

King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
AS481: Actuarial Contingencies 2 - Term 252 (3-2-4) 12PM UTR

Course Objectives: A continuation of Life Contingencies I. Development is based on a stochastic approach to insurance models. Major topics include benefit premiums and reserves, and multi-life and multiple-decrement models. Parallel treatment of topics based on Takaful system. Application of such area in life insurance and property.

Prerequisites: AS 380

Textbook and Package:

1. Camilli, S.J., Duncan, I., & London, R.L. (2014) *Models for Quantifying Risk, 6th edition*. ACTEX Publication: Winsted, USA.
2. Texas BAII Plus Calculator or Texas BAII Professional

Reference:

1. Dickson, D.C., Hardy, M. R., & Waters, H. R. (2020) *Actuarial Mathematics for Life Contingent Risks*, 3rd edition. Cambridge University Press: Cambridge, UK.
2. Bowers N., Gerber, H., Hickman, J., Jones, D. & Nesbitt, C. (1997 or later printing) *Actuarial Mathematics*, 2nd edition. Society of Actuaries Publishing.
3. Society of Actuaries regulations for FAM-L (Fundamental of Actuarial Models - Long Term) and ALTAM (Advanced Long Term Actuarial Models) and sample exams for FAM and ALTAM
4. Institute and Faculty of Actuaries (IFoA) CM1 professional exam

Assessment

Assessment for this course will be based on the following:

Activity	Weight
Attendance*, Quiz*, Classwork, and homework*	25 (5+10+5+5)%
Labwork and Lab Exam (WK 15 Lab time)	10 (5+5)%
Major 1 Exam Ch 3-12 (WK 5, Lab time)	17%
Major 2 Exam Ch 12-16 (WK 10, Lab time)	18%
Presentation (WK 14 Lab time)	5%
Final Exam (Comprehensive) (as posted on registrar website)	25%

* for both coursework and labwork. 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 93% 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:

Exam Questions: >80% of the exams are based on the examples, homework problems, and exercises in the textbook.

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 #1-6: Free; Absence #7-11: 1-mark deduction.
- Official warning will be sent on the 8th and 10th Absence. You will be referred to Irshad for counselling on the 11th Absence.
- A DN grade will be awarded to any student who accumulates:
 - 12 unexcused absences in lecture and labs. (20%)
 - 20 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 result in Late.
- Only University Blue paper Official excuses will be accepted as valid excuse.

Absences are counted as follows:

- Missing a lab is counted as 2 absences.
- Missing a lecture is counted as 1 absence.

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
 - 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 **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.
-  AI is a great study buddy—use it to explain tricky concepts, check your work, or explore different problem-solving approaches.  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.
- A penalty of 20% of the total marks will be applied for each day the submission is late
- Actuaries don't act like the guy in the cartoon below.



They **manage risk**.

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 AS481 before they attempt to take the professional exam LTAM.

Learning Outcomes: From the Society of Actuaries Exam LTAM (Long-Term Actuarial Mathematics – Spring 2022) will be observed. By completing this course, students should be able to

- Demonstrate a thorough understanding of multi-decrement models
- Apply multi-life models to real situations
- Distinguish Actuarial Models with fixed interest rates from those with variable returns
- Calculate Premiums for Pension Funding of Pension payouts
- Compare effects of various assumptions for profit testing
- Explain main features of plans under Universal life insurance and participating Insurance
- Solve SOA type LTAM problems

Tentative Lecture Schedule

Week	Sections	Topics	Notes
1 (Jan 1 - 15)	Ch 3 & 5.5	Review of Markov Chains (4-1/2 class).	
2 (Jan 18 - 22)	Ch 3 & 5.5 Ch 13	Review of Markov Chains (cont.) Multiple-Decrement Models. Discrete Multi-Decrement Models. Theory of Competing Risks. Continuous Multi-Decrement Models. Uniform Distribution of Decrement.	
3	Ch 13 Ch 14 & 6-5	Multiple-Decrement Models. (cont.) Miscellaneous Examples. Multiple-Decrement Models (Applications). Actuarial Present Value. Non-forfeiture Options. Multi-State Model representations, with Illustrations (14.4 & 6.5). (Excluding Asset Shares)	
4	Ch 14 & 6-5 Ch 12	Multiple-Decrement Models (Applications -cont.) Defined Benefit Pension Plans. Models dependent on Multiple Survivals (Multi-life Models). Joint-Life Model. The Last Survivor model. Contingent Probability functions.	
5	Ch 12 Appendix A.6	Multi-life Models (cont.) Contingent Contracts Involving Multi-Life Statuses. General Random Variable Analysis. Common Shock – A model for lifetime dependency. Multi-State Model Representation (5.5 & 12.5),	
6	Ch 15	Models with Variable Interest Rates Actuarial PV using Variable Interest. Deterministic Interest Rate Scenarios. Spot Interest Rates & Term Structure of Interest Rates.	
7	Ch 15	Models with Variable Interest Rates (cont.). Forward Interest Rates. An Example with Simulated Rates of Return. Transferring the Interest Rate Risk.	(2 wks): Midterm grade reports starts
8	Ch 16	Universal Life Insurance Basic Aspects. Indexed Universal Life Insurance.	
9	Ch 16	Universal Life Insurance (cont.) Pricing Considerations (including Pricing for Secondary Guarantees).	
10	Ch 16 Ch 14.5	Universal Life Insurance (cont.) Pension Mathematics	
11	Ch 14.5	Pension Mathematics (cont.)	
12	LTAM supplement	Pension Mathematics (cont.)	.
13	Ch 17	Profit Testing.	
14	Ch 17	Profit Testing (cont.)	
15	Ch 17 Review	Profit Testing (cont.) Review	
16		Review	Normal Monday Class
Final Exam (Comprehensive): TBA			