Stat 202: Probability **2016**
Probability and Statistics, Wackerly, Chapters 1-4,5-9
Dr. Roland Minton, Trexler 270-C, 375-2358, **office hours** 4M, 3T, 9W, 11Th
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Course Objectives: *Continue to learn how to do mathematics!* Mathematics is a problem-solving discipline, and we all have room to improve. To develop as problem-solvers, we must focus on technique and not on memorization. In this course, we focus on the basics of the fields of probability and statistics, mathematical areas that are increasingly important in our digital world. A common complaint about probability and statistics is that there are too many formulas and the formulas are confusing. The way to avoid this problem is to not memorize formulas! If you spend time learning the thought process and concepts behind the formulas, they will make sense and be "obvious" enough that no memorization is needed. Like all math courses, thinking is the key!

Intended Learning Outcomes: At the end of the course, successful students will be able to

- Apply techniques for discrete and continuous distributions to solve problems of interest
- Understand the role of randomness in decision-making processes
- Distinguish among different statistical tests, and know which to use in a given situation
- Distinguish among different distributions, and know which to use in a given situation
- Use integration and sums as appropriate to determine probabilities

Attendance Policy: Regular attendance is expected. You are responsible for everything done in class, through your attendance and sharing class notes with classmates. If you miss a class, you must e-mail or call me before class is over and explain why. **If you have two unexplained absences, you will be dropped from the course.**

Equipment: We will use Mathematica in class, on homework assignments and on tests. You are encouraged to get a copy installed on a laptop or desktop.

Study Problems: In each section, a group of problems will be identified. These are not to be turned in, but you should attempt each one before the next class period and ask questions about ones which you found challenging. Test questions will be similar to study problems.

Daily Grades: Each day, you should bring to class one copy for yourself and turn in a copy for me of (1) two important facts and (2) two questions you have about the current section. On a rotating basis, you will be asked to share these with the class.

In addition, you will turn in two problems that have been assigned, one of which specifically asks you to use Mathematica. Once you overcome the language barrier, you will find Mathematica to be a fantastic resource.

I expect you to spend at least 12 hours of work each week inside and outside of class.

Homework: Every other week, problems will be assigned to hand in at the end of the week. These problems are typically more open-ended than standard problems in the book. They are intended to be fun and thought-provoking. There will be seven of these problems, and your six best scores will count.

Co-Curricular: During the course of the semester, you must attend at least two approved co-curricular events offered by the MCSP department. For each, write a two-paragraph reflection paper, giving a brief summary of the talk and expanding on some aspect of particular interest to you. Reports are due within a week of the talk.

Tests: There will be six tests and a final exam. Each test will cover all material discussed since the previous test. Test dates are W 2/3, W 2/17, W 3/2, W 3/23, F 4/8 and F 4/22. The exam is Tuesday, 5/3, 2-5.

Make-ups: In case of sickness or scheduling conflicts, get in touch with me ASAP.

Academic Integrity: The college policy is fully supported. Tests are closed notes, closed book unless noted. Electronic devices other than calculators are not allowed in test situations.

Extra Credit: You may earn extra credit in a number of ways. My intent is to encourage you to have fun with mathematics, and that is the grading criterion that I will use – so have fun learning! You may check out from the Roanoke College library and report on "popular" statistics or probability books. You may report on mathematical web sites that have good stat demonstrations or extra material. You may do one of the extra credit options posted on Inquire during the semester. The main rule here is to do this now; waiting until the end of the semester will annoy me and (more importantly) distract you from the end-of-semester studying that you need to do.

Grading: Each test counts 11% of the final average. The exam counts 18% of the final average. The remaining 16% comes from: (1) homework, (2) daily grades, (3) co-curricular and (4) class participation. Grades may be curved up based on one unusually low test score or an extenuating circumstance.
A: 93-100 A-: 90-92 B+: 87-89 B : 83-86 B-: 80-82 C+: 77-79 C: 73-76 C-: 70-72
D+: 67-69 D: 63-67 D-: 60-62 F: 59 and below

Model Reflection Paper

(This is made up, but shows what I'd like to get from you. The two main elements are
(1) brief summary of talk and (2) some original thought on the subject.)

The talk on September 7th was by Dr. Sue Dokoo of Pseudo Duke University. Her research is in the game of Sudoku and discussed different aspects of this game. I have seen other people playing it, but did not know the rules or any of the mathematics behind it.

In this game, a 9x9 playing space is provided. An example given was:

		6	2			5	8	
4		2	5					7
				7	8	6		3
5		1		6	7			8
	3						6	
6			8	2		9		1
7		4	3	9				
9					5	2		6
	5	3			1	4		

To "solve" the puzzle, one could just enter numbers in a brute-force kind of way to see if they could get a working configuration. However, sitting in a room full of mathematicians, taking a more analytical approach seemed to be the dominant strategy. Treating this as a constraint-satisfaction problem, you can identify that certain cells must contain specific values. This leads to the conclusion that there is exactly one solution to a "well-formed" Sudoku.

This got me thinking about well-formed Sudoku, and how they are generated in the first place. It seems unlikely that the seeds are randomly assigned, you run the risk of violating set-up rules. A bigger problem is that the seeds may not constrain the possibilities enough to make a unique solution. Another naïve approach might be to take a completed grid and start taking away numbers, but I suspect that you might have a similar issue in terms of necessary constraints.

One that I want to think about is: In forming a viable Sudoku, is it the number of seeds or the placement of seeds that is more critical? I suspect the latter. Also,

- What is the maximum number of seed numbers that can be provided and still result in an ambiguous (unsolvable) puzzle?
- What is the minimum number of seed numbers that can be provided to generate a (uniquely) solvable puzzle?

We were provided two puzzles – one was rated "Easy" the other "Difficult".

- What goes into the rating system?
- Does a difficult puzzle necessarily have fewer seed numbers?
- Is the rating of the complexity somehow determined by the deductive skills required?

Homework #1

This is due on Friday, January 22, before class. You may do this electronically or by hand. Email submissions are fine.

An important part of your grade will be the quality of your explanations. Give thorough explanations, preferably using complete sentences, of your logic. For this assignment, simply getting the right answer will not guarantee a high grade. Diagrams or other visual aides are much appreciated.

We will discuss the Monty Hall problem in class and I will give you a couple of explanations of the basic result. The problem is actually very subtle. An entire book, titled *The Monty Hall Problem*, has been published by Jason Rosenhouse about this problem and its variations.

The basic problem implicitly assumes that the host knows where the car is, always opens up a door with a goat behind it, and randomly opens a door if there are goats behind both other doors. Give your favorite explanation (from class or elsewhere) of why in the basic problem you should switch and double your chances of getting the car.

Variation 1: you choose door 1, the host opens door 2 to reveal a goat. Suppose that it is known that in cases where both doors 2 and 3 have goats behind them the host always opens door 3. Should you switch? What are the odds of getting the car?

Variation 2: you choose door 1, the host opens door 2 to reveal a goat. Suppose that it is known that in cases where both doors 2 and 3 have goats behind them the host always opens door 2. Should you switch? What are the odds of getting the car?

Stat 202 Information Sheet

Name:

Email:

Cell phone:

Intended Major:

Hometown:

List any other statistics courses you have taken.

Briefly describe why you think statistics is useful.

What are your expectations and goals for this course?

What are some of the co-curricular or other campus activities you would like to participate in this year?