

ACT. SCI. 316/516: ACTUARIAL MODELS III
Spring 2006
Professor Michael R. Powers

Class Meetings: Tuesdays and Thursdays: 2:40 p.m. – 4:00 p.m.; 565 Ritter Annex

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Office Hours: Tuesdays, 1:00 p.m. – 2:30 p.m.; Thursdays, 4:00 p.m. – 5:30 p.m.
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Required Texts:

Klugman, S. A., *Estimation, Evaluation, and Selection of Actuarial Models*, 2004, SOA Study Note 05-15-04. (K)
Weishaus, A., *ASM Study Manual Exam C / Exam 4*, 2005. (W)

Learning Objectives:

Students are expected to be able to set up and evaluate a number of models presented on the SOA Exam C / CAS Part 4 professional examination, and to use these models to solve problems in a business context. Specifically, students should be able to:

- Identify the steps in the modeling process and discuss how they interrelate.
- Identify the models and methods available, and understand the difference between the models and the methods.
- Explain the difference between a stochastic and a deterministic model, and identify the advantages/disadvantages of each.
- Discuss the possible limitations imposed by the data available in constructing a model.
- Apply models from more than one family (e.g., regression, stochastic process, time series) to a particular business problem.
- Identify the underlying assumptions implicit in each family of models and recognize which assumptions are applicable to a given business problem.
- Estimate the parameters of a tabular failure-time or loss-distribution model when the data are complete or incomplete, using maximum likelihood, method of moments, and Bayesian estimation.
- Obtain nonparametric estimates for a failure-time or loss-distribution model using the empirical distribution, the Kaplan-Meier estimator, and the Nelson-Aalen estimator.
- Adjust an estimator based upon the presentation of the sample data: complete, incomplete, censored, truncated, grouped, and/or shifted.
- Apply statistical “goodness-of-fit” tests to determine the acceptability of a fitted model.

- For estimators, define the terms: efficiency, bias, consistency, mean squared error.
- Apply limited fluctuation (classical) credibility, including criteria for both full and partial credibility.
- Perform Bayesian analysis using discrete and continuous examples.
- Apply the Buhlmann-Straub credibility model to basic situations, and understand the relationship to the Bayesian model.
- Apply conjugate priors in Bayesian analysis and Buhlmann-Straub credibility, and, in particular, in the Poisson-gamma model.
- Apply empirical Bayesian methods in nonparametric and semiparametric cases.
- Compare and contrast the assumptions underlying limited fluctuation credibility, Bayesian analysis, and the Buhlmann-Straub credibility model.

Schedule (Subject to Revision, with Notification):

<u>Date</u>	<u>Topic</u>
January 17	Overview
19	Estimation Using Data-Dependent Distributions (K 2.2)
24	Estimation Using Data-Dependent Distributions (K 2.2)
26	Estimation for Parametric Models (K 2.3)
31	Problem Session
February 2	Review; Quiz 1
7	Estimation for Parametric Models (K 2.3)
9	Problem Session
14	Review; Quiz 2
16	Measures of Quality (K 3.2)
21	Variance and Confidence Intervals (K 3.3)
23	Problem Session
28	Review; Quiz 3

March	2	Graphical Comparison of the Density and Distribution Functions (K 4.4)
	7	<i>No Class (Spring Break)</i>
	9	<i>No Class (Spring Break)</i>
	14	Hypothesis Tests (K 4.5)
	16	Selecting a Model (K 4.6)
	21	Problem Session
	23	Review; Quiz 4
	28	Total Claim Cost (Pure Premium) Models (On-line class note: totclcost.pdf)
	30	Problem Session
April	4	Review; Quiz 5
	6	The Credibility and Bayesian Paradigms (On-line class note: limfluctcred.pdf)
	11	Bayesian Credibility (On-line class note: bayesestim.pdf)
	13	Problem Session
	18	Review; Quiz 6
	20	Buhlmann-Straub Credibility (On-line class note: buhlcred.pdf)
	25	Empirical Bayes Methods (On-line class notes: bayesvsbuhl.pdf, categorical.pdf)
	27	Problem Session
May	9	(Tues., 2:00 p.m. – 4:00 p.m.) Review; Quiz 7
	17	(Wed., 8:30 a.m. – 12:30 p.m.) <i>SOA Exam C / CAS Part 4</i>

Grading:	Six Highest Quiz Grades	15% each
	Class Participation	10%

Quizzes will be based upon readings, homework assignments, and class discussions. There will be seven quizzes in all, but only the six highest quiz grades will count toward a student's final grade. Make-ups will be given only in exceptional circumstances. If a student completes fewer than six quizzes, the quizzes that are missed will count as zeros in computing the final grade.