred evenly throughout the policy term.
- (b) (2 points) Recommend an annual fixed expense trend. Justify your recommendation.
- (c) (2.5 points) Recommend a fixed expense ratio to be used in ratemaking. Justify your recommendation.

## GIRR Fall 2023 Question 12 (LOs 5b, 5c, 5d, 5e, 6g, 6h)

### Learning Outcomes:

- (5b) Identify the time periods associated with trending procedures.
- (5c) Analyze and evaluate trend for claims (including frequency, severity, and pure premium) and exposures (including inflation-sensitive exposures and premiums).
- (5d) Choose trend rates for claims (frequency, severity, and pure premium) and exposures.
- (5e) Calculate trend factors for claims and exposures.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6h) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 26 and 32.

Actuarial Standards of Practice, Actuarial Standards Board of the American Academy of Actuaries, No. 25, Credibility Procedures, 2013.

### Question:

**12.**

*Provide the response for this question in the Excel spreadsheet.*

(6 points) You are conducting a ratemaking analysis and are given the following:

Accident Year	Earned Exposures	Earned Premiums at Current Rate Level	Ultimate Counts	Ultimate Claims
2018	10,146	9,400,897	862	13,085,953
2019	10,127	9,537,898	869	14,011,147
2020	10,298	9,901,002	875	14,968,858
2021	10,291	10,263,291	852	15,499,745
2022	10,573	10,713,349	883	18,068,228

- The historical annual claim frequency trend was –1.0%.
- The annual claim frequency trend is expected to increase to 1.0% for all accidents occurring after December 31, 2022.
- The historical annual claim severity trend was 6.0% and is not expected to change in the future.
- The new rates are effective March 1, 2024 for one year.

- All policies are written for 12-month policy terms.
- The full credibility standard is 4,654 ultimate counts.
- The square root rule is used for partial credibility.

- (a) (2 points) Calculate the trended pure premiums for each accident year.
- (b) (1 point) Recommend a trended pure premium. Justify your recommendation.

You are also given the following:

- The complement of credibility is derived using the average pure premium underlying the current rates adjusted to the cost level of the forecast period of the new rates.
- The current rates are based on the prior ratemaking analysis that was applied to policies effective July 1, 2022 through June 30, 2023, with average pure premium of 1,700.

- (c) (1 point) Calculate the pure premium to use for the complement of credibility.

You are also given the following:

- Fixed expenses per exposure are 125.
- The ratio of ULAE to claims is 4%.
- The ratio of variable expenses to premiums is 18%.
- The ratio of profit and contingencies to premiums is 5%.

- (d) (1.5 points) Calculate the credibility-weighted indicated rate.

An alternative for the complement of credibility is to use a pure premium based on industry experience.

- (e) (0.5 points) Identify one adjustment that is necessary when relying on a complement of credibility that is a pure premium based on industry experience.



## GIRR Spring 2024 Question 5 (LOs 1d, 1f, 3g, and 3j)

### Learning Outcomes:

- (2d) Adjust historical earned premiums to current rate levels.
- (5b) Identify the time periods associated with trending procedures.
- (5e) Calculate trend factors for claims and exposures.
- (6f) Explain the requirements for loadings for catastrophes and large claims in ratemaking.
- (6g) Calculate loadings for catastrophes and large claims.
- (6h) Apply loadings for catastrophes and large claims in ratemaking.
- (6j) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.
- (6k) Demonstrate the use of credibility in ratemaking.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 13, 26, 31, and 32.

### Question:

**5.**

*Provide the response for this question in the Excel spreadsheet.*

(11 points) You are conducting a ratemaking analysis for a line of business in state S with the following information:

- The new rates are to be effective September 1, 2024, through August 31, 2025.
- All policies are written for 6-month policy terms.
- The annual frequency trend is  $-1\%$ .
- The annual severity trend is  $5\%$ .

You are also given the following state S claims data for non-hurricane weather excluding hail:

Accident Year	Ultimate	
	Frequency per 100 earned house years (EHY)	Severity
2014	2.02	4,100
2015	0.39	3,500
2016	1.99	2,900
2017	0.10	4,400
2018	1.99	2,800
2019	0.80	4,200

Accident Year	Ultimate	
	Frequency per 100 earned house years (EHY)	Severity
2020	0.63	2,600
2021	2.73	3,600
2022	0.56	2,100
2023	1.69	3,100

- (a) *(2 points)* Calculate the trended ultimate non-hurricane weather excluding hail pure premium per 100 EHY for all years.
- (b) *(0.5 points)* Recommend the trended ultimate non-hurricane weather excluding hail pure premium per 100 EHY to use in determining a weather loading. Justify your recommendation.

You are given the following additional information:

- Calendar year 2023 earned premiums at current rate level are 13,089,711.
  - Calendar year 2023 EHY are 17,931.
  - State S is part of region R.
  - The trended ultimate pure premium per 100 EHY for region R is 4,000.
  - The credibility that relates to the non-hurricane weather excluding hail loading for state S is 70%.
- (c) *(1 point)* Calculate the non-hurricane weather excluding hail loading percentage to use for ratemaking.

Actuaries can have flexibility in choosing the number of years to include in the experience period for ratemaking purposes.

- (d) *(1 point)* Identify two considerations when choosing the number of years and/or the weights to assign to each of the years.

You are given the following data:

<b>Accident Year</b>	<b>Earned Exposures</b>	<b>Ultimate Counts</b>	<b>Historical Earned Premiums</b>	<b>Ultimate Claims</b>
2019	20,675	1,070	13,510,549	8,709,600
2020	19,937	1,075	13,268,660	8,673,608
2021	17,061	1,074	11,739,370	7,919,295
2022	17,992	1,141	12,638,750	8,605,528
2023	17,931	1,087	13,089,711	9,489,317

The full credibility standard is 3,654 ultimate counts.

- (e) *(1 point)* Recommend the number of years to include when estimating the weighted average trended claim ratio for the indicated rate change. Justify your recommendation.
- (f) *(1 point)* Recommend the weights to assign to each year when estimating the weighted average trended claim ratio for the indicated rate change. Justify your recommendation.

You are given the following additional information:

- Rate change history:
    - A rate change of +3% was effective July 1, 2020
    - A rate change of +4% was effective July 1, 2022
  - Premiums are written and earned evenly throughout the year.
  - The annual premium trend is 0%.
  - The ratio of ULAE to claims is 5%.
  - The ratio of fixed expenses to premiums at current rates is 3%.
  - The ratio of variable expenses to premiums is 12%.
  - The ratio of profit and contingencies to premiums is 4%.
- (g) *(4.5 points)* Calculate the indicated rate change for this line of business.

### GIRR Spring 2024 Question 6 (LOs 6a)

#### Learning Outcomes:

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

#### Question:

**6.**

(3 points) You are conducting an expense analysis to be used in ratemaking.

- (a) (0.5 points) Describe how you might account for a start-up cost expense.

ANSWER:

- (b) (1 point) Explain whether a residual market assessment would be considered a fixed or variable expense.

ANSWER:

- (c) (0.5 points) Describe a possible consequence to an insurer treating fixed expenses as variable expenses when determining rates.

ANSWER:

- (d) (1 point) Describe two situations where you might cap the percentage of variable expenses in a ratemaking analysis.

ANSWER:

### GIRR Fall 2024 Question 3 (LOs 1l, 6d, 6e)

#### Learning Outcomes:

- (1l) Understand credibility as used for actuarial work.
- (6d) Calculate loadings for catastrophes and large claims.
- (6e) Apply loadings for catastrophes and large claims in ratemaking.

#### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapters 6 and 31.

#### Question:

**3.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) Credibility procedures often require the actuary to exercise professional judgment as the assignment of a credibility value is frequently not a precise mathematical exercise. One consideration in assigning credibility is the volume of claims in the experience set of data.

- (a) (1 point) Identify two other considerations in assigning credibility to an experience set of data.

You are estimating ultimate property claims for ratemaking purposes for State Z. The claims experience of State Z is not fully credible for calculating trend. You are given the following:

Accident Year	Selected Ultimate Claims at 1,000,000 Limit	Selected Ultimate Claims at Total Limits
2021	4,298,400	4,483,200
2022	4,368,900	4,607,900
2023	4,890,200	5,097,900

Selections	1,000,000 Limit	Total Limits
Severity Trend State Z	7.0%	8.6%
Pure Premium Trend State Z	5.5%	6.0%
Credibility State Z	70%	50%
Countrywide Severity Trend	6.0%	7.0%
Countrywide Pure Premium Trend	4.0%	5.0%

- The claim trend period for accident year 2023 is 32 months.

You are given the following loadings for large claims for the 500,000 to 1 million limit:

<b>Accident Year</b>	<b>500,000 to 1 Million Limit</b>
2021	1.196
2022	1.165
2023	1.185

- (b) (3 points) Calculate the loadings for 500,000 to total limits for each accident year.
- (c) (1 point) Recommend a loading for 500,000 to total limits for ratemaking purposes. Justify your recommendation.

## GIRR Fall 2024 Question 5 (LOs 6f, 6g)

### Learning Outcomes:

- (6f) Describe the claim ratio and pure premium methods of ratemaking.
- (6g) Calculate indicated rates and indicated rate changes using the claim ratio and pure premium methods.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 32.

### Question:

**5.**

*Provide the response for this question in the Excel spreadsheet.*

(5 points) You are conducting a ratemaking exercise and are given:

Accident Year	Earned Exposures	Earned Premiums	Trended Earned Premiums at Current Rate Levels	Ultimate Claims	Trended Ultimate Claims
2019	18,640	13,086,213	14,390,080	8,091,546	10,866,820
2020	18,240	13,193,295	14,154,240	7,568,826	9,735,481
2021	17,061	12,668,001	13,341,702	7,496,606	9,235,310
2022	17,992	13,202,396	13,835,848	8,275,177	9,763,870
2023	17,931	13,491,867	13,878,594	9,018,480	10,191,450

- The ULAE to claim ratio is 8%.
- The selected fixed expenses are 7.5% of premiums.
- The selected variable expenses are 15% of premiums.
- The selected profit and contingency ratio is 5% of premiums.
- The average claim ratio and the average pure premium are calculated using a simple average of all years.
- The indicated rate change using the claim ratio approach is 5.91%.

The pure premium and claim ratio approaches typically provide similar indicated rate changes.

- (a) (2.5 points) Demonstrate that the indicated rate change using the pure premium approach is similar to that using the claim ratio approach (i.e.,  $\pm 0.5\%$  of 5.91%).

In general, there are two reasons why there can be a slight difference between indicated rate changes from the claim ratio approach versus the pure premium approach.

- (b) *(0.5 point)* Describe one such reason.

Your company's management decides to increase rates by 2%, instead of the 5.91% rate indication from the claim ratio approach.

- (c) *(1 point)* Calculate the profit and contingencies ratio implied by increasing the rates by 2%.

Implementing a lower rate change than indicated will result in higher rate indications for the next rate review, all other things being equal.

- (d) *(1 point)* Explain how implementing a lower rate change than indicated will result in higher rate indications for the next rate review using the claim ratio approach.



## GIRR Fall 2024 Question 6 (LOs 6a)

### Learning Outcomes:

- (6a) Quantify different types of expenses required for ratemaking including expense trending procedures.

### Source References:

Fundamentals of General Insurance Actuarial Analysis, Second Edition (2022), J. Friedland, Chapter 30.

### Question:

**6.**

*Provide the response for this question in the Excel spreadsheet.*

(4 points) You are conducting a ratemaking exercise and are given:

Calendar Year	Earned Exposures	Direct Written Premium	Direct Earned Premiums	Total Commission Expenses and Premium Taxes	General Expenses
2019	25,800	19,350,000	18,990,120	2,515,500	1,450,000
2020	24,500	19,042,510	18,724,770	2,475,500	1,420,000
2021	23,100	18,507,860	18,240,290	2,313,500	1,440,000
2022	21,900	18,094,650	17,753,030	2,171,400	1,420,000
2023	20,750	17,771,250	17,447,750	2,132,600	1,390,000

- Fixed expenses are 40% of general expenses.
  - The annual trend for fixed expenses is 2%.
  - Fixed expenses are incurred at the time of writing each policy.
  - Premiums are written evenly throughout the year.
  - All policies were written for 6-month terms.
  - New rates will be effective July 1, 2025 for one year.
- (a) (1 point) Calculate the total variable expense ratio for each of calendar years 2019 to 2023.
- (b) (1 point) Recommend the total variable expense ratio to use in ratemaking. Justify your recommendation.
- (c) (2 points) Recommend the fixed expense per exposure to use in ratemaking. Justify your recommendation.