DRAFT 2011 Exam 7
Advanced Techniques in Unpaid Claim Estimation, Insurance Company Valuation, and Enterprise Risk Management

The CAS is providing this advanced copy of the draft syllabus for this exam so that candidates and educators will have a sense of the learning objectives and readings. Please note that the final edition of the 2011 *Syllabus of Basic Education* will be released in November 2010 and that the 2011 Study Kits will be available in early December 2010. The final version of this syllabus may contain wording clarifications and revised readings based on newer editions of study materials that may be produced or identified between now and then.

Before commencing study for this four-hour examination, candidates should read the "Introduction" to "Materials for Study" in the current *Syllabus* for important information about learning objectives, knowledge statements, readings, and the range of weights. [In April 2010, the CAS increased the test time of new Exam 7 to four hours.]

A. Advanced Techniques in Unpaid Claim Estimation and Insurance Company Valuation

Range of weight for Section A: 65–75 percent

This section focuses on advanced techniques that the actuary may use when estimating liabilities for unpaid claims. The candidate is expected to be well versed in the basic principles and standards of practice for reserving. This section addresses how actuarial concepts are adapted to evaluate liabilities arising in complex risk transfer agreements common in excess insurance and reinsurance contracts. Emphasis is placed on developing reserve ranges around the actuarial central estimate. The valuation section covers the methods used to determine the theoretical value of equity securities and covers issues associated with the valuation of property and casualty insurance companies. The candidate is expected to be proficient with the basic tools and techniques of analyzing Corporate Finance issues as described in the VEE Corporate Finance requirements.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Calculate unpaid claim estimates using credibility models. Range of weight: 6-8 percent	a. Application of credibility procedure b. Mechanics of the method c. Strengths and weaknesses d. Testing results for reasonableness
READINGS	
Brosius Mack (2000)	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
2. Estimate parameters and unpaid claims using claims development models related to loss reserving methods such as: • Chain ladder • Cape Cod • Chain ladder plus calendar-year effects • Bornhuetter-Ferguson	a. Key assumptions of the models and testing of assumptions b. Original Mack chain ladder assumptions c. Relationship of variance assumptions to methods of calculating development factors d. Row-factor times column-factor models e. Calendar-year effects in development factor models and in row-column factor models f. Effect of trends and their interrelationship (e.g., calendar year, accident year, and development year trends) g. Testing for and eliminating insignificant parameters h. Testing whether the methods work and how well the models fit i. Moments of the chain ladder unpaid claim estimate when factors are calculated based on different variance assumptions j. Simulation of parameter percentiles and unpaid claims percentiles when models assume a distribution of residuals fit by MLE
3. Calculate the moments and percentiles of unpaid claim distributions implied by the models. Range of weight for Learning Objectives A2-A3 collectively: 20-25 percent	a. Key assumptions of the models and testing of assumptions b. Original Mack chain ladder assumptions c. Relationship of variance assumptions to methods of calculating development factors d. Row-factor times column-factor models e. Calendar-year effects in development factor models and in row-column factor models f. Effect of trends and their interrelationship (e.g., calendar year, accident year, and development year trends) g. Testing for and eliminating insignificant parameters h. Testing whether the methods work and how well the models fit i. Moments of the chain ladder unpaid claim estimate when factors are calculated based on different variance assumptions j. Simulation of parameter percentiles and unpaid claims percentiles when models assume a distribution of residuals fit by MLE
READINGS	
Clark Mack (1994) Venter	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
4. Estimate unpaid claims for various loss layers. Range of weight: 2–4 percent	a. Methods for estimating unpaid claims in a deductible layer b. Methods for estimating unlimited unpaid claims excess of a threshold c. Methods for estimating unpaid claims excess of a retention but bounded by a limit d. Interrelationships between parameters for forecasting deductible, unlimited excess, layer excess and total claims

READINGS
Siewert

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
5. Calculate the mean and prediction error of an unpaid claim estimate given an underlying statistical model.	a. Distributions and distribution-free models b. Comparison of Chain Ladder stochastic models
6. Derive predictive distributions using bootstrapping and simulation techniques.	a. Comparison of methods b. Simulation using bootstrapping c. Simulation from parameters d. Bayesian methods
7. Adjust stochastic reserving models for changes in underlying reserve assumptions Range of weight for Learning Objectives A5-A7 collectively: 9-12 percent	a. Bayesian methods b. Apply adjustments to various reserving techniques

READINGS
England and Verrall Verrall

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS

8. Compare and contrast reinsurance and primary reserving procedures.	a. Overview of reinsurance and primary reserving methods
	b. Impact on assumptions from differences in information available to reinsurers
	c. Stanard-Buhlmann method
	d. Cape Cod method
	e. Underlying business characteristics of reinsurance contracts e.g., concentration of exposures
	f. Data structures:
	  • Ground up versus excess loss
	  • Accident year versus treaty year
	g. Reinsurance reserving methods

9. Adjust primary methods and data to be used for reinsurance reserving.	a. Overview of reinsurance and primary reserving methods
	b. Impact on assumptions from differences in information available to reinsurers
	c. Stanard-Buhlmann method
	d. Cape Cod method
	e. Underlying business characteristics of reinsurance contracts e.g., concentration of exposures
	f. Data structures:
	  • Ground up versus excess loss
	  • Accident year versus treaty year
	g. Reinsurance reserving methods

10. Calculate ceded loss reserves using appropriate methods.
Range of weight for Learning Objectives A8-A10 collectively: 15–18 percent
	a. Overview of reinsurance and primary reserving methods
	b. Impact on assumptions from differences in information available to reinsurers
	c. Stanard-Buhlmann method
	d. Cape Cod method
	e. Underlying business characteristics of reinsurance contracts e.g., concentration of exposures
	f. Data structures:
	  • Ground up versus excess loss
	  • Accident year versus treaty year
	g. Reinsurance reserving methods

READINGS	
Patrik	

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
11. Forecast premium reserves. Range of weight: 3-5 percent	a. Reserves for retrospective premiums b. Reserves for unearned premiums for policies with non pro-rata earning patterns
READINGS	
Teng and Perkins	

Learning Objectives	Knowledge Statements
12. Calculate the impact of loss and expense reserve requirements and regulatory or rating agency capital requirements on the free cash flow to equity for a P&C insurer.	a. Free cash flow to equity for a P&C insurer
13. Value the equity of a P&C insurer based on its expected future dividends, its free cash flow to equity, or its expected abnormal earnings.	a. Dividend Discount Model (DDM) b. Free cash flow to equity for a P&C insurer c. Discounted Cash Flow (DCF) Valuation using free cash flow to equity (FCFE), including impact of alternative methods of estimating terminal values and reasons why this method is preferred over the free cash flow to the firm (FCFF) method for P&C insurers d. Abnormal earnings e. Abnormal Earnings Valuation (AE), including impact of alternative methods of estimating terminal values
14. Value the equity of a firm using comparative or relative valuation methods based on multiples of selected financial variables obtained from either peer companies or from underlying fundamentals. Range of weight for Learning Objectives A12-A14 collectively: 5-10 percent	a. Comparative valuation ratios including price-earnings, price-sales, price-book, price-cash flow b. Relationship between the dividend discount model and the price-earnings (P-E) ratio c. Relationship between the abnormal earnings valuation model and the price-book value (P-BV) ratio
READINGS	
Goldfarb	

B. Enterprise Risk Management

Range of weight for Section B: 25 - 35 percent

This section introduces the candidate to the concepts and basic techniques of Enterprise Risk Management (ERM). ERM seeks to integrate the entire landscape of risk that confronts a business. Topics include value of risk management and basic modeling concepts.

LEARNING OBJECTIVES	KNOWLEDGE STATEMENTS
1. Demonstrate how insurance and financial risk can be analyzed quantitatively. Range of weight: 7-12 percent	a. Currency risk b. Credit risk c. Spread risk d. Liquidity risk e. Interest rate risk f. Equity risk g. Hazard/insurance risk h. Pricing risk i. Reserving risk

2.	Describe the use of enterprise-wide risk modeling and aggregation techniques.	a. Incorporating the use of correlation b. Evaluation and selection of appropriate copulas as part of the process of modeling multi-variate risks c. Scenario analysis d. Stress testing e. Extreme value theory f. Tail distributions and tail correlations g. Low frequency/high severity events h. Model and parameter risk
3.	Evaluate and select appropriate models to handle diverse risks, including stochastic approaches. Range of weight for Learning Objectives B2-B3 collectively: 7-12 percent	a. Incorporating the use of correlation b. Evaluation and selection of appropriate copulas as part of the process of modeling multi-variate risks c. Scenario analysis d. Stress testing e. Extreme value theory f. Tail distributions and tail correlations g. Low frequency/high severity events h. Model and parameter risk
4.	Describe the properties of various risk measures and their limitations.	a. (Semi) standard deviation b. VaR and TVaR c. Expected policyholder deficit and default put option d. Risk-adjusted TVaR e. Distortion measures and probability transforms
5.	Describe how risk measures and risk modeling, including allocation, can affect strategic management. Range of weight for Learning Objectives B4-B5 collectively: 4-7 percent	a. (Semi) standard deviation b. VaR and TVaR c. Expected policyholder deficit and default put option d. Risk-adjusted TVaR e. Distortion measures and probability transforms
6.	Describe the rationale for, methods for, and impact of managing insurance and financial risks. Range of weight: 5-8 percent	a. Selection of appropriate degree of risk b. Risk optimization and value impact c. Retention including estimated costs compared to benefits of risk transfer, value of specific risk, costs of financial distress, taxation, firm value, financing costs, and risk attitudes of debtholders, customers, employees, etc.
7.	Describe operational risk and demonstrate possible mitigation and quantification methodology Range of weight: 3-5 percent	a. Types of operational risk b. Examples c. Quantification d. Mitigation
READINGS		
The readings for Section B on ERM are under development.		

Complete Text References for Exam 7

Text references are alphabetized by the citation column.

Citation	Abbreviation	Learning Objective	Source
Bouska, A.S., "From Disability Income to Mega-Risks: Policy-Event Based Loss Estimation," Casualty Actuarial Society *Forum*, Summer 1996, pp. 291-320.	Bouska	A9	**W**
Brosius, E., "Loss Development Using Credibility," CAS Study Note, March 1993.	Brosius	A1	**W**
Clark, D.R., "LDF Curve-Fitting and Stochastic Reserving: A Maximum Likelihood Approach," Casualty Actuarial Society *Forum*, Fall 2003.	Clark	A2-A3	**W**
England, P.D., and Verrall, R.J., "Stochastic Claims Reserving in General Insurance," Institute of Actuaries and Faculty of Actuaries, 28 January 2002.	England and Verrall	A5-A7	**W**
Goldfarb, R. "CAS Exam 8 Study Note: P&C Insurance Company Valuation," August 2005.	Goldfarb	A12-A14	**W**
Mack, T., "Measuring the Variability of Chain Ladder Reserve Estimates," Casualty Actuarial Society *Forum*, Spring 1994.	Mack (1994)	A2, A3	**W**
Mack, T. "Credible Claims Reserve: The Benktander Method," *ASTIN Bulletin*, 2000, pp. 333-337.	Mack (2000)	A1	**W**
Patrik, G.S., "Reinsurance," *Foundations of Casualty Actuarial Science* (Fourth Edition), Casualty Actuarial Society, 2001, Chapter 7, pp. 434-464 (the section on Reinsurance Loss Reserving).	Patrik	A10-A12	**W**
Siewert, J.J., "A Model for Reserving Workers Compensation High Deductibles," Casualty Actuarial Society *Forum*, Summer 1996, pp. 217-244.	Siewert	A4	**W**
Teng, M.T.S.; and Perkins, M.E., "Estimating the Premium Asset on Retrospectively Rated Policies," *PCAS LXXXIII*, 1996, pp. 611-647, excluding Section 5. Including discussion of paper: Feldbloom, S., *PCAS LXXXV*, 1998, pp. 274-315, Sections 1 and 2 only. Candidates will not be held responsible for specific Annual Statement notation but will be responsible for concepts presented.	Teng and Perkins	A8	**W**
Venter, G.G., "Testing the Assumptions of Age-to-Age Factors," *PCAS* LXXXV, 1998.	Venter	A2-A3	**W**
Verrall, R.J., "Obtaining Predictive Distributions for Reserves Which Incorporate Expert Opinion," *Variance*, Vol. 1, Issue 1, 2007, Casualty Actuarial Society.	Verrall	A5-A7	**W**

Source Key

L   May be purchased from the publisher or bookstore or borrowed from the CAS Library.

SK   Represents material included in the 2011 CAS Study Kit.

W   Represents material in the 2011 Web Notes that is available at no charge from the "Study Tools" section of the CAS Web Site. A printed version may be purchased from the CAS Online Store.

Publishers and Distributors

Contact information is furnished for those who wish to purchase the text references cited for Exam 7. Publishers and distributors are independent and listed for the convenience of candidates; inclusion does not constitute endorsement by the CAS.

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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.

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.

SlideRule Books, P.O. Box 69, Greenland, NH 03840; telephone: (877) 407-5433 or (605) 845-5580; fax: (877) 417-5433 or (605) 845-7627; Web site: www.sliderulebooks.com.