SOCIETY OF ACTUARIES®

Exam GIRR

Date: Thursday, May 13, 2021

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has 19 questions numbered 1 through 19 with a total of 100 points.

   The points for each question are indicated at the beginning of the question.

2. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions provided this document.
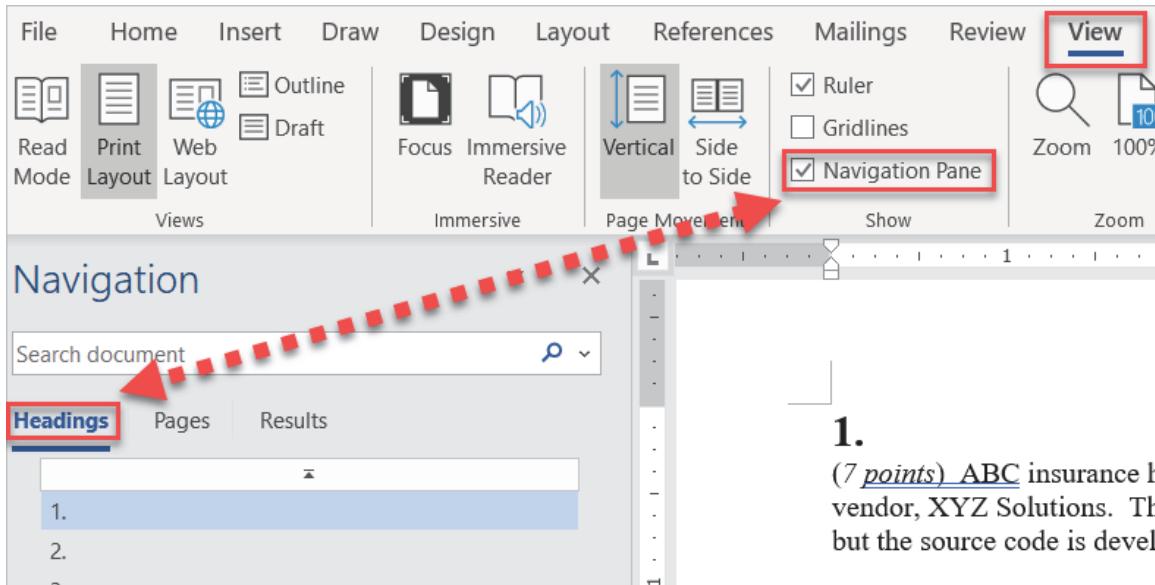
Written-Answer Instructions

1. Each question part or subpart should be answered either in the Word document or the Excel file as directed. Graders will only look at work in the indicated file.

   a) In the Word document, answers should be entered in the box marked ANSWER. The box will expand as lines of text are added. There is no need to use special characters or subscripts (though they may be used). For example, β_1 can be typed as beta_1 and σ^2 can be typed as sigma^2.

   b) In the Excel document formulas should be entered. Performing calculations on scratch paper or with a calculator and then entering the answer in the cell will not earn full credit. Formatting of cells or rounding is not required for credit. Rows can be inserted to the answer input area as required to provide space for your answer.

   c) Individual exams may provide additional directions that apply throughout the exam or to individual items.

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

3. Prior to uploading your Word and Excel files, each file should be saved and renamed with your five-digit candidate number in the filename.

4. The Word and Excel files that contain your answers must be uploaded before time expires.

Navigation Instructions

Open the Navigation Pane to jump to questions.

Press Ctrl+F, or click View > Navigation Pane:

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.*

2.

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

Accident	Ratios of Closed Counts to Reported Counts								
Year	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	Average Reported Claims								
Year	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	Average Paid Claims								
Year	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								

2. **Continued**

Accident	Ratios of Paid Claims to Reported Claims								
Year	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.

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
Total	**149,800**	**11,970**	**54,463,061**	

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.

3. Continued

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
Total	**3,352,724**

- 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.*

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:

5.

(*6 points*) You are given the following transactional claims data for all claims that occurred in 2017 for ABC Insurance Company's liability coverage:

Claim	Transaction Date (m/y)	Indemnity Change in Case Estimate	Payment	ALAE Change in Case Estimate	Payment	Notes
1	03/2018	600,000	0	30,000	0	Claim reported to ABC
1	05/2018	175,000	0	15,000	5,000	Claim activity
1	04/2019	–150,000	150,000	–22,000	22,000	Claim activity
1	07/2020	–625,000	597,000	–23,000	24,000	Claim settled and closed
2	03/2018	90,000	0	10,000	0	Claim reported to ABC
2	05/2019	–90,000	110,000	–10,000	15,000	Claim settled and closed
3	11/2017	400,000	0	60,000	0	Claim reported to ABC
3	08/2018	–75,000	0	–10,000	35,000	Claim activity
3	10/2019	–325,000	300,000	–50,000	35,000	Claim settled and closed
4	03/2018	600,000	0	30,000	0	Claim reported to ABC
4	02/2020	100,000	0	12,000	19,000	Claim activity

- Amounts in the table above are given as incremental changes.
- Claims 1 and 2 are from the same occurrence.
- ABC has a 600,000 excess 200,000 per occurrence excess of loss reinsurance treaty for claims occurring in 2017.

Construct the accident year 2017 row as of December 31, 2020 of ABC's cumulative reported claims and ALAE for each of the following development triangles:

    (i)   Gross of reinsurance

    (ii)   Net of reinsurance with pro rata treatment of ALAE

    (iii)   Net of reinsurance with ALAE included in the insurer's retention and the reinsurer's limit

Provide the response for this part in the Excel spreadsheet.

6.

(*4 points*)

(a)   (*0.5 points*) Describe why grouping risks into more homogeneous classes can improve the effectiveness of a risk classification system.

> ANSWER:

(b)   (*0.5 points*) Describe how an effective risk classification system can contribute to availability of coverage.

> ANSWER:

(c)   (*2 points*) Evaluate each of the following risk characteristics for use in a risk classification system for automobile insurance:

   (i)   Gender

   (ii)   Credit score

   (iii)   Age

   (iv)   Telematics data

> ANSWER:

(d)   (*1 point*) Describe two problems encountered with a one-way analysis of a risk classification system.

> ANSWER:

7.

(*5 points*) You are reviewing premium liabilities as of December 31, 2020.

You are provided with the following information:

	Property		Liability	
	Gross	**Net**	**Gross**	**Net**
Written Premiums (000) – Calendar Year				
2017	1,000	740	2,000	1,820
2018	1,100	814	3,100	2,728
2019	1,200	888	4,900	4,165
2020	1,300	962	6,000	4,920
Unearned Premiums (000) as of December 31 Each Year				
2016	525	415	950	893
2017	500	395	1,000	910
2018	550	435	1,550	1,364
2019	600	474	2,450	2,083
2020	650	514	3,000	2,460
Ultimate Claims including ALAE (000) – Accident Year				
2017	460	300	1,070	830
2018	480	310	1,530	1,190
2019	510	330	2,600	2,030
2020	590	380	3,820	2,980
Ultimate Claim Ratios including ALAE – Accident Year				
2017	45%	39%	55%	46%
2018	46%	40%	60%	52%
2019	44%	39%	65%	59%
2020	47%	41%	70%	66%

(a) (*1 point*) Verify the calculation of ultimate claim ratios.

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

(b) (*1.5 points*) Recommend expected claim ratios for each line of business, gross and net of reinsurance, that will be used in the determination of premium liabilities as of December 31, 2020. Justify each recommendation.

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

7. **Continued**

The following information is provided:

- ULAE is 10% of claims (including ALAE), which is not covered by reinsurance.
- The selected general expense ratio is 15% of gross written premiums.
- The proportion of general expenses applicable to unearned premiums is 25%.
- The selected incentive commission ratio is 3% of gross premiums.

(c)   (*2 points*) Calculate the premium liabilities, both gross and net of reinsurance.

Provide the response for this part in the Excel spreadsheet.

(d)   (*0.5 points*) Determine the equity in unearned premiums.

Provide the response for this part in the Excel spreadsheet.

8.

(*5 points*)

(a)   (*2 points*) Describe four limitations of relying on historical data to analyze catastrophe events.

ANSWER:

(b)   (*1 point*) Explain how catastrophe model output can be used to evaluate alternative loss mitigation strategies.

ANSWER:

You are given the following information:

County	Modeled Gross Hurricane Wind Loss Per 1,000 Coverage A	Selected Risk Load (Standard Deviation)
Monroe	13.82	27.65
Broward	5.54	11.08
Palm Beach	5.26	10.51
Miami-Dade	7.60	15.21
Hillsborough	0.75	1.51
Orange	0.36	0.72
Okeechobee	1.91	3.81
Duval	0.25	0.49
Sarasota	1.74	3.48

- The average Coverage A limit is 207,500.
- The expense load is 27%.
- The risk load includes a provision for profit.

(c)   (*2 points*) Calculate the hurricane wind premium by county for a 207,500 Coverage A limit.

Provide the response for this part in the Excel spreadsheet.

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 | Reported Claims (000) | | | | |
Year	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 | Paid Claims (000) | | | | |
Year	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				

| Accident | Reported Counts | | | | |
Year	12	24	36	48	60
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				

| Accident | Closed Counts | | | | |
Year	12	24	36	48	60
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.

9. Continued

(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:

10.

(*6 points*)

(a) (*1.5 points*) Explain the effect of a straight per-event deductible on each of the following:

   (i) An insurer's claim frequency

   (ii) An insurer's claim severity

ANSWER:

(b) (*0.5 points*) Describe the reason for a coinsurance clause in a property insurance policy.

ANSWER:

A property is valued at 1,000,000.

- The amount of insurance purchased for the property is 500,000.
- The coinsurance requirement is 80% of the property value, applied before the deductible.

(c) (*1 point*) Calculate the claims paid by the insurer under the following scenarios:

   (i) Loss amount is 800,000 and the deductible is 10,000

   (ii) Loss amount is 900,000 and the deductible is 0

Provide the response for this part in the Excel spreadsheet.

You are given the following aggregated claims data for auto collision coverage:

Indemnity Range	Counts	Claims
0 – 1,000	1,510	1,049,000
Over 1,000	10,620	59,410,000

(d) (*0.5 points*) Calculate the elimination ratio to be used for pricing a deductible option of 1,000.

Provide the response for this part in the Excel spreadsheet.

10. Continued

The current rate for this auto collision coverage is 110 with no deductible.

- The underlying claim ratio is 70%.
- The underlying variable expense ratio is 20%.
- The underlying fixed expense ratio is 10%.
- There is no profit load.

(e)   (*1 point*) Calculate a rate for the 1,000 deductible option using results from part (d).

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

You are given the following aggregated claims data for a different coverage:

Indemnity Range	Counts	Claims
0 – 10,000	5,000	35,000,000
10,000 – 20,000	1,500	25,000,000
20,000 – 100,000	500	15,000,000

(f)   (*1.5 points*) Calculate the increased limits factors relative to a basic limit of 10,000 for:

(i)   20,000 limit, and

(ii)   100,000 limit.

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

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Ratemaking & Reserving

11.

(*7 points*)

(a) (*1 point*) Provide two reasons for not using the Cape Cod method for projecting ultimate claims for auto collision coverage.

> ANSWER:

(b) (*1 point*) Describe two approaches for testing potential seasonality in claims data.

> ANSWER:

You are a reserving actuary who used the Bornhuetter Ferguson method to estimate unpaid claims as of December 31, 2020. Your manager asks you to perform an actual versus expected test.

(c) (*0.5 points*) Describe the purpose of this test.

> ANSWER:

Assume your actual versus expected test shows that actual results are significantly less than expected in the latest two years.

(d) (*0.5 points*) Describe two next steps you could perform after reviewing these results.

> ANSWER:

Some methods for estimating ultimate claims are appropriate when experience is immature. Other methods for estimating ultimate claims are appropriate when experience is limited.

(e) (*1 point*) Describe the problem with estimating ultimate claims in each of these two situations:

    (i)   Immature experience

    (ii)   Limited experience

> ANSWER:

11. Continued

You are a reserving actuary who will be using the reported development method to estimate ultimate ALAE. You are considering the following data groupings for your analysis:

        A.   Developing ALAE amounts on their own.

        B.   Developing indemnity and ALAE amounts combined.

        C.   Developing ALAE to claim ratios.

(f)   (*2 points*) Describe your considerations for each data grouping in determining your selection.

> ANSWER:

You are performing an analysis of ultimate claims by layer. Your colleague recommends applying development factors to individual claims so they can then be sorted by size. Your colleague also recommends that the development factors should be applied to open claims only since closed claims are not subject to development.

(g)   (*1 point*) Critique your colleague's recommendations.

> ANSWER:

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.

Accident Year	Trended Ultimate Claims
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.*

12. Continued

(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.*

13.

(*5 points*)

(a) (*0.5 points*) Describe why the risk of a reserve inadequacy is greatly reduced for claims-made policies compared to occurrence policies.

ANSWER:

(b) (*1 point*) Explain how a coverage gap can be created when the insured switches:

    (i)   From claims-made to occurrence coverage

    (ii)   From occurrence to claims-made coverage

ANSWER:

One principle of claims-made ratemaking states that a claims-made policy will cost less than an occurrence policy when claim costs are increasing.

(c) (*1.5 points*) Construct a numerical example demonstrating this principle.

Provide the response for this part in the Excel spreadsheet.

Another principle of claims-made ratemaking states that claims-made policies priced on the basis of prior trend will be closer to the correct price than occurrence policies priced in the same way, when there is a sudden unpredictable change in the underlying trend.

(d) (*2 points*) Construct a numerical example demonstrating this principle.

Provide the response for this part in the Excel spreadsheet.

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.*

14. Continued

(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*

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:

(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:

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:

	Loadings for Large Claims		
	250,000 to 500,000	250,000 to Total Limits	500,000 to Total Limits
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.*

16. Continued

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:

17.

(*4 points*) You are a consulting actuary who has been asked to evaluate individual risk rating for LMN Delivery Services (LMN). You are given the following information:

- LMN is a small business with strong financials.
- LMN's current premiums are based on manual rates.
- LMN has ten years of claims experience, which fluctuated significantly from year to year.
- A new safety program was implemented two years ago, which is expected to reduce claims by 10%.
- LMN prefers stable rates.

(a)   (*3 points*) Evaluate the suitability of each of the following individual risk rating programs for LMN:

   (i)   Schedule rating

   (ii)   Prospective experience rating

   (iii)   Retrospective experience rating

ANSWER:

You have recommended a prospective experience rating program for LMN. A principle of prospective experience rating is that frequency is a better predictor of future claims than severity.

(b)   (*1 point*) Explain how this principle can be considered in the design of LMN's prospective experience rating program.

ANSWER:

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:

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.

19. Continued

(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.*

END OF EXAMINATION