Professor: David McClendon (2046 ASC, phone x2574 (231-591-2574 off campus), office hours MTWR 9-10 **in STR 126** or by appointment, email: `mcclend2@ferris.edu`)

Web: I maintain a personal web page at http://mcclendonmath.com/414.html. This page contains the lecture notes, old exams, useful handouts and information on Actuarial Exam P.

Canvas: The course also has a Canvas shell, accessible through MyFSU or at the web address https://ferris.instructure.com/courses/11229. So long as face-to-face instruction is permitted by FSU, this shell has two purposes:

1. to provide you with a mechanism to submit your homework electronically (see below), and
2. to contain Zoom links to enable you to participate in lectures remotely.

Lectures: 4:00-4:50 MTWR in STR 324. You may participate in lectures online either by following the Zoom links on the Canvas page, or perhaps directly via http://zoom.us/j/92509755746.

DO NOT COME TO CLASS IF YOU ARE SICK.

Prerequisites: Single- and multi-variable calculus and some basic statistics (MATH 220, 230, 251 and 320) are the most important prerequisites: you should be proficient at differentiating and integrating functions and have some recollection of material related to infinite series–if you're not, this will be reviewed with some homework assignments and in-class work. We'll also use a bit of linear algebra (multiplication of matrices, matrix inverses, dot products, transposes and determinants) which will be reviewed as necessary.

Lecture notes: You will need my lecture notes, which can be obtained in either of two ways:

- as a course pack, available at the bookstore, or
- online, at my web page as a pdf file

You should bring the lecture notes to class every day as they contain the examples and notes from which I will teach the course.

Supplies: You should bring two or three colored pens or pencils to class each day to help you take good notes. Many problems we discuss are best attacked by use of color-coded pictures. (Calculators are prohibited on MATH 414 exams, but you will need a TI-30X calculator for the Actuarial Exam P.)

Textbook: There is no required textbook. If you need or want a textbook beyond my notes, there are several I can recommend.

Course material: MATH 414 is called "Statistics" but is really a course in probability theory. Essentially, probability is the branch of mathematics which tries to make predictions about data which will come from the repetition of some experiment which might have several different outcomes. In MATH 414, we will cover most of "the basics" of probability theory: combinatorics, discrete and continuous probability distributions, conditional probability and independence, joint distributions, expected value and variance, moment generating functions, laws of large numbers and the Central Limit Theorem. This corresponds roughly to the material on the Society of Actuaries' Exam P.

Probability theory is a really nice branch of mathematics that has applications to a wide range of real-world problems, most especially in economics and business but also in the hard-core sciences.

Learning outcomes: Upon completion of MATH 414, it is my hope and expectation that you will become proficient in probability theory. This includes the ability to:

1. Use the language of sample spaces and events to model probabilistic problems;
2. Solve elementary combinatorics problems;
3. Calculate probabilities of events and probabilities associated to discrete and continuous random variables;
4. Derive density and/or distribution functions for random variables defined as a transformation of other random variables;
5. Compute probabilities, marginals, conditional densities, etc. given a joint distribution, and determine whether or not random variables are independent;
6. Compute and interpret expected values, moments and generating functions, variance and covariance, conditional expectation and variance;
7. Write arguments mimicking the proof of the Central Limit Theorem;
8. Apply the Central Limit Theorem to solve problems associated to sums and averages of i.i.d. random variables.

Grading policy: Your homework average counts 20%; your worst midterm counts 10%; the other three midterms count 15% each; work done in class on "activity" days counts 5% and the final exam counts 20%. Grades are curved at the end of the semester, but an average of 90% will receive at least A-, an average of 80% will receive at least B-, etc.

Attendance policy: I have no formal attendance policy. That said, **nothing** is more correlated with strong performance in my classes than attendance in lectures.

Homework: There will be (roughly) weekly assignments which are due in class; the numbered problems due are listed on the attached course calendar and come from Chapter 10 of the lecture notes. Additionally, there are two review assignments called the "Calculus Review Assignment" (CRA) and "Matrix Review Assignment" (MRA) which are already available on Canvas. I will grade a subset of the homework problems from each assignment for correctness; your work should be legible and easy to follow, and you should show all your work.

Some (many) of the homework questions will be hard! It is normal not to know how to do some of the questions. Work with others and/or come ask me for help on the problems on which you are struggling.

You may either submit your homework on paper, or upload file(s) through Canvas (click on Assignments). Work on paper can be given to me in person or put in the slot next to my office door marked "MATH 414". If you submit electronically, I prefer that each assignment is uploaded as a single PDF - Adobe Scan is a free app that enables your phone to be used as a scanner, saving pictures as PDFs. If you upload your work through Canvas, I will create a file in the Canvas grade book with feedback for you. View that file (in "Grades", click the assignment and then "View Feedback") to see my comments and your grade for that assignment.

Activities: We will occasionally spend a class period working on an assignment I call an "activity" (the dates are listed on the attached course calendar). These vary in style (some review concepts from previous math courses; others review or reinforce ideas from MATH 414) and logistics. Ordinarily, these are done in groups, but in light of social distancing issues, I'm not exactly sure how I will implement these yet.

Midterms: There are four midterms, all of which you will complete at home. Each of them is due on a Friday (see the course calendar); you are to take them according to the following rules:

- You are to complete the exam in one single 60-minute block of time.
- You are not to look at any the questions on the exam before that block of time.
- On each exam, you may use one $8.5'' \times 11''$ sheet of paper with anything you want written on it on both sides (you may create a different crib sheet for each exam, but your crib sheet must be finished before you look at the exam).
- On Exam 4, you may also use what I call the "green sheet", which gives a table of values for the normal distribution.
- You may not use a calculator or computer on any exam, nor can you use your notes or a book or other study aids beyond your crib sheet.
- All answers must be appropriately justified.

For those of you attending in person, I will distribute exams the day before they are due. For those of you connecting remotely, I will email them to you shortly after 5 PM the day before they are due. All students may either return paper copies of the exam to the slot next to my office door, give them to me in person, or upload solutions to Canvas.

Final exam: The final exam covers the whole semester; it is also done remotely (I will email it to you sometime in early December). The rules for the final are the same as the midterms, except that the exam is to be done in a single 120-minute block of time. As with the midterms, you may use one $8.5'' \times 11''$ sheet of paper with anything you want written on it, and you can also use the "green sheet". Your solutions to the final exam are to be submitted electronically through Canvas.

Office hours / Getting help: My official in-person office hours are from 9-10 MTWR **in STR 126**. Outside those hours, I am happy to meet with you most of the time when I am present. Feel free to ask me questions on lecture content, or to get help with any or all of the homework questions. I can also videoconference with you through Zoom or Skype, if needed. You can also seek assistance from your classmates, or students who have taken MATH 414 and/or 416 from me in the past.

Students with disabilities who require reasonable accommodations to fully participate in course activities or meet course requirements should register with the Educational Counseling and Disability Services office (x3057, `ecds@ferris.edu`). While ECDS will send me a letter outlining the accommodations to make for you, I would appreciate it if you could contact me immediately for assistance with any necessary classroom accommodations.

Academic dishonesty: Papers will be monitored for "magic answers". Issues with academic dishonesty are taken very seriously, will almost always result in an F for the class, and will be referred to the Office of Student Conduct.

COVID contingency plan: Should in-person instruction be interrupted due to a "second wave" of COVID-19 cases, me getting sick, or any other issue, this course will transition to online delivery. Course policies that will change in such a situation can be found in the "contingency plan" distributed with this syllabus (the contingency plan is also available on my web page).