# Delivery Format

| APPOINTMENT TIME: 4.5 HOURS | | |
|---|---|---|
| **Exam Duration** | **Scheduled Break** | **Exam Tutorial, Confidentiality Agreement, End of Exam Survey** |
| **4 hours** | **15 min** | **15 min** |

The syllabus for this four-hour exam is defined in the form of learning objectives, knowledge statements, and readings.

**LEARNING OBJECTIVES** set forth, usually in broad terms, what the candidate should be able to do in actual practice. Included in these learning objectives are certain methodologies that may not be possible to perform on an examination, such as complex simulations, but that the candidate would still be expected to explain conceptually in the context of an examination.

**KNOWLEDGE STATEMENTS** identify some of the key terms, concepts, and methods that are associated with each learning objective. These knowledge statements are not intended to represent an exhaustive list of topics that may be tested, but they are illustrative of the scope of each learning objective.

**READINGS** support the learning objectives. It is intended that the readings, in conjunction with the material on earlier examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The CAS Syllabus & Examination Committee emphasizes that candidates are expected to use the readings cited in this *Syllabus* as their primary study materials.

Thus, the learning objectives, knowledge statements, and readings complement each other. The learning objectives define the behaviors, the knowledge statements illustrate more fully the intended scope of the learning objectives, and the readings provide the source material to achieve the learning objectives. Learning objectives should not be seen as independent units, but as building blocks for the understanding and integration of important competencies that the candidate will be able to demonstrate.

Note that the range of weights shown should be viewed as a guideline only. There is no intent that they be strictly adhered to on any given examination—the actual weight may fall outside the published range on any particular examination.

The overall section weights should be viewed as having more significance than the weights for the individual learning objectives. Over a number of years of examinations, absent changes, it is likely that the average of the weights for each individual overall section will be in the vicinity of the guideline weight. For the weights of individual learning objectives, such convergence is less likely. On a given examination, in which it is very possible that not every individual learning objective will be tested, there will be more divergence of guideline weights and actual weights. Questions on a given learning objective may be drawn from any of the listed readings, or a combination of the readings. There may be no questions from one or more readings on a particular exam.

After each set of learning objectives, the readings are listed in abbreviated form. Complete text references are provided at the end of this exam syllabus.

Items marked with a bold **SK** or **SKU** constitute the Fall 2023 Exam 8 Study Kit that may be purchased from the CAS Online Store. The Fall 2023 Update to the 2022 Study Kit includes only the new items marked with a bold **SKU**; the Update may be purchased from the CAS Online Store. Items marked with a bold **OP** (Online Publication) are available at no charge and may be downloaded from the CAS website.

Please check the "*Syllabus* Updates" section of the CAS website for any changes to the *Syllabus*.

Candidates for Exam 8 are expected to have already acquired considerable technical knowledge and practical experience in insurance ratemaking. Therefore, this examination will assume a working knowledge of basic ratemaking and will deal with advanced topics. To some degree, the examination will deal with the types of practical problems that a fully qualified actuary, working in ratemaking, should be able to solve. The ability to apply ratemaking knowledge and experience may be tested through questions dealing with problems for which there are no generally recognized solutions. The readings for Exam 8 should be studied for illustration of basic principles and theories, as well as for insight into advanced ratemaking problems and their solutions.

## A. Classification Ratemaking

Range of weight for Section A: 20-35 percent

In this exam, classification ratemaking and rate filings, which were introduced earlier in the syllabus, are treated in greater depth. The material in this section provides tools that enable the practitioner to go beyond mechanical construction to the comparison and evaluation of alternative classification schemes.

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 1. Identify and evaluate possible rate classes.<br><br>Range of weight: 5-10 percent | a. Characteristics of appropriate classifications<br>b. Sampling techniques<br>c. Credibility considerations<br>d. Statistical significance<br>e. Cluster analysis |
| **READINGS** | |
| • ASOP 12<br>• Bailey & Simon<br>• Mahler<br>• Robertson | |

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 2. Measure statistical significance of possible classes and estimate the loss costs of rating classes.<br><br>Range of weight: 5-10 percent | a. Multidimensional relativities<br>b. Credibility techniques<br>c. Quintiles Test<br>d. Holdout sample |
| **READINGS** | |
| • Bailey & Simon<br>• Couret & Venter | |

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 3. Design and build generalized linear models (GLMs) for classification ratemaking. | a. Components of a GLM formula<br>b. Data considerations<br>c. Distribution selection<br>d. Transformation of variables<br>e. Variable interactions |
| 4. Assess model fit and interpret model results<br><br>Range of weight for Learning Objectives A.3 through A.4 collectively: 10-15 percent | a. Measures of fit: Log-likelihood, Deviance, etc.<br>b. Comparing competing models<br>c. Assessing fit with plots<br>d. Measuring Lift |
| **READINGS** | |
| • GLM | |

## B. Excess, Deductible, and Individual Risk Rating

Range of weight for Section B: 45-65 percent

One of the important functions performed by an actuary is rating individual risks. Prior to Exam 8, most of the readings addressed group or classification risk rating. This section is intended to prepare candidates to design and manage excess, deductible, and individual risk rating systems.

The readings range from those that discuss the theoretical foundation of excess, deductible, and individual risk rating, to those that discuss the application of specific rating plans. Candidates are expected to apply these concepts in a creative and problem-solving manner.

The first subsection covers pricing for layers of loss including excess and deductible business while the following subsections cover individual risk rating consisting of:

- Experience rating, in which prior individual risk experience is used to adjust rates prospectively.
- Retrospective and loss sensitive rating, in which the insured will pay an amount (in premium or retained loss) that depends on the experience after the policy has been written.

Candidates are also expected to be knowledgeable in the application of individual risk rating plans currently in use. The NCCI *Experience Rating Plan Manual for Workers Compensation and Employers Liability Insurance* and ISO *Commercial General Liability Experience and Schedule Rating Plan* will be provided in their entirety with the examination. Excerpts from the NCCI *Retrospective Rating Plan Manual for Workers Compensation and Employers Liability Insurance* will also be provided with the examination. Candidates are not required to memorize the details but will be expected to be able to use the details of these plans during the examination. Since the manuals/excerpts will be included with the examination, candidates will not be allowed to bring copies of the documents into the examination room.

### Excess and Deductible Rating

Excess and deductible rating allows the insured to retain the risk of loss and loss expenses up to limits selected in advance.

This section builds on the material covered in the basic ratemaking section of Exam 5. Candidates should have a general knowledge and understanding of excess coverages and the problems inherent in pricing these coverages for different lines of business.

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 1. Apply frequency and severity distributions to determine expected losses by layer of insurance. | a. Severity distributions and their uses, including increased limits factors (ILFs) and loss elimination ratios (LERs)<br>b. Properties of ILFs and LERs<br>c. Interaction among inflation, changes in layer, and losses<br>d. Methods of estimating frequency and severity distributions from losses |
| 2. Calculate the cost of the layer of risk given the loss cost.<br><br>Range of weight for Learning Objectives B.1 and B.2 collectively: 10-15 percent | a. Impact of policy provisions on expected losses<br>b. Variability of expenses by layer and policy provisions |
| **READINGS** | |
| • Bahnemann<br>• Case Study for Fisher et al.<br>• Fisher et al. | |

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 3. Estimate aggregate loss distributions.<br><br>Range of weight: 5-10 percent | a. Techniques to estimate aggregate loss distributions directly from aggregate data (e.g., Table M, Table L)<br>b. Construction of an aggregate loss distribution from frequency and severity distributions |
| **READINGS** | |
| • Bahnemann<br>• Case Study for Fisher et al.<br>• Fisher et al. | |

## Experience Rating

The primary goal of experience rating is the adjustment of an individual risk's rate to reflect the extent to which that risk's own experience identifies it as being different from other risks in the same class. The readings begin with principles and concepts, and then move to a discussion of plans in current use.

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 4. Adjust class rates based on individual risk experience and exposure. | a. Actuarial principles and concepts underlying the development of experience rating plans<br>b. Methods to apply credibility concepts to an insured's experience (e.g., maximum single loss)<br>c. Current NCCI and ISO experience rating plans<br>d. Schedule rating and its interaction with experience rating |
| 5. Assess effectiveness of experience rating plans.<br><br>Range of weight for Learning Objectives B.4 and B.5 collectively: 15-20 percent | a. Relationship between Modifications and Loss Ratios<br>b. Evaluation techniques, e.g., quintile test<br>c. Over-/Under- corrections |
| **READINGS** | |
| • Case Study for Fisher et al.<br>• Fisher et al.<br>• ISO<br>• NCCI | |

## Retrospective and Loss Sensitive Rating

Retrospective rating allows adjustment of individual risk premium after policy expiration in response to actual loss and expenses associated with the policy. The retrospective rating plans currently in use adjust the premium up or down within limits selected in advance.

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 6. Construct a loss sensitive rating plan (LSRP). | a. Actuarial principles and concepts underlying the construction of a retrospective rating plan (e.g., construction of table of insurance charges)<br>b. NCCI retrospective rating plans |
| 7. Analyze the elements of a LSRP.<br><br>Range of weight for Learning Objectives B.6 and B.7 collectively: 15-20 percent | a. Influence of the parameters and other elements of the plan on the final price and potential cost of product<br>b. Influence of the parameters and other elements of the plan on cost and cash flow to insured<br>c. Criteria for selecting among various LSRPs |
| **READINGS** | |
| • Case Study for Fisher et al.<br>• Fisher et al.<br>• NCCI Circular | |

# C. Catastrophic and Reinsurance Pricing

Range of weight for Section C: 15-20 percent

## Catastrophe Ratemaking

This subsection introduces candidates to the methods used to model losses due to catastrophic events for the purpose of generating a catastrophe risk load and to manage the total exposure from catastrophic events within an insurance portfolio.

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 1. Describe the components and structure of catastrophe models. | a. Hazard, exposure, vulnerability, and loss modules<br>b. Exceedance Probability Curve<br>c. Simulation and modeling techniques |
| 2. Explain the use of catastrophe models in insurance ratemaking and portfolio management.<br><br>Range of weight for Learning Objectives C.1 and C.2 collectively: 4-6 percent | a. Insurability of catastrophe risks<br>b. Sources and nature of uncertainty in catastrophe modeling<br>c. Use of catastrophe models in insurance ratemaking<br>d. Use of catastrophe models in portfolio management |
| **READINGS** | |
| • Grossi & Kunreuther and including errata for Section 2.4 | |

## Reinsurance Ratemaking

This subsection introduces candidates to current and historical methods used to price reinsurance. The candidates will be familiar with many of these methods from the materials on primary insurance ratemaking; the emphasis here is on the application of these methods in pricing reinsurance contracts.

| LEARNING OBJECTIVES | KNOWLEDGE STATEMENTS |
|---|---|
| 3. Determine the price of various types of reinsurance contracts. | a. Types of contracts, including excess of loss, quota share, surplus share, treaty, aggregate excess of loss, and facultative<br>b. Common methods for pricing reinsurance, including burning cost, exposure rating and experience rating<br>c. Reinsurance loss development and trend<br>d. Use of increased limit factors in reinsurance pricing<br>e. Evaluation of aggregate distribution models<br>f. Prospective and retrospective pricing in reinsurance<br>g. Reinsurer's expenses<br>h. Final premium |
| 4. Determine the effect of common contract provision on the price of reinsurance contracts. | a. Pricing for reinstatements, loss corridors, clash, profit and sliding scale commissions, and other common provisions in reinsurance contracts |
| 5. Specify, fit, and use loss distribution based exposure curves.<br><br>Range of weight for Learning Objectives C.3 through C.5 collectively: 11-14 percent | a. Define an exposure curve<br>b. Limited and unlimited distributions<br>c. Expected value and total loss probability<br>d. Use of MBBEFD class distributions as exposure curves |
| **READINGS** | |
| • Clark<br>• Bernegger | |

## Complete Text References for Exam 8

Text references are alphabetized by the citation column.

| Citation | Abbreviation | Learning Objective | Source |
|---|---|---|---|
| Actuarial Standards Board of the American Academy of Actuaries, "Actuarial Standard of Practice No. 12, Risk Classification (for all Practice Areas)," December 2005, updated for deviation language in May 2011. | ASOP 12 | A1 | **OP** |
| Bahnemann, D., "Distributions for Actuaries," CAS Monograph #2, Chapters 5 and 6. Including errata.<br><br>It is highly recommended that candidates should read the entire monograph, as the material in Chapters 1-4 will be assumed to be familiar to candidates. | Bahnemann | B1-B3 | **OP** |
| Bailey, R. A. and Simon, L. J., "An Actuarial Note on the Credibility of Experience of a Single Private Passenger Car," *PCAS* XLVI, 1959, pp. 159-164. Including discussion of paper: Hazam, W. J., *PCAS* XLVII, 1960, pp. 150-152. | Bailey & Simon | A1-A2 | **OP** |
| Bernegger, S., "Swiss Re Exposure Curves and the MBBEFD Distribution Class," ASTIN Bulletin, Vol. 27, No. 1, May 1997, pp. 99-111. | Bernegger | C3, C5 | **OP** |
| Clark, D. R., "Basics of Reinsurance Pricing," CAS Study Note, Revised 2014. | Clark | C3-C4 | **OP** |
| Couret, J. and Venter, G., "Using Multi-Dimensional Credibility to Estimate Class Frequency Vectors in Workers Compensation," ASTIN Bulletin, Vol. 38, No. 1, May 2008, pp. 72-85. | Couret & Venter | A2 | **OP** |
| Fisher, G., et al., Case Study for "Individual Risk Rating Study Note."<br><br>Candidates are responsible for the **Case Study** presented in the Excel file, which can be downloaded at:<br><br>https://www.casact.org/sites/default/files/2021-03/8_Fisher_et_al_Case_Study.xlsx | Case Study for Fisher et al. | B1-B7 | **OP** |
| Fisher, G., et al., "Individual Risk Rating Study Note," CAS Study Note, Version 3, October 2019. | Fisher et al. | B1-B7 | **OP** |
| Goldburd, M., et al., "Generalized Linear Models for Insurance Rating," CAS Monograph #5, 2nd edition, Chapters 1-9. | GLM | A3-A4 | **OP** |
| Grossi, P. and Kunreuther, H., Editors, *Catastrophe Modeling: A New Approach to Managing Risk*, 2005, Springer, Chapters 2-6 (excluding references at the end of each chapter) and including errata for Section 2.4, updated March 2021. | Grossi & Kunreuther | C1-C2 | **B**<br><br>**Errata is OP** |

| Citation | Abbreviation | Learning Objective | Source |
|---|---|---|---|
| Insurance Services Office, Inc., *Commercial General Liability Experience and Schedule Rating Plan — Multistate*, Manual Notice GL-MU-2019-CGLES-001.<br><br>Candidates are not required to memorize the details but will be expected to be able to use them on the examination. The entire manual will be provided both in the study kit and on the exam. | ISO | B4-B5 | **SK** |
| Mahler, H. C., "An Example of Credibility and Shifting Risk Parameters," *PCAS* LXXVII, 1990, pp. 225-282. Candidates will not be tested on the Appendices. | Mahler | A1 | **OP** |
| National Council on Compensation Insurance, *Experience Rating Plan Manual for Workers Compensation and Employers Liability Insurance*, 2003 Edition, Issued 10 Jan 2022.<br><br>Candidates are not required to memorize the details but will be expected to be able to use them on the examination. The entire manual will be provided both in the study kit and on the exam. | NCCI | B4-B5 | **SK** |
| National Council on Compensation Insurance, *Retrospective Rating Plan Manual for Workers Compensation and Employers Liability Insurance*, Circular CIF-2018-28, 06/21/2018. The selected pages are included in the Study Kit and the exam.<br><br>The manual consists mostly of two tables (the following tables have not been included in the study kit nor the exam):<br>• pp. 9-728: "Tables of Aggregate Loss Factors – sub tables 1 through 18" and<br>• pp. 735-882: tables for "Sample Values for a Policy with No Loss Limit and All Exposure in Single Hazard Group" by state.<br><br>Candidates are not required to memorize the details but will be expected to be able to use them on the examination. | NCCI Circular | B6-B7 | **SK** |
| Robertson, J.P., "NCCI's 2007 Hazard Group Mapping," *Variance*, Vol. 3, Issue 2, 2009, Casualty Actuarial Society, pp. 194-213. | Robertson | A1 | **OP** |

## Source Key

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|---|---|
| **B** | Book—may be purchased from the publisher or bookstore. |
| **DSK** | Material included in the 2023 Digital Study Kit. |
| **NEW** | Indicates new or updated material. |
| **OP** | All text references marked as Online Publications will be available by clicking the hyperlink within the syllabus. |
| **SK** | Material included in the Fall 2023 Study Kit. |
| **SKU** | Material included in both the Fall 2023 CAS Study Kit and the Fall 2023 Update to the 2022 Study Kit. |

Items printed in **red** indicate an update, clarification, or change.

**Version: Exam_8_2023_F v02 2023_10_24.docx**