KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS
DHAHRAN, SAUDI ARABIA

AS483: Actuarial Risk Theory and Credibility (162)

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Office Hours: UTR 08:10 AM – 09:50 AM or by appointment

Time: UT 02:10 PM – 03:25 PM
Place: Building 4 – Room 237

For regular announcements, students are advised to check Blackboard regularly.

Prerequisite: STAT 416

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Course Description:

Distribution of aggregate claims associated with insurance including analysis of the risk due to variations in expected claim numbers and amounts. Frequency and severity distributions, individual and collective models, ruin theory, continuous-time compound Poisson surplus processes, reinsurance, dividend formulas, credibility models, and simulation. An introduction to empirical Bayes and statistical distributions used to model loss experience. Application of risk theory to the operation of insurance and takaful system and assessment of the credibility of data for ratemaking.

Course Material:

1. Course Syllabus: (Posted on Blackboard)
2. Text: **Klugman, S. A., Panjer, H. H., and Willmot, G. E. (2012). Loss Models: from Data to Decisions 4th edition. John Wiley and Sons.**
3. Class Notes: (Posted on Black Board)
4. Calculator: Texas BAII Plus Calculator or Texas BAII Professional

Supplemental Course Material:

1. Formula Sheets and Flash Cards: (Posted on Blackboard)
2. February, 2017 Exam C Syllabus as given by SOA.
   https://www.soa.org/education/exam-req/edu-exam-c-detail.aspx
3. Tables for Exam C:
   https://www.soa.org/education/exam-req/edu-exam-c-detail.aspx
4. Exam C sample Questions (Only those related to AS 483 coverage of Exam C material):
   https://www.soa.org/Education/Resources/Cae/edu-soa-sponsored-study-resources.aspx
5. Exam C Past Exams Questions (Only those related to AS 483 coverage of Exam C material):
   https://www.soa.org/education/exam-req/syllabus-study-materials/edu-multiple-choice-exam.aspx

Attendance:

The student is responsible for all material presented in class. Some of the material presented in class might not be in the textbook and class notes. Generally, attendance will be checked once the teacher enters the class room. Entering the class after that, is considered as late where two late cases will be considered as one Absence. Students' late more than 10 minutes will be considered absent regardless of any excuse. Excessive unexcused absences will result in a grade of *DN* in accordance with University rules.

Grading:

Your course grade will be based on the total of points accumulated on the quizzes (75 points), two major exams (125 points each), and Final Exam (175 points). The following scale gives the cut-off points for the course grades.

Letter grade	A+	A	B+	B	C+	C	D+	D	F	DN
Cut-off	90%	85%	80%	75%	67%	60%	55%	50%	<50%	≥ 6 absences

Activity	Weight
Exam 1 (Chapters 3, 4, 5, & 6) **Sunday (Mar 12) , Time and Location TBA**	125 points (25%)
Exam 2 (Chapters 8, 9, 10, & 14) **Tuesday (Apr 18), Time and Location TBA**	125 points (25%)
Professional Exam Preparation Project **In class**	75 points (15%)
Final Exam (Comprehensive) **Tuesday May 28th (as posted on registrar website)**	175 points (35%)

NOTES:

1. There is no quota on the number of students who can get an A+ or F grade.
2. No makeup exam will be given under any circumstance. When a student misses Exam I or Exam II for a legitimate reason (such as medical emergencies), his grade for this exam will be determined based on the existing formula, which depends on his performance in the non-missed exams and in the final exam. It is to the professor's discretion whether to accept or refuse the student's excuse for missing an exam.

General Comments:

- It is essential that you keep up with the material as it is presented. This, unfortunately, is not one of those course where it is possible to catch up the last minute.
- I encourage you to discuss the assigned problems with other students and work on them in groups. Discussing he assigned problems with others will also help you explain them clearly in the quizzes or exams. In this course, you will earn credit for a solution to a problem only if you provide a detailed and clear explanation that shows you completely understand the solution.
- Students are required to carry pens, note-taking equipment and a calculator to EVERY lecture and exam. It is strongly recommended to keep a binder for class-notes.
- Bonus points might be awarded for showing alertness and participation in class discussions.
- The schedule is tentative and might be adjusted based on the progress of the class.
- Students are also expected to bring the book, take notes and organize their solved questions in a binder for easy retrieval to help them in study and review for class, exams, etc
- It is to the student's advantage to keep a binder for storing class notes, homework, and other graded assignments. Students who are organized will find it easier to find important materials when studying for exams.
- To successfully prepare for the SOA exams, students MUST solve problems regularly and with discipline. The selected assigned problems are specifically designed to prepare you for major and final exams. So, it is expected that you complete these problems step-by-step and with comprehension.
- If you happen to stumble upon a solution manual somewhere, remember 2 important points. (1) Due to publishing costs and deadlines, these solutions are brief and may have mistakes and (2) in your career as an actuary and your exams and quizzes in this class, you are expected to know every step to a problem and to know if a solution is incorrect. Thus, the best way to solve problem is without these brief solutions. *Never round* your intermediate results to problems when doing your calculations. This will cause you to lose calculation accuracy. Your answers may then be different from the SOA exam key even when you use the right procedure.
- For every exam, so you need to bring with you *pens, pencils, a sharpener, an eraser*, and a *SOA approved calculator*.

Week	*Dates*	*Sections*	*Topic*	*Notes*
1	Feb 5th - Feb 9th	Ch 3	**Basic Distributional Quantities** (Generating functions & sums of RV, Tails of distributions, Risk Measures)	
2	Feb 12th - Feb 16th	Ch 4	**Characteristics of Actuarial Models**	
3	Feb 19th - Feb 23rd	Ch 5	**Continuous Models**	Quiz 1 (Ch 3+ch 4) on Tuesday Feb 21st
4	Feb 26th - Mar 2nd	Ch 6	**Discrete Distributions**	
5	Mar 5th - Mar 9th	Ch 8	**Frequency & Severity with Coverage modifications**	Quiz 2 (Ch 5+ch 6) on Sunday Mar 5th
Tuesday, Mar 14 – 1st Major Exam (chapters 3, 4, 5,& 6)				
6	Mar 12th - Mar 16th	Ch 9	**Aggregate Loss Models**	
7	Mar 19th - Mar 23rd	Ch 9	**Aggregate Loss Models (cont.)**	
8	Mar 26th - Mar 30th	Ch 10 & 14	**Review of Mathematical Statistics (only new material)** **Frequentist Estimation of Discrete Data**	Quiz 3 (Ch 8+ch 9) on Sunday Mar 26th
	Apr 2nd - Apr 6th		Midterm Break	
9	Apr 9th - Apr 13th	Ch 20	**Simulation**	Quiz 4 (Ch 10+ch 14) on Tuesday Apr 11th
Tuesday , Apr 18 – 2nd Major Exam (chapters 8, 9, 10 & 14)				
10	Apr 16th - Apr 20th	Ch 17	**Introduction and Limited Fluctuation Credibility**	
11	Apr 23rd - Apr 27th	Ch 18	**Greatest Accuracy Credibility**	Quiz 5 (Ch 20+ch 17) on Tuesday Apr 25th
12	Apr 30th - May 4th	Ch 15	**Bayesian Estimation**	
13	May 7th - May 11th	Ch 19	**Empirical Bayes Credibility**	
14	May 14th - May 18th	C review if time permits	**Practice format from SOA C professional exam**	Quiz 6 (Ch 18+ch 15+ch 19) on Tuesday Apr 11th
15	May 21st - May 25th	Review	**Review**	
16	**Sunday** May 28th	**"Comprehensive" Final Exam**		

Academic Integrity: All KFUPM policies regarding **ethics** and **academic honesty** apply to this course.

Student Learning Outcomes: (From the Society of Actuaries Exam C) May change in 2016
As a summary, the number of SOA C learning outcomes per KFUPM course is as follows:

Course	# SOA C Learning Outcomes
STAT301	3
STAT302	4
AS475	23
AS483	34
AS475/AS483	1
Total	65

a) Post-2014 Outcomes with SOA weights of 40-55 discussed in this course

SOA Learning Outcomes	Weights	COURSE
A. Severity Models	15-20%	
1. Calculate the basic distributional quantities:		
a) moments b) Percentiles		STAT301
c) Generating functions		AS483
2. Describe how changes in parameters affect the distribution.		AS483
3. Recognize classes of distributions and their relationships.		AS483
4. Apply the following techniques for creating new families of distributions:		
a) Multiplication by a constant b) Raising to a power c) Exponentiation, d) Mixing		AS483
5. Identify the applications in which each distribution is used and reasons why.		AS483
6. Apply the distribution to an application, given the parameters.		AS475/AS483
7. Calculate various measures of tail weight and interpret the results to compare the tail weights.		AS483
8. Identify and describe two extreme value distributions.		AS483
B. Frequency Models		
For the Poisson, Mixed Poisson, Binomial, Negative Binomial, Geometric distribution and mixtures thereof:		
1. Describe how changes in parameters affect the distribution,		AS483
2. Calculate moments,		AS483
3. Identify the applications for which each distribution is used and reasons why,		AS483
4. Apply the distribution to an application given the parameters.		AS483
5. Apply the zero-truncated or zero-modified distribution to an application given the parameters		AS483
C. Aggregate Models		
1. Compute relevant parameters and statistics for collective risk models.		AS483
2. Evaluate compound models for aggregate claims.		AS483
3. Compute aggregate claims distributions.		AS483
D. For severity, frequency and aggregate models		
1. Evaluate the impacts of coverage modifications:		
a) Deductibles b) Limits c) Coinsurance		AS483
2. Calculate Loss Elimination Ratios.		AS483
3. Evaluate effects of inflation on losses.		AS483
E. Risk Measures		
1. Calculate VaR, and TVaR and explain their use and limitations.		AS483
I. Credibility (20-25%)	20-25%	
1. Apply limited fluctuation (classical) credibility including criteria for both full and partial credibility.		AS483
2. Perform Bayesian analysis using both discrete and continuous models.		AS483
3. Apply Bühlmann and Bühlmann-Straub models and understand the relationship of these to the Bayesian model.		AS483
4. Apply conjugate priors in Bayesian analysis and in particular the Poisson-gamma model.		AS483
5. Apply empirical Bayesian methods in the nonparametric and semiparametric cases.		AS483
J. Simulation (5-10%)	5-10%	
1. Simulate both discrete and continuous random variables using the inversion method.		STAT301
2. Simulate from discrete mixtures, decrement tables, the (a,b,0) class, and the normal and lognormal distributions using methods designed for those distributions		AS483
3. Estimate the number of simulations needed to obtain an estimate with a given error and a given degree of confidence.		AS483
4. Use simulation to determine the p-value for a hypothesis test.		STAT302
5. Use the bootstrap method to estimate the mean squared error of an estimator.		AS483
6. Apply simulation methods within the context of actuarial models.		AS483

Other SOA C learning outcomes are discussed mainly in AS475 Survival Models for Actuaries and STAT302 Statistical Inference.