King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
AS491: Topics in AS & Fin. Math. II - Term 252 (3-0-3) 2PM UTR

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Office Hours: UTR (11.00 - 11.50am) or by appointment via email or Teams.

Course Objectives: supervised versus unsupervised learning, regression versus classification, assessing model accuracy, bias-variance tradeoff, resampling methods for model validation including Training set vs. test set approach, *k*-fold cross-validation, and Leave-one-out cross-validation, K-nearest neighbors**,** LASSO, Ridge regression**,** regression-based time series models, Decision Trees

Prerequisites: Junior Standing
Textbook and Package:
1. *An Introduction to Statistical Learning, with Applications in R Second Edition*, James, Witten, Hastie, Tibshirani, New York: Springer. https://www.statlearning.com
2. *Regression Modeling with Actuarial and Financial Applications*, Edward W. Frees, 2010, New York: Cambridge. ISBN: 978-0521135962.
3. Texas BAII Plus Calculator or Texas BAII Professional
Reference:
1. Tables for Exam SRM
2. Sample Questions and Solutions
3. Society of Actuaries regulations and sample exams for Statistics for Risk Modeling Exam
4. R Studio software

Assessment

Activity	Weight
Attendance, Quiz*, Classwork, and homework	**25** (5+10+5+5)%
Major 1 Exam **(WK 5) – CH. 2-3**	15%
Major 2 Exam **(WK 10)**	20%
Term Project, Presentation **(WK 15)**	10%
Final Exam (Comprehensive) **(as posted on registrar website)**	30%

 * There will be 2 announced quizzes and a pop quiz. Your best 2 will be selected.

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.

Academic Integrity: All KFUPM policies regarding **ethics** and **academic honesty** apply to this course.
Exams:
Cheating in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of
F in the course along with reporting the incident to the higher university administration. Cheating in exams includes (but not restricted to)
  ➤ Looking at the papers of other students,
  ➤ Talking to other students,
  ➤ Using mobiles or any other electronic devices.

Exam Issues:
  ➤ No student will be allowed to take the exam if not having his/her KFUPM ID or National/Iqama ID.
  ➤ Students are not allowed to carry mobiles, smart watches, or electronic devices to the exam halls/rooms.
  ➤ Students must take the exam in the place assigned to them.

Missing an Exam:
In case a student misses any exam for a legitimate reason (such as medical emergencies), he must bring an official excuse from Students Affairs with the "Exam Included" box checked. Otherwise, he will get zero in the missed exam.
Attendance: Students must adhere to the attendance policy of KFUPM. Students are expected to attend all lecture and recitation classes.
  ➤ If a student misses a class, he is responsible for any announcement made in that class.
  ➤ Out of the 5 marks for attendance: Absence #1-5: Free; Absence #6: 1-mark deduction; Absence #7-8: 2-mark deduction.
  ➤ Official warning will be sent on the 6th and 7th Absence. You will be referred to Irshad for counselling on the 8th Absence.
  ➤ A DN grade will be awarded to any student who accumulates:
    o 9 unexcused absences in lecture and labs. (20%)
    o 15 excused and unexcused absences in lecture and recitation classes. (33%).
    Note:

- ▪ ***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).
- ▪ Student must be available until the end of the class. Leaving the class for any reason for more than 10 minutes will results in Late.
- ▪ Only University Blue paper Official excuses will be accepted as valid excuse.

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.
- 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
  - o 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**.

Home Work:

- To successfully prepare for the SOA exams, students MUST <mark>solve problems</mark> 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 <mark>with comprehension</mark>.
- ➢ 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.
- ➢ 🤖 <mark>AI is a great study buddy—use it to explain tricky concepts, check your work, or explore different problem-solving approaches.</mark> 🚫 But don't let it do your work for you. Submissions that are copied and pasted from AI will receive no marks. 💡 Your learning matters most—rewrite, rethink, and revise to make sure the final answer is truly yours.
- ➢ Homework is due in Teams for the class on the first Sunday after completing a chapter.
- ➢ No late homework will be accepted, and 20% decrease for late submission
- ➢ Actuaries don't act like the guy in the cartoon below.

They <mark>manage risk</mark> .   They don't let risk manage them

- ***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***.
- Students should wait until completion of course AS482 before they attempt to take the professional exam LTAM.

Learning Outcomes*:* From the Statistics for Risk Modeling (January 2026) will be observed. By completing this course, students should be able to understand key concepts

- ➢ of statistical learning
- ➢ concerning generalized linear models
- ➢ concerning regression-based time series models
- ➢ concerning decision tree models.
- ➢ concerning principal component and cluster analysis
- ➢ Solve SOA type SRM problems

Tentative Lecture Schedule

Week	Sections	Topics	Notes
1	Ch 2.1	What Is Statistical Learning?	
2	Ch 2.2 – 2.3	Assessing Model Accuracy Lab: Introduction to R	
3	Ch 3.1 - 3.2	Simple Linear Regression Multiple Linear Regression	
4	Ch 3.3 - 3.5	Other Considerations in the Regression Model The Marketing Plan Comparison of Linear Regression with K Nearest Neighbors	
5	Ch 3.6	Lab: Linear Regression	
6	Ch 5.1	Resampling Methods: Cross-Validation	
7	Ch 5.2 - 5.3	The Bootstrap Lab: Cross-Validation and the Bootstrap	(2 wks): Midterm grade reports starts
8	Ch 6.1 – 6.3	Linear Model Selection and Regularization: Subset Selection Shrinkage Methods Dimension Reduction Methods	
9	Ch 6.4 – 6.5	Considerations in High Dimensions Lab: Linear Models and Regularization Methods	

10	Ch 8.1 – 8.2	Tree-Based Methods: The Basics of Decision Trees Bagging, Random Forests, Boosting, and Bayesian Additive Regression Trees	
11	Ch 8.3	Lab: Decision Trees	
12	Ch 12.1 – 12.2	Unsupervised Learning: The Challenge of Unsupervised Learning Principal Components Analysis	.
13	Ch 12.4 – 12.5	Clustering Methods Lab: Unsupervised Learning	
14		Presentation	
15		Review	
16		Review	Normal Monday Class
Final Exam (Comprehensive): TBA			