King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

AS-388: Actuarial Science Prob Lab II
Fall Semester 2017 (Term 171)

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Office Hours (Tentative): UTR. 10:55 pm – 11:55 pm, or by appointment

Course Objectives: This problem lab is designed to prepare Actuarial majors for the first Society of
Actuaries (SOA) and Casualty Actuarial Society (CSA) Examinations, Exam P (Probability). Students are
assumed to have taken the appropriate prerequisite courses (STAT301 or equivalent) prior to registering for
this society exam preparation lab.


Assessment*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Participation (home works, quizzes, attendance, etc.)</td>
<td>10%</td>
</tr>
<tr>
<td>First Major Exam</td>
<td>20%</td>
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<tr>
<td>Second Major Exam</td>
<td>30%</td>
</tr>
<tr>
<td>Final Exam (Comprehensive)</td>
<td>40%</td>
</tr>
</tbody>
</table>

Grade Assignment

<table>
<thead>
<tr>
<th>Score</th>
<th>89 – 100</th>
<th>83 – 88.9</th>
<th>78 – 82.9</th>
<th>72 – 77.9</th>
<th>66 – 71.9</th>
<th>60 – 65.9</th>
<th>55 – 59.9</th>
<th>50 – 54.9</th>
<th>0 – 49.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>A+</td>
<td>A</td>
<td>B+</td>
<td>B</td>
<td>C+</td>
<td>C</td>
<td>D+</td>
<td>D</td>
<td>F</td>
</tr>
</tbody>
</table>

General Notes:

- Students are required to carry pens, binder and a calculator with statistical functions to EVERY
  lecture, quiz, and exam.
- Students are also expected to take class notes and organize their learning material 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 effectively learn statistics, students need to solve problems and analyze data. The selected
  assigned problems are specifically designed to prepare you for class quizzes, lab, majors and final
  exam. So, it is expected that you complete these problems step-by-step and with comprehension.
- Never round your intermediate results to problems when doing your calculations. This will cause you
to lose calculation accuracy. Round only your final answers and you should not round less than 4
decimal places unless required otherwise.
- A formula sheet and statistical tables will be given for you in every exam, so you only need to bring
  with you pens, pencils, a sharpener, an eraser, and a calculator.

Academic Integrity: All KFUPM policies regarding ethics and academic honesty apply to this course.
Student Learning Objectives: (Extracted from SOA professional exam P objectives).
By completing this course, students should be able to prepare themselves for the SOA exam P for which the objectives are as follows:
Candidates should be able to use and apply the following concepts in a risk management context:

1. General Probability (15-30% of SOA-P Exam)
   - Set functions including set notation and basic elements of probability
   - Mutually exclusive events
   - Addition and multiplication rules
   - Independence of events
   - Combinatorial probability
   - Conditional probability
   - Bayes Theorem/Law of total probability

2. Univariate probability distributions (including binomial, negative binomial, geometric, hypergeometric, Poisson, uniform, exponential, chi-square, beta, Pareto, lognormal, gamma, Weibull, and normal) (30-50% of SOA-P Exam)
   - Probability functions and probability density functions
   - Cumulative distribution functions
   - Mode, median, percentiles, and moments
   - Variance and measures of dispersion
   - Moment generating functions
   - Transformations

3. Multivariate probability distributions (including the bivariate normal) (30-45% of SOA-P Exam)
   - Joint probability functions and joint probability density functions
   - Joint cumulative distribution functions
   - Central Limit Theorem
   - Conditional and marginal probability distributions
   - Moments for joint, conditional, and marginal probability distributions
   - Joint moment generating functions
   - Variance and measures of dispersion for conditional and marginal probability distributions
   - Covariance and correlation coefficients
   - Transformations and order statistics
   - Probabilities and moments for linear combinations of independent random variables

Tips on how to enhance your problem-solving abilities:
1. Please try as many questions in the manual.
2. You are urged to practice (but not memorize) more problems than assigned.
3. You should always try to solve a problem on your own before reading the solution or asking for help.
4. If you find it difficult to handle a certain type of problem, you should try more problems of that type.
5. You are encouraged to solve some of the review problems at the end of each chapter.
6. The practice you get doing homework and reviewing the class lectures and recitations will make exam problems easier to tackle.
7. Try to make good use of the office hours of your instructor.

Important Notes:
- In accordance with University rules, 20% or 3(THREE) unexcused absences will automatically result in a grade of DN.
- Attendance on time is very important. Mostly, attendance will be checked within the first five minutes of the class. Entering the class after that, is considered as one late, and every two times late equals to one absence.
**Home Work Problems:**

- Problems to be discussed will be posted on the Blackboard. Students are expected to solve as many problems in the manual as possible to prepare for the SOA exam.

**Tentative Syllabus**

<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ch 0</td>
<td>Algebra and Calculus Review. Introduction. Set Theory, Graphing Inequality in 2 Dimensions, Properties of Functions, Limits and Continuity, Differentiation, Integration, Geometric and Arithmetic Progressions (series), Problem Set 0</td>
</tr>
<tr>
<td>2</td>
<td>Ch 1</td>
<td>Basic Probability Concepts. Probability Spaces and Events, Probability, Problem Set 1</td>
</tr>
<tr>
<td>3-4</td>
<td>Ch 2</td>
<td>Conditional Probability and Independence. Definition of Conditional Probability, Bayes’ Theorem and the Law of Total Probability, Problem Set 2</td>
</tr>
<tr>
<td>5</td>
<td>Ch 3</td>
<td>Combinatorial Principles. Permutations and Combinations, Problem Set 3</td>
</tr>
<tr>
<td>7</td>
<td>Ch 5</td>
<td>Expectation and Other Distribution Parameters. Expected Value, Moments of a Random Variable, Variance and Standard Deviation, Moment Generating Function, Percentiles, Median, and Mode, Problem Set 5</td>
</tr>
<tr>
<td>10-11</td>
<td>Ch 7</td>
<td>Frequently Used Continuous Distributions. Continuous Uniform Distribution, Normal Distribution, Approximating a Distribution Using a Normal Distribution, Exponential Distribution, Gamma Distribution, Summary of Continuous Distributions, Problem Set 7</td>
</tr>
<tr>
<td>14</td>
<td>Ch 9</td>
<td>Transformation of Random Variables. Distribution of a Transformation of X, Distribution of a Transformation of Joint Distribution of X and Y, Distribution of a Sum of Random Variables, Distribution of the Maximum or Minimum of Independent RV {X_1, X_2, \ldots, X_n}, Order Statistics, Mixtures of Distributions, Problem Set 9.</td>
</tr>
</tbody>
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**Final Exam (Comprehensive) Thursday January 04, 2018 (8:00 AM)**