MATH 3637 – Actuarial Statistical Modeling II ~ *Fall 2025*

Three credits *9:30 to 10:45 PM ~ Tuesdays and Thursdays ~ MONT 319*

Instructor

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Please utilize our **Teams** channel for questions. *A link to the Teams channel is located on HuskyCT.* Either myself and/or other students can answer, which will allow everyone to see and share questions, answers, and ideas across the semester.

If you would like to meet separately…
My office hours *(MONT 206)***:**

- In-person: Tuesdays and Thursdays from 2:30 – 5:15
- Nexus link provided in HuskyCT to sign up for a time
- Please let me know if these times don't work for you

In the event of a snow day or virtual lecture: We will meet via our Teams channel.

Course Objectives

Introduce generalized linear models, principal component analysis, decision tree models, and cluster analysis. The underlying theories are covered and case studies are used to demonstrate the applications.

Upon completion of this course, students will be able to:

- Describe the general structure of a GLM
- Estimate and interpret a GLM for binary and count responses
- Estimate and interpret a GLM for continuous responses that are not normally distributed
- Define a decision tree and identify the steps to estimating a decision tree for regression and classification problems
- Define and estimate bagging models, random forest models, and boosting models
- Recall basic concepts, methods, and applications of cluster analysis
- Learn multiple distance or similarity measures for cluster analysis
- Learn hierarchical clustering algorithms and the k-means algorithm
- Understand, interpret, and apply principal component analysis
- Write technical reports and **communicate results**

We will successfully accomplish these objectives only if we work together. My role will be to provide a forum for the review and discussion of these topics and ultimately to test your understanding of the materials. In turn, you will be expected to prepare for each class, reading the assigned chapters from the text and any supplemental materials, and to participate actively in the classroom discussions. **An actuary is so much more than a number-cruncher!**

Required Materials

- *Actuarial Statistics with R: Theory and Case Studies* by Guojun Gan and Emiliano Valdez, ACTEX, 2018. (text is given free via HuskyCT)

- Reference Materials:
    - An Introduction to Statistical Learning, with Applications in R by James, Witten and Hastie, Tibshirani, 2013, New York: Springer. Preprint freely available at http://www-bcf.usc.edu/~Egareth/ISL/
    - Regression Modeling with Actuarial and Financial Applications by Edward W. Frees, Cambridge University Press, 2009. Book website: http://research.bus.wisc.edu/RegActuaries

Computers, Programs and Calculators

R, which is an open source software for statistical computing and graphics, will be used for this course. You can download and install R from http://www.r-project.org/. You may also want to download and install RStudio from https://rstudio.com/products/rstudio/. The free version of RStudio Desktop is sufficient for this course.

Students will be expected to have a working familiarity with the Microsoft Office suite of products. Instruction on these programs is outside the scope of this class.

You may use R and Excel for all assignments and exams. I am trusting you, particularly with exams. If you cheat, I will be sad. Your ethics will be compromised, and you will not have gained the proper level of understanding to be a stellar actuary in the future. i.e. cheating is beneath you.

I ask that you refrain from the use of email, instant messaging, or any other distracting behavior during class. This class goes fast. You need to pay attention!

Group Project

The group project is a very exciting and important portion of this course. In this project, your group will analyze a dataset using the techniques covered in this course (e.g., GLM, decision trees, PCA, cluster analysis). You will be assigned teams of four or five. If you have any questions or need guidance, please feel free to contact me.
There are two parts of this project: the final report and the project presentation. For full instructions and further information, please review the "Group Project" folder in HuskyCT.

Grading for the Course

Your grade for this class will be based on the following weightings:

15%	Homework Assignments* *(6 assignments)*
30%	Exam 1**
30%	Exam 2**
25%	Group Project *(24% project / 1% eval)*
30%	Comprehensive Final Exam**

A	=	93.3 – 100
A-	=	90.0 – 93.2
B+	=	86.7 – 89.9
B	=	83.3 – 86.6
B-	=	80.0 – 83.2
C+	=	76.7 – 79.9
C	=	73.3 – 76.6
C-	=	70.0 – 73.2
D+	=	66.7 – 69.9
D	=	63.3 – 66.6
D-	=	60.0 – 63.2
F	=	< 60

I will not round grades all semester long and then your final grade will be rounded to the tenth and your letter grade will be given according to the table above.

** Please note that the Homework Assignments are for the purpose of helping you study, solidifying concepts from class. As such, I will not be fully grading them. Rather, I will be giving you a grade based off how much of the assignment you complete. The act of just completing the assignment and not taking it seriously will only hurt yourself. Upon release of the answers, you can self-grade and we will discuss any follow-up questions. Assignments should be turned in by the due date and time specified. Assignments may be accepted late, but only until the morning of the following class (1:00am), and will be marked down by 25%.*

*** Please note that I will drop the lowest of your exam grades for the overall course total. For example, if you did well on Exam 1, bombed Exam 2, and did medium on the Final, I will use Exam 2 and the Final for the total calculation. Another example, if you did fantastic on both Exams 1 & 2, there may be no need for you to sit for the final (i.e. take a zero, knowing it will be dropped in the total calc).*

Appeal Process

If you feel that an answer you provided deserved more points than it was awarded, simply send an e-mail within two class days of when the grades were released. Your appeal must include the following:

1. Note which item(s) you are concerned with and what you answered.
2. Justify why your answer warrants more points, using reference materials from the class, information from other classes or other reliable sources.
3. Tell me how many points you think your answer deserves; what you think is fair.

Note: This process is similar to the process used for appeals on CAS examinations. Successful appeals typically have the following characteristics:

- Cite references in the Syllabus for an alternative answer
- Explain fully an alternative answer including alternative solution for a numerical question
- Point out an error in the answer key for the short-answer questions and the reasoning for an alternative correct answer.

I will consider each appeal that is sent and let you know what I think is fair. We can talk in person if you are not satisfied with the outcome.

Code of Conduct

All of you aspire to become actuaries. As actuaries - and even as candidates - you agree to live by a Code of Professional Conduct. This code governs your work as actuaries, but also outlines your responsibilities to the profession and to the public.

Precept 1 of the Code is entitled Professional Integrity. It states: "An actuary shall act honestly, with integrity and competence, and in a manner to fulfill the profession's responsibility to the public and to uphold the reputation of the actuarial profession."

Precept 13 of the Code is entitled Violations of the Code of Professional Conduct. It states: "An Actuary with knowledge of an apparent, unresolved, material violation of the Code by another Actuary should consider discussing the situation with the other Actuary and attempt to resolve the apparent violation. If such discussion is not attempted or is unsuccessful, the Actuary shall disclose such violation to the appropriate counseling and discipline body of the profession….".

The Code of Professional Conduct encompasses my expectations for how you will behave in this class. I will expect that each of you act honestly - and with integrity – in all facets of this class (including but not limited to exams and quizzes). As Precept 13 relates to this class, any student who suspects or observes cheating by another student (an apparent violation of the Code) is expected to disclose such apparent violation.

Use of AI

AI programs are not a replacement for your human creativity, originality, and critical thinking. Writing, thinking, and researching are crafts that you must develop over time to become a successful actuary. At the same time, you should learn how to use AI and in what instances AI can be helpful to you. If you use it, cite it in your work (e.g. "ChatGPT, personal communication, MM/DD/YYYY"), to stay within university policies on academic honesty. You are responsible to make sure that any content is accurate and says what you want it to say. No more than 25% of student work in this course should be generated by AI.

Please remember:

- Don't accept anything AI generates at face value without checking it critically. AI may provide completely erroneous responses, called AI hallucination. As such, every response should be carefully vetted for accuracy and validity.
- Practice and improve your AI prompting skills. As you first get started, don't rely on your initial prompts without deep validation. It will take a while to learn the art of prompting and may take several refining prompts to get the proper results.
- As with anything online, be safe and smart when using AI, being extra careful of the information you feed it.

The use of generative AI tools (e.g., ChatGPT, Google Bard, Microsoft Copilot, etc.) is permitted in this course for the following activities:

- Brainstorming and refining your ideas.
- Helping write starter code to be adjusted and validated.
- Studying further on particular topics, after referencing class notes, slides, and the text.
- Finding information on a particular topic.
- Drafting an outline to organize your thoughts.
- Checking grammar and style.

The use of generative AI tools is NOT permitted in this course for the following activities:

- Impersonating you in classroom contexts, such as by using the tool to compose responses to assignments, exams, and/or the group project.
- Writing sentences, paragraphs, etc. to complete assignments greater than 25% of the total content.

You are responsible for the information you submit based on an AI query (i.e. that it does not violate intellectual property laws, or contains misinformation or unethical content).

If any part of this is confusing or uncertain, please reach out to me for a conversation before submitting your work.