Math 3636
Actuarial Statistical Modeling I

Course Instructor

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Office hours: Monday 9:00am - 10:00am, Wednesday 9am-10am, or by appointment

Course Description

Introduction to linear regression models, generalized linear models, and time series models. Case studies are used to demonstrate applications. The underlying theories are covered and case studies are used to demonstrate the applications.

Learning Outcomes

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

- build single and multiple linear regression models to analyze data
- use the method of least square to estimate parameters
- conduct hypothesis testing and estimate confidence intervals in linear regression models
- test and select models
- build linear time series models to analyze data
- estimate and forecast with time series models
- calculate forecast errors and confidence intervals
- write technical reports and communicate results

Prerequisites

- Math3160 (Probability)
- Stat3375 (Introduction to Mathematical Statistics)
- Not open to students who have passed MATH 5637

Textbooks

No textbooks are required for this course. Here are some useful references.

- *Actuarial Statistics with R: Theory and Case Studies* by Guojun Gan and Emiliano Valdez, ACTEX, 2018.
- *Regression Modeling with Actuarial and Financial Applications* by Edward W. Frees, Cambridge University Press, 2009. Book website: `http://research.bus.wisc.edu/RegActuaries`
- *An Introduction to Statistical Learning, with Applications in R* by James, Witten and Hastie, Tibshirani, 2013, New York: Springer. Preprint freely available at `https://www.statlearning.com`
- Data Visualization: A Practical Introduction, Healy, 2018, Princeton University Press. Book website: `https://socviz.co`

Software

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/`.

Homework

You will get approximately biweekly homework, which will be posted to HuskyCT on an ongoing basis.

Exams

This course has two midterm exams and a final exam. For midterm exams, you can prepare a piece of paper (letter size) with notes on both sides and bring the notes to exams. For the final exam, you can have a 4-page cheatshet.

Presentation

At the end of the semester, you will give a 5–7 minute presentation demonstrating how you can apply the concepts and techniques covered in this course to a real-world dataset. You should select a dataset that interests you and use appropriate statistical methods from the course to analyze it. Your presentation should clearly explain the dataset, the methods you used, your main findings, and what you learned from the analysis.
You may find suitable datasets from websites such as:

- `https://archive.ics.uci.edu`
- `https://www.kaggle.com`

Your presentation should include the following components:

- **Dataset:** Describe the dataset, including its source, variables, sample size, and the research question or problem you are investigating.

- **Methods:** Explain the statistical concepts and methods from this course that you used to analyze the data. You should explain why the methods are appropriate for your problem.
- **Results:** Present and interpret your main findings using appropriate tables, graphs, or other visualizations.
- **Conclusion:** Summarize your key findings and discuss what they mean in the context of the problem.

The goal of this assignment is not simply to demonstrate that you can run statistical procedures. You should demonstrate that you understand when and how to apply the concepts covered in this course to a real-world problem.
Your presentation will be graded using the following rubric:

Component	**Weight**	**Criteria**
Attendance	10%	Attend the presentation sessions and actively participate.
Timing	15%	Finish the presentation within the required 5–7 minute time limit.
Dataset and Problem	15%	Clearly describe the dataset and the problem or question being investigated.
Application of Methods	25%	Appropriately apply and explain concepts and methods covered in the course.
Results and Interpretation	25%	Clearly present and correctly interpret the main results.
Organization and Communication	10%	Present the material clearly, logically, and effectively.

Important: The presentation must be between 5 and 7 minutes. You should practice your presentation in advance to ensure that you can communicate your main ideas clearly within the allotted time.

Course Assessment

Homework	20%
Midterm exam 1	15%
Midterm exam 2	15%
Presentation	20%
Final Exam	30%

For each component and subcomponent of the rubrics, I will use the following 5-point scale:

Proficiency Level	**Points**
Correct answer with clear and complete explanation	4
Correct answer with incomplete explanation or missing steps	3
Correct answer without showing work or providing an explanation	2
Incorrect answer or explanation	1
No answer or blank	0

Your final grade is determined as follows:

Grade	A	A-	B+	B	B-	C+
Points	[93, 100)	[90, 93)	[87, 90)	[83, 87)	[80, 83)	[77, 80)
Grade	C	C-	D+	D	D-	F
Points	[73, 77)	[70, 73)	[67, 70)	[63, 67)	[60, 63)	[0, 60)

Tentative Schedule

Week	**Date**	**Lecture**	**Due**
1	31-Aug-26	R Review	
1	2-Sep-26	Simple Linear Regression	
2	7-Sep-26	No class	
2	9-Sep-26	Simple Linear Regression	
3	14-Sep-26	Simple Linear Regression	HW 1
3	16-Sep-26	Multiple Linear Regression	
4	21-Sep-26	Multiple Linear Regression	
4	23-Sep-26	Multiple Linear Regression	
5	28-Sep-26	Exam 1 Review	HW 2
5	30-Sep-26	Exam 1	
6	5-Oct-26	GLM framework	
6	7-Oct-26	GLM framework	
7	12-Oct-26	GLM framework	
7	14-Oct-26	Binary Regression	
8	19-Oct-26	Binary Regression	
8	21-Oct-26	Binary Regression	
9	26-Oct-26	Count Regression	HW 3
9	28-Oct-26	Count Regression	
10	2-Nov-26	Severity modeling	
10	4-Nov-26	Severity modeling	
11	9-Nov-26	Exam 2 Review	
11	11-Nov-26	Exam 2	
12	16-Nov-26	Time Series	HW 4
12	18-Nov-26	Time Series	
13	23-Nov-26	Thanksgiving break	
13	25-Nov-26	Thanksgiving break	
14	30-Nov-26	Time Series	
14	2-Dec-26	Presentation	

15	7-Dec-26	Presentation	
15	9-Dec-26	Review	HW 5
16	TBD	Final Exam	

Due Dates

All course due dates are identified in the syllabus. However, I reserve the right to change due dates accordingly as the semester progresses. All changes will be communicated in an appropriate manner.

Late Policy

I expect students to submit homework assignments by the due dates. However, late submissions will be accepted for up to one week after the due date and will be marked down 25%.

Missed Assessment Policy

I expect students to be present for all course assessments. If a midterm assessment is missed, the grade of the missed assessment will be made up by one of the following options:

- Scaling the grades of the remaining assessments to cover the missed assessment.
- A make-up assessment that is different from the original assessment.

For the final exam, the university rules [1] will be followed.

AI Policy

The problems in this course can be solved without the use of AI tools; however, their responsible use is permitted. In fact, students are encouraged to use AI tools as a supplement to support their learning and to gain a deeper understanding of the concepts covered in this course.

AI tools can provide valuable support in this course, such as summarizing, paraphrasing, refining language, and generating initial ideas for the final project. However, they also come with certain risks: (1) they may lack objectivity, (2) they can produce inaccurate or false content, (3) they may misinterpret context, and (4) their usefulness is limited by the scope of their training data. Therefore, students should exercise caution when using AI tools to create models, select models, or interpret results.

In this course, students are required to:

1. Clearly disclose any use of AI tools (e.g., ChatGPT, Co-Pilot) in their assignments.
2. Verify the accuracy and appropriateness of all AI-generated outputs.
3. Provide proper citations and references where applicable.
4. Remain mindful of plagiarism and uphold academic integrity.

[1] `https://registrar.uconn.edu/undergraduate-final-exam-information/`

When AI tools are used, students must include a section titled "Report on Use of AI Tools" at the end of their submission. Students can follow the following format to report the use of AI tools:

AI tool name:
Version:
Date:
Prompt:
Output: