

2013 Exam 8 Syllabus Advanced Ratemaking

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 the lower numbered examinations, provide sufficient resources to allow the candidate to perform the learning objectives. Some readings are cited for more than one learning objective. The Syllabus and Examination Committees emphasize 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** constitute the 2013 CAS Exam 8 Study Kit that 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 links in the Complete Text References section below.

Please check the “*Syllabus Updates*” section of the CAS Web Site 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: 20-30 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. Range of weight: 5-10 percent	a. Characteristics of appropriate classifications b. Sampling techniques c. Credibility considerations d. Statistical significance e. Cluster analysis
READINGS	
AAA Bailey & Simon Mahler I Robertson	

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

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
3. Formularize and solve generalized linear models (GLMs) for classification ratemaking. Range of weight: 5-10 percent	a. GLM assumptions compared to: <ul style="list-style-type: none"> One-way analysis Minimum bias procedures Classical linear analysis b. Components of a GLM formula c. Aliasing and near-aliasing
READINGS	
Anderson et al.	

B. Excess, Deductible, and Individual Risk Rating

Range of weight for Section B: 50-70 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:

1. Experience rating, in which prior individual risk experience is used to adjust rates prospectively.
2. 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. Excerpts from the NCCI *Experience Rating Plan Manual for Workers Compensation and Employers Liability Insurance*, NCCI *Retrospective Rating Plan Manual for Workers Compensation and Employers Liability Insurance*, and ISO *Commercial General Liability Experience and Schedule Rating Plan* will 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 necessary 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
<ol style="list-style-type: none">1. Apply frequency and severity distributions to determine expected losses by layer of insurance. Range of weight: 8-12 percent	<ol style="list-style-type: none">a. Severity distributions and their uses, including increased limits factors (ILFs) and loss elimination ratios (LERs)b. Properties of ILFs and LERsc. Interaction among inflation, changes in layer, and lossesd. Methods of estimating frequency and severity distributions from losses
READINGS	
Gillam & Snader 1 Lee 1 Mahler 2 Miccolis	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Estimate aggregate loss distributions. Range of weight: 8-12 percent	a. Techniques to estimate aggregate loss distributions directly from aggregate data (e.g., Table M, Table L) b. Construction of an aggregate loss distribution from frequency and severity distributions
READINGS	
Brosius Gillam & Snader 2 Lee 2 Mahler 3 Skurnick	

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
3. Adjust class rates based on individual risk experience and exposure. Range of weight: 8-12 percent	a. Actuarial principles and concepts underlying the development of experience rating plans b. Credibility concepts (e.g., maximum single loss) c. Current NCCI and ISO experience rating plans d. Schedule rating
READINGS	
Gillam Gillam & Snader 1 ISO NCCI 1 NCCI 2 Venter	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Assess effectiveness of experience rating plans. Range of weight: 5-10 percent	a. Off-balance factors b. Evaluation techniques (e.g., quintile test)
READINGS	
Gillam Venter	

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
5. Construct a retrospectively rated plan. Range of weight: 8-12 percent	a. Actuarial principles and concepts underlying the construction of a retrospective rating plan (e.g., balance principle, construction of table of insurance charges) b. NCCI retrospective rating plans
READINGS	
Brosius Gillam & Snader 2 Lee 2 NCCI 3 Skurnick	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
6. Analyze the elements of a loss sensitive rating plan. Range of weight: 8-12 percent	a. Influence of the parameters and other elements of the plan on the final price and potential profitability of product b. Influence of the parameters and other elements of the plan on cost and cash flow to insured
READINGS	
Fisher Gillam & Snader 2 Lee 2 Skurnick	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
7. Calculate the cost of the layer of risk given the loss cost. Range of weight: 4-6 percent	a. Variability of expenses by layer and policy provisions b. Large dollar deductible (LDD) and excess policy provisions c. Advantages of LDD and excess policies
READINGS	
Fisher Gillam & Snader 3 Teng	

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 b. Exceedance Probability Curve c. Simulation and modeling techniques
2. Explain the use of catastrophe models in insurance ratemaking and portfolio management. Range of weight for Learning Objectives C.1 and C.2 collectively: 4-6 percent	a. Insurability of catastrophe risks b. Sources and nature of uncertainty in catastrophe modeling c. Use of catastrophe models in insurance ratemaking d. Use of catastrophe models in portfolio management
READING	
Grossi & Kunreuther, plus 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. Range of weight: 3-5 percent	a. Types of contracts, including excess of loss, quota share, surplus share, treaty, aggregate excess of loss, and facultative b. Common methods for pricing reinsurance, including burn cost, exposure rating and experience rating c. Reinsurance loss development and trend d. Use of increased limit factors in reinsurance pricing e. Evaluation of aggregate distribution models f. Prospective and retrospective pricing in reinsurance
4. Determine the effect of common contract provision on the price of reinsurance contracts. Range of weight: 3-5 percent	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. Range of weight: 3-5 percent	a. Define an exposure curve b. Limited and unlimited distributions c. Expected value and total loss probability d. Use of MBBEFD class distributions as exposure curves
READING	
Clark Bernegger	

Complete Text References for Exam 8

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
American Academy of Actuaries Committee on Risk Classification, "Risk Classification Statement of Principles," June 1980. [Available at no charge from the American Academy of Actuaries at (202) 223-8196 or on the Academy's Web Site at www.actuary.org .]	AAA	A1	OP
Anderson, D.; Feldblum, S.; Modlin, C.; Schirmacher, D.; Schirmacher, E.; and Thandi, N., "A Practitioner's Guide to Generalized Linear Models" (Third Edition), CAS Study Note, February 2007, pp. 4-39 only. [Note: the study note edition is a revised version of a paper from the <i>CAS Discussion Paper Program</i> . Candidates must use the study note edition.]	Anderson et al.	A3	OP
Bailey, R.A.; and Simon, L.J., "An Actuarial Note on the Credibility of Experience of a Single Private Passenger Car," <i>PCAS</i> XLVI, 1959, pp. 159-164. Including discussion of paper: Hazam, W.J., <i>PCAS</i> XLVII, 1960, pp. 150-152.	Bailey & Simon	A1-A2	OP
Bernegger, S., "Swiss Re Exposure Curves and the MBBEFD Distribution Class," <i>ASTIN Bulletin</i> , Vol. 27, No. 1, May 1997, pp. 99-111.	Bernegger	C3, C5	OP
Brosius, J.E., "Table M Construction," CAS Study Note, 2002.	Brosius	B2, B5	OP
Clark, D.R., "Basics of Reinsurance Pricing," CAS Study Note, 1996. Candidates are not responsible for Section 6 of the paper.	Clark	C3, C4	OP
Couret, J.; and Venter, G., "Using Multi-Dimensional Credibility to Estimate Class Frequency Vectors in Workers Compensation," <i>ASTIN Bulletin</i> , Vol. 38, No. 1, May 2008, pp. 72-85.	Couret & Venter	A2	OP
Fisher, G.K., "Pricing Aggregates on Deductible Policies," CAS Study Note, May 2002.	Fisher	B6, B7	OP
Gillam, W.R., "Workers' Compensation Experience Rating: What Every Actuary Should Know," <i>PCAS</i> LXXIX, 1992, Sections 1-5, pp. 215-239.	Gillam	B3, B4	OP
Gillam, W.R.; and Snader, R.H., "Fundamentals of Individual Risk Rating," National Council on Compensation Insurance (Study Note), 1992, Part I.	Gillam & Snader 1	B1, B3	OP
Gillam, W.R.; and Snader, R.H., "Fundamentals of Individual Risk Rating," National Council on Compensation Insurance (Study Note), 1992, Part II.	Gillam & Snader 2	B2, B5, B6	OP
Gillam, W.R.; and Snader, R.H., "Fundamentals of Individual Risk Rating," National Council on Compensation Insurance (Study Note), 1992, Part III.	Gillam & Snader 3	B7	OP
Grossi, P.; and Kunreuther, H., Editors, <i>Catastrophe Modeling: A New Approach to Managing Risk</i> , 2005, Springer, Chapters 2-6 (excluding references at the end of each chapter). Errata 2.4.	Grossi & Kunreuther	C1, C2	B

Citation	Abbreviation	Learning Objective	Source
Insurance Services Office, Inc., <i>Commercial General Liability Experience and Schedule Rating Plan</i> , 2006. Excerpts from the ISO <i>Commercial General Liability Experience and Schedule Rating Plan</i> will be provided with the exam. Candidates are not required to memorize the details, but will be expected to be able to use them on the exam. Since they will be included with the exam, candidates will not be allowed to bring copies of the documents into the examination room.	ISO	B3	SK
Lee, Y.S., “The Mathematics of Excess of Loss Coverages and Retrospective Rating—A Graphical Approach,” Sections 1-3, <i>PCAS LXXV</i> , 1988, pp. 49-64.	Lee 1	B1	OP
Lee, Y.S., “The Mathematics of Excess of Loss Coverage and Retrospective Rating—A Graphical Approach,” Section 4, <i>PCAS LXXV</i> , 1988, pp. 64-78. Candidates are not responsible for “Other Applications” on pp. 75-76.	Lee 2	B2, B5, B6	OP
Mahler, H.C., “An Example of Credibility and Shifting Risk Parameters,” <i>PCAS LXXVII</i> , 1990, pp. 225-282. Candidates will not be tested on the Appendices.	Mahler 1	A1	OP
Mahler, H.C., Discussion of “Retrospective Rating: 1997 Excess Loss Factors,” <i>PCAS LXXXV</i> , 1998, pp. 316-344. Appendices B-D are for reference only; candidates do not need to memorize formulas in Appendices B-D. Including Errata.	Mahler 2	B1	OP
Mahler, H.C., “Workers Compensation Excess Ratios: An Alternative Method of Estimation,” <i>PCAS LXXXV</i> , 1998, pp. 132-156.	Mahler 3	B2	OP
Miccolis, R.S., “On the Theory of Increased Limits and Excess of Loss Pricing,” <i>PCAS LXIV</i> , 1977, pp. 27-59 excluding “Risk Reduction by Layering” (pp. 45-49). Including discussion of paper: Rosenberg, S., <i>PCAS LXIV</i> , 1977, pp. 60-73.	Miccolis	B1	OP
National Council on Compensation Insurance, <i>The 1998 Adjustment to the Experience Rating Plan: Your Guide to Understanding the Changes</i> .	NCCI 1	B3	SK
National Council on Compensation Insurance, <i>Experience Rating Plan Manual for Workers Compensation and Employers Liability Insurance</i> . Candidates are responsible for only the excerpted material included in the Study Kit. Candidates are not required to memorize the details, but will be expected to be able to use them on the examination. Since the required excerpts will be included with the examination, candidates will not be allowed to bring copies of the documents into the examination room.	NCCI 2	B3	SK

Citation	Abbreviation	Learning Objective	Source
National Council on Compensation Insurance, <i>Retrospective Rating Plan Manual for Workers Compensation and Employers Liability Insurance</i> . Candidates are responsible for only the excerpted material included in the Study Kit, excluding Part 2, Section III, on cancellation provisions. Candidates are not required to memorize the details, but will be expected to be able to use them on the examination. Since the required excerpts will be included with the examination, candidates will not be allowed to bring copies of the documents into the examination room.	NCCI 3	B5	SK
Robertson, J.P., “NCCI’s 2007 Hazard Group Mapping,” <i>Variance</i> , Vol. 3, Issue 2, 2009, Casualty Actuarial Society, pp. 194-213.	Robertson	A1	OP
Skurnick, D., “The California Table L,” <i>PCAS LXI</i> , 1974, pp. 117-140. Including discussion of this paper: Gillam, W.R., <i>PCAS LXXX</i> , 1993, pp. 353-365.	Skurnick	B2, B6	OP
Teng, M.T.S., “Pricing Workers’ Compensation Large Deductible and Excess Insurance,” <i>Casualty Actuarial Society Forum</i> , Winter 1994, pp. 413-437.	Teng	B7	OP
Venter, G.G., “Experience Rating—Equity and Predictive Accuracy,” <i>NCCI Digest</i> , April 1987, Volume II, Issue I, pp. 27-35. (Pages are shown as 1-9 in the Study Kit version.)	Venter	B3, B4	SK

Source Key

- B** Book—may be purchased from the publisher or bookstore or borrowed from the CAS Library.
- OP** Online publication—available at no charge and is linked from the text references section above.
- SK** Material included in the 2012 CAS Study Kit.

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

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for Exam 8. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

ACTEX Publications (Mad River Books), 107 Groppo Drive, Suite A, P.O. Box 974, Winsted, CT 06098; telephone: (800) 282-2839 or (860) 379-5470; fax: (860) 738-3152; e-mail: retail@actexmadriver.com; Web site: www.actexmadriver.com.

Actuarial Bookstore, P.O. Box 69, Greenland, NH 03840; telephone: (800) 582-9672 (U.S. only) or (603) 430-1252; fax: (603) 430-1258; Web site: www.actuarialbookstore.com.

American Academy of Actuaries, 1100 Seventeenth Street NW, Seventh Floor, Washington, DC 20036; telephone: (202) 223-8196; Web site: www.actuary.org.

Casualty Actuarial Society *Forum*, *PCAS*, and *Discussion Paper Program*, Casualty Actuarial Society, 4350 N. Fairfax Drive, Suite 250, Arlington, VA 22203; telephone: (703) 276-3100; fax: (703) 276-3108; e-mail: office@casact.org; Web site: www.casact.org.

Insurance Services Office, Inc., 545 Washington Boulevard, Jersey City, NJ 07310-1686; telephone: (800) 888-4476.

National Council on Compensation Insurance, 901 Peninsula Corporate Circle, Boca Raton, FL 33487; telephone: (800) NCCI-123.

SlideRule Books, P.O. Box 69, Greenland, NH 03840; telephone: (877) 407-5433 or (603) 373-6140; fax: (877) 417-5433 or (603) 430-1258; Web site: www.sliderulebooks.com.