ACTEX Learning

GI 301
Further Topics in General Insurance
Study Manual with Practice Problems
Volume 1

1st Edition

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CPCU, ARe, ARC, API, AIS, AIE, AIAF
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Practice Problems on GI 301: Further Topics in General Insurance - *First Edition: Fall 2025*

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Introduction to Practice Problems on GI 301: Further Topics in General Insurance

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The purpose of this book is to help you pass Course GI 301: Further Topics in General Insurance. This course was heavily based upon the previous Exam GIADV: Advanced Topics in General Insurance but has incorporated significant additional materials.

This book is structured to align with the syllabus topics and syllabus papers. The current installment is the first portion of the study manual, drawing primarily from materials previously present on the Exam GIADV syllabus. Several topics were moved to Course GI 301 from the old SOA GI RR (Ratemaking and Reserving) exam, and for those topics, I received the generous permission of Ke Min, ACIA, ASA, CERA, to republish both content outlines and practice problems and solutions from his *Study Manual: General Insurance Introduction to Ratemaking & Reserving Exam, Fall 2020 Edition*.

This manual adopts a question-led approach: each section opens with questions that introduce and develop the syllabus content, encouraging close reading of the original papers. Citations are provided so candidates can engage directly with the source material.

Each section presents all of the problems in succession, followed by the solutions at the end. You are encouraged to attempt each problem on your own and write down or type your solution, and then look at the answer key for step-by-step explanation and/or calculations. As this book is a learning tool, I have provided relevant citations from the syllabus readings for many of the practice problems. Also, I am not an advocate of leaving any problems as unexplained "exercises to the reader." While *each* of these problems is intended to be an exercise for you, this book's purpose is to show you how they can be solved as well – so give each of them your best attempt, but know that detailed answers are available for you to check your work and fill in any gaps that may have prevented you from solving a problem yourself.

It is important to emphasize that the exam is always based on the syllabus readings and not primarily on any external study materials. As such, you are strongly encouraged to read and re-read the syllabus papers and internalize their contents. This book should be viewed as a companion and supplement to, *not* a substitute for, the syllabus readings. Here is a suggested approach for how to use this book in conjunction with the syllabus papers.

Step 1. Read a particular syllabus paper from start to finish, as you would an article or book. This helps you gain a familiarity with the contents and the structure of the paper, as well as where to find particular concepts and methods.
Step 2. Perform a second, closer reading of the syllabus paper, this time in conjunction with this book. The original exercises in this book were structured to align with the sequence of each syllabus paper's content. Look at the citations within each exercise to see where you will find the corresponding discussion within the syllabus paper. Once you have visited the relevant portions of the syllabus paper, attempt the exercise, and check your answer. This process will facilitate active reading of each paper. At this stage, you should be engaged with the material in detail and check your understanding at every step of the way.
Step 3. Create flashcards from the conceptual questions in this book and review them daily so as to internalize key ideas, methods, formulas, and even calculation shortcuts that may help if deployed properly during the exam. Making your own flashcards helps you actively engage with the material further. You have many options regarding how to create them – from the traditional pen-and-notecard approach, to often-free online and mobile applications. Even you as move on to subsequent syllabus topics, you should be regularly reviewing flashcards from previous papers and topics to keep these materials fresh in your mind.
Step 4. Once you have completed all of the exercises in this book, re-read each of the syllabus papers once more and focus on any areas that may still require additional work for you to understand and recall. Think about how else any particular idea might be tested. I encourage you to extend your practice by developing your own original problems as well. Nothing helps you learn the material as much as trying to teach it in a stepwise manner, even to yourself.

Other Study Recommendations

The key for success on any actuarial exam is to set ambitious but flexible study goals that require a regular exertion of effort but can also adapt to changing circumstances without sacrificing other priorities in life. My greatest successes on exams came during sittings for which I studied using a self-developed point system, assigning a certain number of points for every page I read, every practice problem I solved or created, and every flashcard I reviewed. The point assignment could vary based on the type of activity and its difficulty level. For each day, I would set a point goal and try to exceed it, ideally raising my all-day average of points every day. Of course, my point system is not scientific and does not precisely match the difficulty level of each studying activity, but the existence of a point goal is a subjective motivator for continual effort while also giving one an eventual sense of satisfaction with what one has done on any given day. If one does need to attend to other priorities during the day, one can tailor one's activities to match (for instance, reviewing electronic flashcards during a trip, or reading a syllabus paper on a tablet during an elliptical-trainer run) while still meeting the point goal. It is also important to deploy one's available energy and resources wisely, always being heedful of the Aristotelian "golden mean" – a useful principle to follow with regard to any physical or mental exertion. Avoiding excessive stress and burnout is vital for any candidate who seeks to make steady exam progress. Try to keep your mind fresh and find ways to build buffers of time into your schedule to enable you to swiftly react to the inevitable changes of circumstance. Remember that this endeavor is an ultramarathon, not a sprint.

Use a variety of study techniques to keep the information fresh in your mind. Simple memorization creates anchors in your mind that can render the application of a skill more instantaneous. You should also be solving practice problems on a daily basis, if possible. The more different problem types and approaches for solving them that you are able to internalize, the more capable you will be when facing an unfamiliar problem. With enough practice you might, indeed, be able to recognize some seemingly completely new problems as variations on familiar themes.

Exams are time-limited, and it is important to pace yourself appropriately. During the 15-minute reading period, make a mental note of the problems that you know how to approach right away, and do those first. At the end, you should strive to give yourself a sufficient time buffer to think through the problems you find more challenging and unusual. Try, as much as possible, to always keep moving forward somewhere. If you hit a block on one problem, shift to another and work through it; perhaps an insight on the first problem will arrive later.

If you are preparing to take Exam GIADV, you have already come far. Hopefully, this book will assist you in mastering the exam syllabus and achieving another milestone on your journey to Fellowship along the SOA's General Insurance Track.

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September 2, 2025

Syllabus Topic 2: Development Analysis for Excess Limits and Layers

Section 5: Development Analysis for Excess Limits and Layers

Learning Objectives
The candidate will understand the considerations in the development of losses for excess limits and layers.

Learning Outcomes
The candidate will be able to:
a) Estimate ultimate claims for excess limits and layers.
b) Understand the differences in development patterns and trends for excess limits and layers.

References

- Fundamentals of General Insurance Actuarial Analysis, J. Friedland, Second Edition, 2022
  - Appendix G

[Candidates may also use the Appendix I of the 2019 supplement to the First Edition]

Overview

Adapted from the ACTEX Exam GIRR Study Manual:
Study Manual: General Insurance Introduction to Ratemaking & Reserving Exam, Fall 2020 Edition by **Ke Min, ACIA, ASA, CERA –** FGIAA Appendix I: Development Analysis for Excess Limits and Layers, pp. 576-577

Approaches for Estimating Development Patterns – The Need for Professional Judgment

Actuaries should understand and reflect the differences in age-to-age factors between claims:
- At limited values
- At total limits
- Excess of stated limits
- Within layers

Approaches for estimating development patterns at alternative limits and within layers:

1. Apply development method on claims data at alternative limits
   - This method is no different than the regular development method.
2. A theoretical approach based on a formula (Siewart's Development Formulas)

Siewert's Development Formulas

$CDF^L = CDF * (R^L/R_t^L)$
$XSCDF^L = CDF * (1 - R^L)/(1 - R_t^L)$

Where
- CDF = cumulative development factors at total limits
- XSCDF = cumulative development factors for excess claims

- t = age
- L = limit, which may represent basic limit, deductible, SIR, or excess reinsurance limit
- S = severity
- R^L = severity relativity, severity at limit L divided by unlimited severity

Example for Dentist Insurer

Approach 1 – Apply development method on claims data at alternative limits

This method is no different than the regular development method. Only difference is the claims data. Therefore, no example will be given for this approach.

Approach 2 – A theoretical approach based on Siewert's formula

Step 1. Determine the CDF

Develop the cumulative age-to-age factors using the claims data at total limits. Below is the CDF determined:

	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-Ult
Selected	1.692	1.055	1.032	1.019	1.004	1.001	1.000	1.000
CDF	1.887	1.115	1.057	1.024	1.005	1.001	1.000	1.000

Step 2. Determine the severity relativities R_t at each maturity age t.

- Complex process since different trend rates are associated with claims at different limits
- Historical data or industry data can be used
- Professional judgment is heavily involved

	12	24	36	48	60	72	84	96
R_t (given)	0.901	0.833	0.814	0.807	0.800	0.797	0.796	0.796

Step 3. Develop CDF at limit and excess of limit

	12	24	36	48	60	72	84	96
CDF (Step 1)	1.887	1.115	1.057	1.024	1.005	1.001	1.000	1.000
R_t (Step 2)	0.901	0.833	0.814	0.807	0.800	0.797	0.796	0.796
CDF^L	1.667 (1.887 x (0.796/0.901))	1.065	1.033	1.010	1.000	1.000	1.000	1.000
$XSCDF^L$	3.887 (1.887 x (1-0.796)/(1-0.901))	1.362	1.159	1.082	1.025	1.006	1.000	1.000

Conceptual Practice Problems

Problem 5-1. (a) What is the term "ground-up" used to refer to in regard to claims?
(b) What are two reasons why ground-up data may not be available to the insurer?
(c) For which two kinds of insurers might ground-up data be less likely to be available?
(Friedland, Appendix G, p. 443)

Problem 5-2.
(a) Does limiting claims for development purposes lengthen or shorten the development patterns?
(b) Explain why your answer in part (a) is the case.
(Friedland, Appendix G, p. 443)

Problem 5-3. (a) Friedland (Appendix G, p. 443) considers it important that actuaries understand and reflect the differences in age-to-age factors between claims in four situations. What are those situations?

(b) What are four bases on which to examine these differences?

Problem 5-4. (a) Friedland (Appendix G, p. 444) discusses two approaches used to estimate development patterns for the analysis of claims at alternative limits and within layers. Briefly summarize each approach.

(b) One of these approaches in part (a) above is called a "theoretical" approach. What are two circumstances in which that approach would need to be used?

Problem 5-5. You are given the following notation from Jerome J. Siewert's paper, *A Model for Reserving Workers' Compensation High Deductibles*:

CDF = cumulative development factor at total limits;
XSCDF = cumulative development factor for excess claims;
t = age in months;
L = limit, which may represent a basic limit, a deductible, self-insured retention, or excess reinsurance limit;
S = severity (at an ultimate value if no reference to t); and
R^L = severity relativity, the severity limit at L divided by unlimited severity.

(a) Express CDF^L, the cumulative development factor at limit L, in terms of the other terms and using the notation above.

(b) Express $XSCDF^L$, the cumulative development factor for excess claims at limit L, in terms of the other terms and using the notation above. (Friedland, Appendix G, p. 445)

Exam-Style Practice Problems

Problem 5-6. SOA Spring 2023 Exam GIADV, Question 10. You are given the following information for estimating claims in excess of 400,000 for a liability line of business:

Accident Year	Reported Claims (000) at Total Limits					
	12	24	36	48	60	72
2017	784	880	938	983	1,006	1,016
2018	1,011	1,164	1,288	1,367	1,380	
2019	1,062	1,233	1,331	1,404		
2020	1,120	1,231	1,328			
2021	1,230	1,400				
2022	1,200					

Accident Year	Reported Claims (000) at 400,000 Limit					
	12	24	36	48	60	72
2017	770	862	917	959	980	989
2018	932	1,002	1,091	1,159	1,168	
2019	862	942	1,008	1,054		
2020	1,100	1,203	1,297			
2021	1,093	1,190				
2022	1,133					

Summary of Severity Relativity (R_t) of 400,000 Limit to Total Limits by Maturity Age					
12	24	36	48	60	72
0.88	0.84	0.81	0.79	0.79	0.79

There is no development beyond 72 months.

(a) Calculate the total IBNR for claims excess of 400,000 as of December 31, 2022 using each of the following approaches:
(i) Development factors calculated using a simple average
(ii) Theoretically-derived development factors based on Siewert's formula

(b) Describe two considerations in the calculation of Rt values.

(c) Explain why alternative methods should be considered based on the results from part (a).

(d) You are assessing the increased-limits factors approach as an alternative. Identify two considerations when applying the increased-limits factors approach.

Problem 5-7. SOA Fall 2023 Exam GIADV, Question 10. You are estimating ultimate claims for the layer of 500,000 excess of 250,000. You are given the following information including estimated cumulative development factors (CDFs):

Accident Year (AY)	Reported Claims (000) at 12/31/2022			Estimated CDF	Severity Relativity (R_t)	
	250,000 Limits	750,000 Limits	Total Limits	Total Limits	250,000 to Unlimited	750,000 to Unlimited
2016	4,978	5,693	6,170	1.000	0.730	0.901
2017	4,332	5,040	5,616	1.005	0.733	0.903
2018	5,088	5,785	6,167	1.013	0.739	0.909
2019	4,334	5,192	5,699	1.033	0.747	0.913
2020	3,704	4,298	5,029	1.085	0.751	0.917
2021	4,222	4,640	4,721	1.248	0.762	0.951
2022	3,721	3,978	3,999	1.747	0.780	0.975

There is no development beyond 84 months.

(a) Calculate total IBNR for the layer as of December 31, 2022 using Siewert's formula.

(b) Describe a peculiarity with the CDFs derived from Siewert's formula in part (a).

(c) You are considering using the increased limit factor (ILF) method to estimate ultimate claims for the layer. You have the following additional information:

- Ultimate claims at 250,000 limits for AY 2022 using actual development factors are 5,019,000.
- The estimated ILF at 750,000 relative to 250,000 at the January 1, 2020 cost level is 1.19.
- The selected annual trend factor for a 750,000 limit is 2.2%.
- The selected annual trend factor for a 250,000 limit is 1.0%.

Calculate the layer IBNR for AY 2022 as of December 31, 2022 using the ILF method.

Conceptual Solutions

Solution 5-1. (a) The term "ground-up" is used to refer to the value of claims from the first dollar of loss, prior to the application of any deductible. (Friedland, Appendix G, p. 443)

(b) Reasons why ground-up data may not be available to the insurer:
1. Insureds frequently do not report losses that fall within their deductible to their insurer for fear of increased rates or even policy cancellation.
2. The IT systems of some insurers may not have the capability to record the values of losses below policyholder deductibles not the values of losses in excess of policy limits.
(Friedland, Appendix G, p. 443)

(c) (1) Insurers which provide coverage excess of large deductibles or self-insured retentions; and (2) reinsurers which offer excess coverage might encounter more issues with availability of ground-up data.

Solution 5-2. (a) Limiting claims for development purposes **shortens** the development patterns.
(b) The ultimate values of limited claims are reached at earlier maturity ages than would be the case for total-limits claims.

(Friedland, Appendix G, p. 443)

Solution 5-3. (a) Four situations in which it is important that actuaries understand and reflect the differences in age-to-age factors between claims:
1. At limited values;
2. At total limits;
3. Excess of stated limits;
4. Within layers. (Friedland, Appendix G, p. 443)

(b) Four bases on which to examine these differences are the following:
1. Based on **actual data**;
2. Based on assumed relationships derived from **statistical models**;
3. Based on assumed relationships derived from **simulation analysis**;
4. Based on assumed relationships derived from **professional judgment**.
(Friedland, Appendix G, p. 443)

Solution 5-4.
(a) Approach 1: The Development Method is used directly with reported claims data at alternative limits.
Approach 2: A theoretical approach estimates development using formulaic relationships between the development factors at different limits.

(b) The theoretical approach is needed when:
1. Complete data triangles at alternative limits are not available; or
2. The available data are insufficient or unreliable. (Friedland, Appendix G, p. 444)

Solution 5-5.
(a) $CDF^L = CDF^*(R^L / R_t^L)$
(b) $XSCDF^L = CDF^*[(1 - R^L)/(1 - R_t^L)]$

Exam-Style Solutions

Solution 5-6. From SOA Spring 2023 Exam GIADV Solutions:

(a) (i) Development factors calculated using a simple average
• Create development triangle of reported claims excess of 400,000 by subtracting the development triangle of reported claims at 400,000 limit from the development triangle of reported claims at total limits.
• Create a triangle of age-to age development factors with the created triangle.
• Average age-to-age development factors and then calculate cumulative development factors (CDFs) with them.
• Calculate IBNR with the CDFs minus one times the reported excess claims on the diagonal of the triangle.

	Reported Claims (000) Excess of 400,000 Limit					
AY	**12**	**24**	**36**	**48**	**60**	**72**
2017	14	18	21	24	26	27
2018	79	162	197	208	212	
2019	200	291	323	350		
2020	20	28	31			
2021	137	210				
2022	67					

	Age-to-Age Factors – Excess of 400,000 Limit					
AY	**12-24**	**24-36**	**36-48**	**48-60**	**60-72**	**72-Ult**
2017	1.29	1.17	1.14	1.08	1.04	
2018	2.05	1.22	1.06	1.02		
2019	1.46	1.11	1.08			
2020	1.40	1.11				
2021	1.53					
2022						
Simple Average	1.54	1.15	1.09	1.05	1.04	1.00
CDF xs 400	2.12	1.37	1.19	1.09	1.04	1.00

AY	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**Total**
Reported	67.0	210.0	31.0	350.0	212.0	27.0	897.0
Ultimate	142.2	288.4	37.0	382.1	220.2	27.0	1,096.9
IBNR	75.2	78.4	6.0	32.1	8.2	-	199.9

(ii) Theoretically-derived development factors based on Siewert's formula
• Create a triangle of age-to age development factors with the development triangle of reported claims at total limits.
• Select age-to-age development factors and then calculate CDFs with them.
• Calculate the CDFs for claims excess of 400,000 using the formula $CDF_t \times (1 - R_{72}) \div (1 - R_t)$ for t = 12 to 72.
• Calculate IBNR with the CDFs minus one times the reported excess claims on the diagonal of the triangle.

	Age-to-Age Factors – Total Limits					
AY	**12-24**	**24-36**	**36-48**	**48-60**	**60-72**	**72-Ult**
2017	1.12	1.07	1.05	1.02	1.01	
2018	1.15	1.11	1.06	1.01		
2019	1.16	1.08	1.05			
2020	1.10	1.08				
2021	1.14					
2022						
Simple Average	1.13	1.08	1.05	1.02	1.01	1.00
CDF Total	1.33	1.17	1.08	1.03	1.01	1.00
R_t	0.88	0.84	0.81	0.79	0.79	0.79
CDF xs 400	2.33	1.54	1.20	1.03	1.01	1.00

AY	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**Total**
Reported	67.0	210.0	31.0	350.0	212.0	27.0	897.0
Ultimate	155.9	323.1	37.1	359.3	214.1	27.0	1,116.5
IBNR	88.9	113.1	6.1	9.3	2.1	-	219.5

(b) SOA Commentary on Question: "*There are more than two considerations. The model solution is an example of a full-credit solution.*"
Two considerations in the calculation of R_t values:
• The different trend rates that are associated with claims at differing limits
• Whether to use actual historical data, industry data, or a combination

(c) There are large differences in the estimated IBNR between the two methods.

(d) SOA Commentary on Question: "*There are more than two considerations. The model solution is an example of a full-credit solution.*"

Two considerations when applying the increased-limits factors approach:
• Treatment of ALAE
• Whether the factors are applicable to claims or premiums

Solution 5-7. From SOA Fall 2023 Exam GIADV Solutions:

(a) Step 1: Calculate estimated CDFs for 250,000 and 750,000 limits.
At each age of development, the estimated CDF for a limit is the total limits CDF times the severity relativity for a limit at 84 months of development divided by the severity relativity for a limit at the age of development.

Step 2: Project ultimate claims for 250,000 and 750,000 limits.
For each accident year, the projected ultimate claims for a limit is the reported claims for the limit times the estimated CDF for that limit at its age of development.

Step 3: Estimate the ultimate claims for the layer 500,000 excess of 250,000.
For each accident year, this is the projected ultimate claims for 750,000 limits minus the projected ultimate claims for 250,000 limits.

Step 4: Estimate the IBNR for the layer 500,000 excess of 250,000.
For each accident year, this is the projected ultimate claims for the layer minus the reported claims for the layer. The reported claims for the layer is the reported claims for 750,000 limits minus the reported claims for 250,000 limits. The sum of these amounts by accident year gives the total IBNR for the layer.

AY	Estimated CDF		Projected Ultimate Claims (000)			IBNR (000)
	250,000 Limits	750,000 Limits	250,000 Limits	750,000 Limits	500,000 xs 250,000	500,000 xs 250,000
2016	1.000	1.000	4,978	5,693	715	0
2017	1.001	1.003	4,336	5,054	718	10
2018	1.001	1.004	5,091	5,809	717	20
2019	1.009	1.019	4,375	5,293	918	60
2020	1.055	1.066	3,906	4,582	676	82
2021	1.196	1.182	5,048	5,486	438	20
2022	1.635	1.614	6,084	6,422	338	81
					TOTAL	**273**

(b) The estimated CDFs for 250,000 limits are higher than the CDFs for 750,000 limits for accident year 2021 and accident year 2022. It is unusual for lower limits to have a higher CDF.

(c) SOA Commentary on Question: *"Claim amounts are shown in thousands."*

The estimated ILF is at the Jan. 1, 2020 cost level. Therefore, 2.5 years of trend are required to take the factor to an AY 2022 level (i.e., assumed to be the average date of the year, July 1, 2022).
Residual trend factor for the 750,000 limit is (1.022)/(1.01) = 1.0119.
ILF trended is $1.19 \times 1.0119^{2.5} = 1.2257$.
AY 2022 Ultimate claims at 750,000 limits is 5,019 × 1.2257 = 6,152.
AY 2022 Ultimate claims for the layer is 6,152 – 5,019 = 1,133.
AY 2022 Layer IBNR is AY 2022 ultimate claims for the layer minus AY 2022 reported claims for the layer = 1,133 – (3,978 – 3,721) = **876.**

Section 20: Insurance Risk Transfer and Categorization of Reinsurance Contracts
Topic 7: Reinsurance

Learning Outcomes:
The Candidate will be able to:
(i) Test for risk transfer in reinsurance contracts.

References
• Gurenko, E., Itigin, A. and Wiechert, R., "Insurance Risk Transfer and Categorization of Reinsurance Contracts," World Bank Policy Research Working Paper No. 6299, December 2012, excluding Section IV and the Annexes. Available at https://documents1.worldbank.org/curated/en/685801468328580905/pdf/wps6299.pdf.

Practice Problems

Problem 20-1. What is the main objective of the paper by Gurenko, Itigin, and Weichert, entitled "Insurance Risk Transfer and Categorization of Reinsurance Contracts"? (Gurenko et al., p. 2)

Problem 20-2. (a) Financial reinsurance, also known as finite risk reinsurance or finite reinsurance, mainly focuses on which three financial effects?
(b) What does financial reinsurance *not* focus on that traditional reinsurance does?
(c) According to Gurenko et al., which reinsurance contracts are particularly difficult to categorize and receive acceptance for supervisory purposes? (Gurenko et al., p. 4)

Problem 20-3. (a) What two objectives can financial reinsurance contracts address, other than transferring insurance risk?

(b) What are two examples of financial reinsurance contracts that do not transfer any insurance risk? (Gurenko et al., p. 4)

Problem 20-4. Provide five synonyms for the term "financial reinsurance". (Gurenko et al., p. 4)

Problem 20-5. What general action can be taken if a contract contains elements of both financial and insurance risks, in order to enable the application of existing accounting guidance? (Gurenko et al., p. 5)

Problem 20-6. Fill in the blanks: If it can be demonstrated that a contract transfers insurance risk, an assessment has to be made of the _____ of insurance risk transferred to a reinsurer. Depending on the _____ _____and the _____ _____, those contracts that fail to prove enough risk transfer are categorized as _____ _____ under "_____ accounting" and must be recorded under the _____ results, with no effect on _____ results. (Gurenko et al., p. 5)

Problem 20-7. In a country with a well-developed insurance regulatory regime, if a reinsurance contract does not transfer enough risk to a reinsurer, what kind of relief is the cedant disqualified from obtaining? (Gurenko et al., p. 5)

Problem 20-8. What is the most common type of malpractice in the use of financial reinsurance? (Gurenko et al., p. 5)

Problem 20-9. What is the main problem with the application of quantitative tests for reinsurance risk transfer? (Gurenko et al., p. 5)

Problem 20-10. (a) Give five examples of risk-limiting features in financial reinsurance contracts.

(b) Why is it sometimes impractical to simply look at whether a reinsurance contract contains any of the features in part (a) in order to determine whether or not it transfers risk? (Gurenko et al., pp. 5-6)

Problem 20-11. Fill in the blanks: EU Directive 2005/68/EC defines "finite reinsurance" as "reinsurance under which the explicit maximum loss potential, expressed as the maximum _____ _____ _____, arising both from a significant _____ risk and _____ risk transfer, exceeds the _____ over the lifetime of the contract by a limited but _____ amount, together with at least one of the following two features:
(i) explicit and material consideration of the _____ _____ of _____,
(ii) contractual provisions to moderate the balance of _____ _____ between the parties over time to achieve the target risk transfer." (Gurenko et al., p. 6)

Problem 20-12. What are the seven most common features of risk-financing instruments, as distinguished from traditional reinsurance, which have been identified by the IAIS? (Gurenko et al., p. 6)

Problem 20-13. How does the IFRS 4 Appendix A define "financial risks"? (Gurenko et al., p. 6)

Problem 20-14. In the United States, not all reinsurance contracts need to be tested for risk transfer. Describe the exception to risk-transfer testing and what that exception entails. (Gurenko et al., p. 7)

Problem 20-15. Describe three types of reinsurance contracts for which risk transfer is reasonably self-evident. (Gurenko et al., p. 8)

Problem 20-16. Fill in the blanks: In general, it is less likely that risk transfer is reasonably self-evident, when most risk is retained by the _____ _____ and if certain _____-based contractual features, such as _____ _____, _____ _____, or _____ _____, are included in the contract. (Gurenko et al., p. 8)

Problem 20-17. (a) What is a "rate on line"?
(b) What is the "rate-on-line criterion" regarding risk transfer?
(c) Even if a contract has no risk-limiting features, in which situation could it still not be considered to have reasonably self-evident risk transfer?
(Gurenko et al., p. 8)

Problem 20-18. What is the general categorization approach under quantitative methods that evaluate risk transfer? (Gurenko et al., p. 9)

Problem 20-19. Identify four types of contracts that would not automatically qualify for reinsurance accounting treatment because risk transfer is not reasonably self-evident. (Gurenko et al., p. 9)

Problem 20-20. Fill in the blanks: The rigor of the risk-transfer analysis is likely to be _____ [directly or inversely?] correlated with the amount of risk transferred under the contract (e.g. the less risk is transferred, the _____ [more or less?] technical effort is required to determine the true extent of such transfer). (Gurenko et al., p. 9)

Problem 20-21. (a) What is the "virtually equivalent" condition for risk transfer?

(b) Fill in the blanks: Virtual equivalence means that _____ _____ insurance risk relating to the reinsured portions of the underlying contracts has been _____ by the _____. This condition is met if the _____ position of the reinsurer is equivalent to having _____ the underlying policies _____. In such contracts, the reinsurer de facto acts as the _____ _____. (Gurenko et al., pp. 9-10)

Problem 20-22. What typically supplements a categorization analysis based on virtual equivalence, and what is the purpose of this supplementary approach? (Gurenko et al., p. 10)

Problem 20-23. (a) What two comparisons need to be made to prove virtual equivalence for "not-reasonably self-evident" contracts?

(b) For what types of reinsurance contracts is virtual equivalence difficult to demonstrate? (Gurenko et al., p. 10)

Problem 20-24. (a) When performing quantitative testing for risk transfer, what are the two general options for relevant data?

(b) What are the two general options for scenario testing?

(c) Fill in the blanks: Risk-transfer testing is essentially a _____ _____ _____ test for the assumed scenarios. (Gurenko et al., p. 13)

Problem 20-25. What are the three steps into which most risk-transfer approaches can be broken down? (Gurenko et al., p. 13)

Problem 20-26. What are five examples of the cash flows between the cedant and reinsurer that should be modeled for each characteristic loss scenario? (Gurenko et al., p. 13)

Problem 20-27. What are two options for the use of risk-free interest rates in analyzing cash flows in a quantitative risk-transfer analysis? (Gurenko et al., p. 13)

Problem 20-28. (a) Fill in the blank: Under the criterion of the Premium to Limit of Coverage Ratio, a contract is unlikely to have risk transfer if the value of the ratio approaches or exceeds _____.

(b) What is an advantage of the criterion of the Premium to Limit of Coverage Ratio?

(c) What are two drawbacks of the criterion of the Premium to Limit of Coverage Ratio? (Gurenko et al., p. 14)

Solutions

Solution 20-1. The main objective of the paper by Gurenko, Itigin, and Weichert is to develop "a simple, affordable, and robust regulatory method that can help insurance regulators to categorize financial reinsurance contracts as reinsurance or financial instruments." (Gurenko et al., p. 2)

Solution 20-2. (a) Financial reinsurance focuses on:
1. Capital management;
2. Solvency relief;
3. Influencing financial and earnings position.

(b) Unlike traditional reinsurance, financial reinsurance does not focus on **transfer of insurance risk.**

(c) The reinsurance contracts that are particularly difficult to categorize and receive acceptance for supervisory purposes are contracts that combine the features of traditional reinsurance and financial reinsurance, thus being both a financial instrument and a risk-transfer-oriented traditional reinsurance transaction. (Gurenko et al., p. 4)

Solution 20-3.

(a) Financial reinsurance contracts can address the following objectives:
1. Financing
2. Smoothing the profit and loss results.

(b) Examples of financial reinsurance contracts that do not transfer any insurance risk:
1. Contract that protects only the investment results of a client;
2. A loan that is written as a reinsurance contract. (Gurenko et al., p. 4)

Solution 20-4. Synonyms for the term "financial reinsurance":
1. Non-traditional reinsurance
2. Limited risk reinsurance
3. Structured reinsurance
4. Finite risk reinsurance
5. Finite reinsurance
(Gurenko et al., p. 4)

Solution 20-5. In cases where a contract contains elements of both financial and insurance risks, the contract may need to be separated into individual elements (so-called "unbundling") to enable the application of the guidelines. (Gurenko et al., p. 5)

Solution 20-6. If it can be demonstrated that a contract transfers insurance risk, an assessment has to be made of the **amount** of insurance risk transferred to a reinsurer. Depending on the **contractual content** and the **accounting environment**, those contracts that fail to prove enough risk transfer are categorized as **financial instruments** under "**deposit** accounting" and must be recorded under the **investment** results, with no effect on **underwriting** results. (Gurenko et al., p. 5)

Solution 20-7. If a reinsurance contract does not transfer enough risk to a reinsurer, the cedant is disqualified from obtaining **solvency capital relief**. (Gurenko et al., p. 5)

Solution 20-8. The most common type of malpractice in the use of financial reinsurance is the attempt to disguise self-financing or borrowing as a legitimate risk transfer for obtaining solvency relief or for smoothing the underwriting results. (Gurenko et al., p. 5)

Solution 20-9. The main problem with the application of quantitative tests is their **technical complexity**, which considerably impairs their wide-spread use by the market and insurance regulators. Often this means that the tests cannot be performed without hiring specialized technical resources, such as actuarial consulting companies (Gurenko et al., p. 5)

Solution 20-10. (a) The following are examples of risk-limiting features in financial reinsurance contracts. Any five among the list below would suffice.

1. Self-retention
2. Loss corridor
3. Loss cap
4. Aggregate limit of liability
5. Adjustable commissions, such as sliding-scale or profit commissions
6. Experience refunds in case of positive or negative performance
7. Multi-year terms
8. Applicability to multiple lines of business to reduce volatility and aggregate risk

(b) Traditional reinsurance contracts could also have some of the features in part (a), so the presence of such features is often not sufficient to determine whether or not the reinsurance contract transfers risk. (Gurenko et al., pp. 5-6)

Solution 20-11. EU Directive 2005/68/EC defines "finite reinsurance" as "reinsurance under which the explicit maximum loss potential, expressed as the maximum **economic risk transferred**, arising both from a significant **underwriting** risk and **timing** risk transfer, exceeds the **premium** over the lifetime of the contract by a limited but **significant** amount, together with at least one of the following two features:
(i) explicit and material consideration of the **time value** of **money**,
(ii) contractual provisions to moderate the balance of **economic experience** between the parties over time to achieve the target risk transfer" (Gurenko et al., p. 6)

Solution 20-12. Features of risk-financing instruments as identified by the IAIS:
1. Insurance risk transfer and financing are combined.
2. Assumption of limited risk by the reinsurer (e.g., aggregate limit of liability, blended cover, sliding-scale and other adjustable commissions, loss corridors, and limits or caps);
3. Transfer of volatility (e.g., multiple lines of business, multiple years of account, and multiple-year contract terms);
4. Inclusion of future investment income in price of contract (recognition of time value of money with funds withheld);
5. Potential profit sharing between parties (e.g., profit-sharing formulas, experience accounts);
6. Pricing determined by ceding insurers' results and not the reinsurance pricing cycle;
7. Terms and pricing are typically determined in advance for the whole a block of new or in-force business (i.e., administration of reinsurance is done on a bulk basis rather than on a traditional policy-by-policy basis). (Gurenko et al., p. 6)

Solution 20-13. The IFRS 4 Appendix A defines "financial risks" as "The risk of a possible future change in one or more of a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit rating or credit index or other variable, provided in the case of a non-financial variable that the variable is not specific to a party to the contract." (Gurenko et al., p. 6)

Solution 20-14. The "reasonably self-evident exception" or "safe harbor exception" states that reinsurance contracts that contain only traditional contractual components do not have to be tested for a sufficient amount of risk transfer. Only in case a contract includes some characteristic risk-transfer-limiting features, would quantitative testing have to be performed. (Gurenko et al., p. 7)

Solution 20-15. Types of reinsurance contracts for which risk transfer is reasonably self-evident:

1. Straight quota shares with fixed terms, e.g. no risk-limiting or any other variable terms (like sharing positive or negative contract experience) and with a fixed reinsurance commission that adequately compensates the ceding company for all acquisition costs.

2. Most traditional per-risk or per-occurrence excess-of-loss reinsurance contracts (both treaty and facultative), if for a predetermined amount of premium the reinsurer assumes all or nearly all of the potential variability in the underlying losses, and it is evident from reading the basic terms of the contract that the reinsurer can incur a significant loss.

3. Single-year property catastrophe and casualty clash covers, if no risk limiting features, like sub-limits, retrospective premium adjustments, or other exclusions apply. (Gurenko et al., p. 8)

Solution 20-16. In general, it is less likely that risk transfer is reasonably self-evident, when most risk is retained by the **ceding company** and if certain **experience**-based contractual features, such as **experience accounts**, **variable commissions**, or **premium adjustments**, are included in the contract. (Gurenko et al., p. 8)

Solution 20-17.
(a) "Rate on line" is defined as the premium paid to reinsurer divided by the amount of reinsurance coverage.
(b) The "rate-on-line criterion" regarding risk transfer is that even if no risk-limiting features are included in the contract, a high premium (rate on line) can disqualify the contract from meeting the exemption rule.
(c) If the premium approaches the present value of the limit of coverage, risk transfer is usually no longer deemed to be reasonably self-evident, even if a contract has no risk-limiting features. (Gurenko et al., p. 8)

Solution 20-18. The general general categorization approach under quantitative methods that evaluate risk transfer is that "each method calculates the value of a specific parameter which provides a quantitative measure for the amount of risk transferred by the reinsurance transaction. The resulting value is then compared with a specific parameter threshold value which corresponds to the minimum level of risk transfer required by the method. If the parameter value is higher than the threshold, i.e. the transaction is transferring more risk than minimally required, then the transaction is categorized as reinsurance and accounted for as such." (Gurenko et al., p. 9)

Solution 20-19. Contracts where risk transfer is not reasonably self-evident:

1. Non-proportional per-risk, per-occurrence, or aggregate excess-of-loss contracts if the premium approaches the present value of the coverage provided and/or the contracts contain significant risk-limiting features or other variable features, e.g. profit commissions;
2. Contracts with experience accounts, i.e., sharing positive or negative experience of the contract, or similar provisions with a significant impact on the contract's economics;
3. Multi-year contracts with experience provisions and/or provisions that adjust the contractual terms in later years, based on contractual experience in earlier years;
4. Proportional quota -share contracts with risk-limiting features such as loss-ratio caps, loss participations/corridors or sub-limits, or other variable features sharing positive or negative contract experience, like sliding-scale commissions. (Gurenko et al., p. 9)

Solution 20-20. The rigor of the risk-transfer analysis is likely to be **inversely** correlated with the amount of risk transferred under the contract (e.g. the less risk is transferred, the **more** technical effort is required to determine the true extent of such transfer). (Gurenko et al., p. 9)

Solution 20-21. (a) The "virtually equivalent" condition for risk transfer states that if the economic positions of the cedant (before risk transfer) and reinsurer (after risk transfer) are virtually equivalent for the ceded part of the underlying risk exposure, then the contract can be accounted for as reinsurance even if a quantitative risk transfer test is not fulfilled.

(b) Virtual equivalence means that **substantially all** insurance risk relating to the reinsured portions of the underlying contracts has been **assumed** by the **reinsurer**. This condition is met if the **economic** position of the reinsurer is equivalent to having **written** the underlying policies **directly**. In such contracts, the reinsurer de facto acts as the **original insurer**. (Gurenko et al., pp. 9-10)

Solution 20-22. A categorization analysis based on virtual equivalence is typically supplemented by a **transaction study** to establish whether the contract includes some specific features aimed at limiting the extent of risk transfer to reinsurers, such as loss caps, loss participations, loss corridors, sliding scale commissions, experience accounts, etc. (Gurenko et al., p. 10)

Solution 20-23. (a) The following comparisons need to be made to prove virtual equivalence for "not-reasonably self-evident" contracts:

1. Comparing the risk retained by the cedant with the risk transferred to the reinsurance company;
2. Comparing the profit position of the cedant and the reinsurance company under the reinsurance contract.

(b) For **non-proportional reinsurance contracts**, virtual equivalence is difficult to demonstrate. (Gurenko et al., p. 10)

Solution 20-24. (a) Two options for relevant data are (1) **based on the historical results of the business in question** or (2) **based on similar business**.
(b) Two options for scenario testing are (1) **deterministic** or (2) **stochastic**.
(c) Risk-transfer testing is essentially a **discounted cash-flow** test for the assumed scenarios. (Gurenko et al., p. 13)

Solution 20-25. Three steps for most risk-transfer approaches:

1. Analysis of the underlying risk exposure and defining the loss scenarios.

2. Analysis of the reinsurance transaction and modeling the resulting cash flows.

3. Cash-flow analysis and deriving a quantitative measure of risk transfer. (Gurenko et al., p. 13)

Solution 20-26. Examples of the cash flows between the cedant and reinsurer that should be modeled for each characteristic loss scenario:

1. Claims
2. Premiums
3. Commissions
4. Loss participations
5. Experience-based premium provisions

(Gurenko et al., p. 13)

Solution 20-27. Options for the use of risk-free interest rates in analyzing cash flows in a quantitative risk-transfer analysis:

Option 1. Discount with multiple risk-free interest rates for different maturities depending on the timing of each cash flow.

Option 2. Use a single risk-free rate, in which case the duration of the interest rate should be chosen to be approximately equal to that of the net cash flows.

(Gurenko et al., p. 13)

Solution 20-28. (a) Under the criterion of the Premium to Limit of Coverage Ratio, a contract is unlikely to have risk transfer if the value of the ratio approaches or exceeds **1**.

(b) An advantage of the criterion of the Premium to Limit of Coverage Ratio is that it is easy to apply and does not require any scenario testing or in-depth analysis of the underlying exposure.

(c) Drawbacks of the criterion of the Premium to Limit of Coverage Ratio:

1. It may generate inaccurate results when the ratio is slightly below 1, indicating that the degree of risk transfer is insufficient.

2. When the Premium to Limit of Coverage ratio is substantially under 1, the objective of the contract might still be purely financial even though according to the method the contract should be categorized as reinsurance. (Gurenko et al., p. 14)

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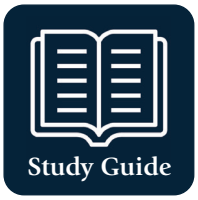

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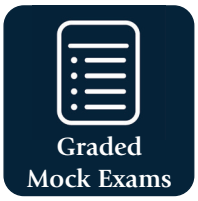

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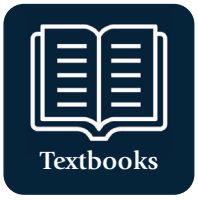

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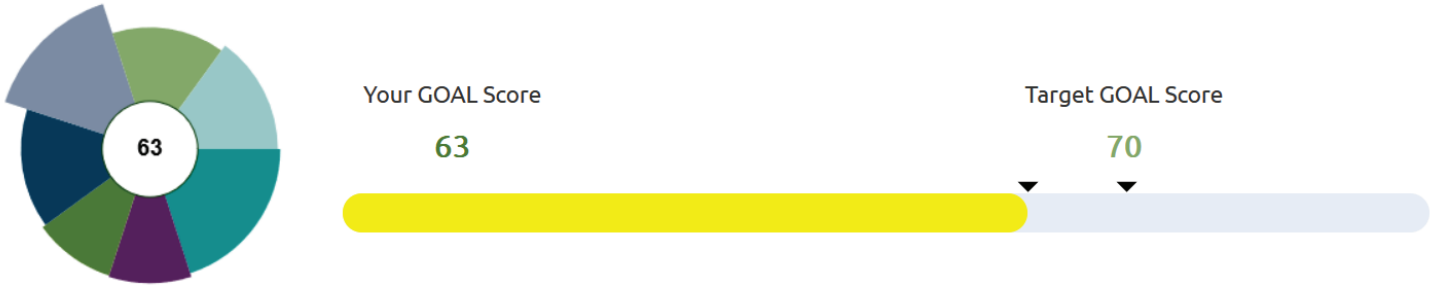

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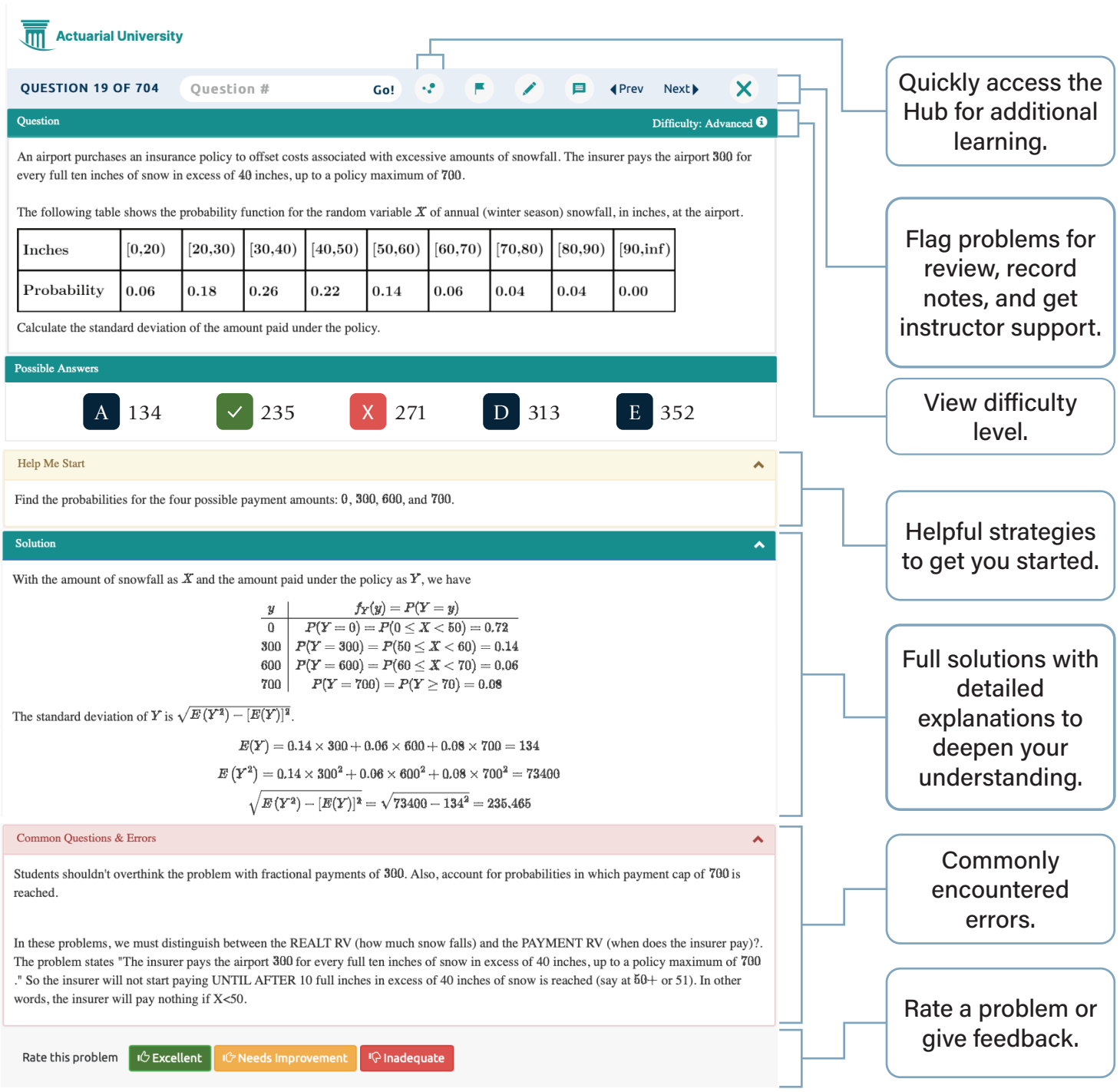

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QUESTION 19 OF 704 | Question # | Go! | Prev | Next

Question — Difficulty: Advanced

An airport purchases an insurance policy to offset costs associated with excessive amounts of snowfall. The insurer pays the airport 300 for every full ten inches of snow in excess of 40 inches, up to a policy maximum of 700.

The following table shows the probability function for the random variable X of annual (winter season) snowfall, in inches, at the airport.

Inches	[0,20)	[20,30)	[30,40)	[40,50)	[50,60)	[60,70)	[70,80)	[80,90)	[90,inf)
Probability	0.06	0.18	0.26	0.22	0.14	0.06	0.04	0.04	0.00

Calculate the standard deviation of the amount paid under the policy.

Possible Answers

A 134 ✓ 235 X 271 D 313 E 352

Help Me Start

Find the probabilities for the four possible payment amounts: 0, 300, 600, and 700.

Solution

With the amount of snowfall as X and the amount paid under the policy as Y, we have

y	$f_Y(y) = P(Y = y)$
0	$P(Y = 0) = P(0 \le X < 50) = 0.72$
300	$P(Y = 300) = P(50 \le X < 60) = 0.14$
600	$P(Y = 600) = P(60 \le X < 70) = 0.06$
700	$P(Y = 700) = P(Y \ge 70) = 0.08$

The standard deviation of Y is $\sqrt{E(Y^2) - [E(Y)]^2}$.

$$E(Y) = 0.14 \times 300 + 0.06 \times 600 + 0.08 \times 700 = 134$$

$$E(Y^2) = 0.14 \times 300^2 + 0.06 \times 600^2 + 0.08 \times 700^2 = 73400$$

$$\sqrt{E(Y^2) - [E(Y)]^2} = \sqrt{73400 - 134^2} = 235.465$$

Common Questions & Errors

Students shouldn't overthink the problem with fractional payments of 300. Also, account for probabilities in which payment cap of 700 is reached.

In these problems, we must distinguish between the REALT RV (how much snow falls) and the PAYMENT RV (when does the insurer pay)?. The problem states "The insurer pays the airport 300 for every full ten inches of snow in excess of 40 inches, up to a policy maximum of 700 ." So the insurer will not start paying UNTIL AFTER 10 full inches in excess of 40 inches of snow is reached (say at 50+ or 51). In other words, the insurer will pay nothing if X<50.

Rate this problem | Excellent | Needs Improvement | Inadequate

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