

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

AS484: Actuarial Risk Theory and Credibility – Term 251 (3-2-4) 11am UTR

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.

We shall often refer to the description of SOA Exam ASTAM at:

<https://www.soa.org/4ae926/globalassets/assets/files/edu/2025/spring/syllabi/2025-spring-exam-astam-syllabus.pdf>

Textbook and package:

1. Klugman, S. A., Panjer, H. H., and Willmot, G. E. (2012). Loss Models: from Data to Decisions 4th edition. John Wiley and Sons
2. Texas BAI Plus Calculator or Texas BAI Professional
3. R studio statistical package (in Lab)

Reference:

1. Computational Actuarial Science with R, Edited by Arthur Charpentier, Chapman and Hall, 2015.
2. SoA ASTAM sample on the SOA official website.
3. Tables for Exam ASTAM:
<https://www.soa.org/globalassets/assets/files/edu/2023/astam-formula-sheet.pdf>
4. Exam ASTAM sample Questions (Only those related to AS 484 coverage of Exam ASTAM material):
<https://www.soa.org/globalassets/assets/files/edu/2024/spring/questions/february-2024-astam-questions.pdf>
<https://www.soa.org/globalassets/assets/files/edu/2024/spring/solutions/february-2024-astam-solutions.pdf>

Instructor: Dr. Mohammad H. Omar **Office:** Bldg 5-rm 508 **Phone:** 2471 **E-mail:** omarmh@kfupm.edu.sa

Office Hours: UTR: 10.00am-10:45am (office) or by appointment on MS Teams chat

Assessment

Assessment for this course will be based on the following:

| Activity | Weight |
|--|--------|
| Classwork (Attendance, Quizzes, and Hwk) | 12% |
| Labwork (Attendance, computer assignments, lab Quizzes, Lab Exam) | 20% |
| Mid-Term (Chapters 3, 4, 5, & 6) Wednesday (Oct 8 week 7) 6.00 pm | 20% |
| Term Paper Report Sunday (Nov 16 week 12) | 18% |
| Final Exam (Comprehensive) (as posted by registrar) | 30% |

IMPORTANT NOTE on GRADES: The A+ grade is granted to students who score 95% or above. There is no quota on the number of students who can get an A+ grade. The passing score for the course is 50%. DN grade is awarded to those with excessive total absences

Attendance: Students are expected to attend all class meetings.

- If a student misses a class, he/she is still responsible for any announcement made in that class.
- **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 late (**2 lates = 1 Absence**) and
- **More than 10 minutes late = Absence** (regardless of any excuse).
- Attendance on time is **very important**.
- **According to University rules**, after warned **twice** by the instructor, a DN grade will be awarded to any student who **excessively** accumulates
 - 12 unexcused absences in lectures+labs. (20%)
 - 20 excused and unexcused absences in lectures and labs. (33.3%)
- Only official excuse from KFUPM student affairs office will be accepted. All other excuses (medical centers, governmental offices, etc) are not.

The Usage of Mobiles in Class: Students are **not allowed** to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes **must take permission** from their instructor. Violations of these rules will result in a **penalty** decided by the instructor.

Important Notes:

- ✓ A class quiz is often given at the end of the following week a chapter is completely covered.
- ✓ A formula sheet (check OneNote) and statistical tables will be provided for you in every exam.

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

General Notes:

- Students are required to carry **pens, note-taking equipment** and a **calculator** to **EVERY lecture and exams**. It is strongly recommended to keep a **binder** for class-notes.
- 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**.
- 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**.

Schedule

| Week | Dates | Sections | Topic | Notes |
|---|----------------------------|------------------------------|--|--|
| 1 | Aug 24 - 28 | Ch 3 | Basic Distributional Quantities (Generating functions & sums of RV, Tails of distributions, Risk Measures) | |
| 2 | Aug 31- Sep. 4 | Ch 4 | Characteristics of Actuarial Models | |
| 3 | Sep. 7 - 11 | Ch 5 | Continuous Models | Declare your Term paper topic: Sun Sep 7 |
| 4 | Sep. 14 - 18 | Ch 6 | Discrete Distributions | |
| 5 | Sep. 21 - 25 | Ch 8 | Frequency & Severity with Coverage modifications | (2 wks): Midterm grade reports starts |
| 6 | Sep. 28 - Oct. 2 | Ch 9 | Aggregate Loss Models | |
| Wednesday (Oct 8 week 7 6pm). – Midterm Exam (chapters 3, 4, 5,& 6) | | | | |
| 7 | Oct. 5 - 9 | Ch 9 | Aggregate Loss Models (cont.) | Saudi Founding Day (Feb 23) |
| 8 | Oct. 12 - 16 | Ch 10 & 14 | Review of Mathematical Stats (new material only) Frequentist Estimation of Discrete Data | |
| 9 | Oct. 19 – 23 | Ch 17 | Introduction and Limited Fluctuation Credibility | |
| Oct. 26-30 Midterm Break | | | | |
| 10 | Nov. 2 - 6 | Ch 15 | Bayesian Estimation (Review) | |
| 11 | Nov. 9 - 13 | Ch 18 | Greatest Accuracy | |
| Sunday Nov 16 (week 12)– Term Paper due to instructor | | | | |
| 12 | Nov. 16 - 20 | Ch 19 | Empirical Bayes Credibility | |
| 13 | Nov. 23 - 27 | Ch 20 | Simulation (Note: Not in ASTAM but in practice) | |
| 14 | Nov. 30 - Dec.4 | ASTAM review if time permits | Practice format from SOA ASTAM exam | |
| 15 | Dec. 7 - 11 | Review | Review | |
| 16 | Dec 14 | Normal Tuesday Class | | |
| | "Comprehensive" Final Exam | | | |

Student Learning Outcomes: (From the Society of Actuaries Exam ASTAM)

As a summary, the number of SOA ASTAM learning outcomes are distributed across the following KFUPM courses:

- (1) STAT302 (2) AS 484 (majority)

For 2025 ASTAM learning outcomes with SOA weights discussed in this course, check

<https://www.soa.org/4ae926/globalassets/assets/files/edu/2025/spring/syllabi/2025-spring-exam-astam-syllabus.pdf>

| AS484 HOMEWORK | CHAPTER | QUESTIONS |
|----------------|---------|---|
| Homework 1 | 3 | 3.11, 3.20, 3.21, 3.29, 3.35 |
| | 4 | 4.4, 4.7, 4.12 |
| Homework 2 | 5 | 5.3, 5.17, 5.19, 5.22, 5.26 |
| | 6 | 6.1, 6.3, 6.5 |
| Homework 3 | 8 | 8.1, 8.6, 8.13, 8.14, 8.17, 8.26, 8.30 |
| Homework 4 | 9 | 9.1, 9.3, 9.6, 9.39, 9.48, 9.55, 9.63, 9.74 |
| Homework 5 | 10 | 10.8, 10.11, 10.13 |
| Homework 6 | 17 | 17.1, 17.8 |
| | 15 | 15.4, 15.23 |
| Homework 7 | 18 | 18.11, 18.15, 18.16 |
| | 19 | 19.2, 19.6, 19.10 |