Math 489A Spring 2021
Actuarial Senior Seminar: Predictive Analytics and Actuarial Modeling

Instructor: Dr. Kathy Temple
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Office Hours: MW 2 - 2:50 PM, TTh 10:00 - 10:50 AM, and by appointment.

Meeting Times: Please plan on being on Zoom from 3 - 3:50PM M and W. We will not, in general, meet synchronously on Fridays; however, we may want to use that time for presentations in the last week of class, and you may want to use it for group meeting times. Note that, since this course has a mix of synchronous and asynchronous content, you should use the guideline that you should expect to spend a total of 3 credits*3 hours per week/credit = 9 hours/week on this course (2 hours of synchronous meeting times and 7 hours of work outside of those times).

Course Description: The actuarial modeling process, including problem definition, model selection and validation, and communication of results and uncertainties. Includes a capstone senior project.

Pre-requisites: MATH 410B and (MATH 417B or MATH 419B) with grades of C or higher.

Texts: Readings will be distributed as assigned. You'll also want to have your texts from MATH 410 around for reference! If you want to investigate the texts required for Exam PA, those are *R for Everyone*, 2nd Ed. Lander; and *Data Visualization: A Practical Introduction* Healy, 2018.

Required Materials: You will need access to a computer with the statistical package R, the interface R Studio (note that both of these are free, open-source programs) and the standard Office suite to complete out-of-class assignments.

Requirements Satisfied: This course satisfies a requirement for the Actuarial Science Major. It also is a Culminating Experience course in the general education program. *Important note: If you are in the General Education program for academic year 2019-2020 or earlier, you may need to petition to have this course count as your culminating experience course. Please talk to me if you have any questions!*

Why is this course a culminating experience? In this course, we're going to be asking you to "put it all together" - not only your actuarial science major but also all of your undergraduate education. This course is about how actuaries approach problem-solving and modeling. The best way for you to learn that is for you to do some problem-solving and modeling yourself! Actuarial models are by their very nature interdisciplinary - and one of the key recognition in building a model is what outside factors (actuaries call them external forces) may affect our model and our ability to draw conclusions from it. You'll be building a model, proposing a course of action based on your model, and communicating your results (along with the limitations of your analysis) to others - all goals for the culminating experience requirement of the general education program.

Student Learning Outcomes:

Course Student Outcome	Assessment	Gen Ed Outcome
Assess the strengths and weakness of data and conduct basic data validation.	Graded assignments and capstone project proposal.	CE-2 and CE-3
Formulate an actuarial problem in terms that are amenable to a solution.	Graded assignments and capstone project proposal. The project proposal will require students to formulate an actuarial problem and select initial models and methods.	CE-1, CE-2, and CE-4
Select an appropriate model that addresses an actuarial problem.	Graded assignments; capstone project will be graded in part on selection of an appropriate model.	CE-2, CE-3, CE-4
Evaluate a model and assess whether the model is valid for its intended purpose.	Graded assignments; capstone project report.	CE-2 and CE-4
Assess outside factors that may affect a model and the relationship between variables, including social, economic, and technological factors.	Graded assignments; capstone project report will require students to discuss and evaluate outside factors.	CE-2 and CE-3
Communicate the results of an actuarial analysis clearly, including any limitations and uncertainties.	Capstone project report will be assessed in part on the clarity and effectiveness of the writing and communication.	CE-1 and CE-4

Topics to be covered: This course will cover the actuarial modeling process and the actuarial way of approaching problems. It covers some of the topics on the SOA Exam PA. In particular, we will discuss:

- An introduction to predictive modeling and a quick review of R.

- Identifying the actuarial problem to be solved and translating a vague question into something that can be analyzed.

- Using data visualization to solve actuarial problems.

- Appropriately making use of given data and how to handle missing data.

- Evaluating data quality, including potential ethical issues.

- Choosing an appropriate model for a given problem.

- Communicating the results of a model and analysis, including following standards of practice for actuarial communication.

Evaluation and Grading:

- Homework and in-class exercises (40%)

- Capstone project proposal (15%)

- Capstone project report (30%)

- Capstone project presentation (15%)

Grades will be assigned according to the following scale:

		A	93-100%	A- 90-92.99%
B+	87-89.99%	B	83-86.99%	B- 80-82.99%
C+	77-79.99%	C	73-76.99%	C- 70-72.99%
D+	67-69.99%	D	63-66.99%	D- 60-62.99%
		F	59.99%	and below

Homework and In-Class Exercises: Homework will be assigned most class meetings (and sometimes between class meetings!). It may have a variety of forms: You may be asked to read and respond to a reading (either in-class or on a discussion board); do 'traditional' homework problems; analyze a data set; or draft a memo or e-mail, for example. Due dates will be announced at the time of the assignment. In-class exercises may take any of the forms above, or may consist of small-group discussion and responding to a prompt, for example. Late homework will not be accepted, but see below about "drop" assignments.

Any written work for the course should be submitted using the guidelines below. Your work should be clear, in a logical order, use correct mathematical notation, and provide sufficient explanation. What's sufficient explanation? A good guide is to think about whether another student in the class who didn't know how to do this particular problem could understand your solution. This will also help you understand your solution later! Collaboration on homework is permitted, but **copying is not permitted.** A good rule of thumb is that you should write up a problem or assignment on your own, even if you worked with others to figure it out.

Because life happens, a number of homework or in-class exercises equal to 10% of the number of total assignments (but no fewer than two assignments) will be dropped.

Capstone Project Components: The capstone project will consist of a proposal, a report (the bulk of the project itself) and a presentation, where the presentation will be given during the last week of classes. The project proposal will be due on Friday of the fourth week of the quarter (Friday, April 23). The final report will be due by 5PM on Thursday, June 10. Note that since the Monday of the last week of classes is a holiday, we may need to meet for an extended time on Wednesday or meet on Friday (or both) in order to do all of the presentations.

The capstone project should investigate an overarching question that can benefit from applying life contingency models, predictive analytics, or actuarial mathematics. You wil be working on the capstone project in groups of 2-3. If you have a strong reason for needing to do an individual project, you will need to talk to me first.

Participation and Recordings: This is intentionally a seminar course - this means that your attentive presence and active participation is important. Participation includes being prepared for class, actively participating in discussions, and responding thoughtfully to the contributions of others. Not actively participating in discussions may result in a lower grade on the in-class exercises portion of the course.

Lecture/discussion will be recorded and posted on Canvas for those who can't attend synchronously on a given day. Please plan on attending synchronously on an ongoing basis, however. We all benefit from the conversations in-class, and they will be richer for having you there! Also, please note that work done in breakout rooms will *not* be recorded.

Please turn on your camera if that is reasonable given your situation, bandwidth issues, etc. If you cannot turn on your camera, please use a profile picture on Zoom that matches your profile picture on Canvas (and please put one up on Canvas) so that we don't have to look at a sea of names/initials!

Face Coverings and Social Distancing: Due to COVID-19, and under the directive and mandate of public health officials and the president of Central Washington University, students must adopt face covering protocol before entering any classroom or building at CWU until further

notice. Students must also follow the social distancing placement marks in buildings and classrooms. If you do not have a face covering Central Washington University can provide one for you. If you have not yet received your CWU-supplied facial covering, please go the SURC Information Desk. Please do so prior to the start of your first class. Face coverings must cover both the mouth and nose. Your mask protects me; my mask protects you. Masks with one-way valves for exhalation don't have the protective value for others - please don't use them as your face covering for any in-person components. Thank you for helping keep all of us safe!

Submitting Work Electronically: All work for this course will be submitted electronically through Canvas.

- Any typed work (formal reports, memos, etc.) may be in .doc, .docx, or .pdf formats only. If you are using an alternate word processing program, please make sure that you know how to generate one of these formats.

- R scripts, when required, are to be submitted as either RStudio scripts (.r files) or RMarkdown files (.rmd). They may not be submitted as text files.

- For any handwritten work, you have a couple of options for submission:

  - You can scan it to a PDF document using a cell phone camera. Some apps that do this (there are many others if you don't like these): Adobe (free) or CamScanner (free version) for Android phones; the Notes App (built-in) or CamScanner(free version) for iPhone.
  - You can take a well-lit, easy-to-read photograph, insert it into a Microsoft Word or OpenOffice Writer document, make sure that the photo is oriented correctly and easy to read, and then save the document as a .doc, .docx, or .pdf file for upload to Canvas.
  - For any handwritten work (homework, quizzes, or exams), if your work is multiple pages, please upload as a SINGLE file.

  Whichever method you choose, please double-check that your image is oriented correctly. Images not oriented correctly or images that are not easy to read will lead to the assignment being returned without being graded.

Academic Dishonesty: Consult university policies (CWUP 5-90-040(22), CWUR 2-90-040(22), and WAC 106-125-020) for student conduct, cheating, plagiarism, and other academic expectations. CWU's policies and recommendations for academic misconduct will be followed, leading to disciplinary action up to and including failing the course. Actuaries take their professional obligations of honesty and integrity very seriously; see the Code of Professional Conduct at https://www.soa.org/about/governance/about-code-of-professional-conduct/ and the Society of Actuaries' Code of Conduct for Candidates at https://www.soa.org/education/general-info/discipline/edu-code-of-conduct-cand.aspx.

Inclusivity Statement: As a member of a peer learning community, a high degree of professionalism is necessary. **CWU expects every member of the university community to contribute to an inclusive and respectful classroom culture.**

Classroom Conduct: Students in this class are expected to interact with students and the professor professionally. Instances of disruptive conduct, obstructive conduct, or harassment (see definitions below from the Washington Administrative Code: WAC 106-125-020) will be referred to the Dean of Student Success.

Disability Support Services: Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. Students with disabilities

should contact Disability Services to discuss a range of options to removing barriers, including accommodations: Hogue Hall 126, 509.963.2214, DS@cwu.edu

Is my absence excused? Excused absences will not lower your overall grade in this class and are determined on a case-by-case basis. Excused absences include illness, bereavement, and school-related activities. With the exception of illness, documentation is required. Excused absences do not include travel for holiday breaks, work, or non-emergency travel delays.
In compliance with RCW 28B.137.010, Central Washington University makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Students must present written notice to their instructor within the first two weeks of class listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.

Communication: This is going to be an unusual quarter in many ways. We are all completely remote. Some of us may need to quarantine in the middle of the quarter. In all things, communication is going to be key. If you have something going on, please let me know (no details you don't feel comfortable sharing, of course, just a general heads-up). As things need to change during the quarter, I will do my best to let you know as soon as I can. In all things, please extend grace to me and your classmates, and I will do my best to do the same.

I reserve the right to change the policies contained in this syllabus as dictated by developments during the quarter.