

## Math 107, Spring 2015: Midterm II Study Guide

The second midterm exam will take place on Monday April 13. **There will be two different rooms for the exam and these will be the same as for the first midterm.** It will be 50 minutes long, starting *promptly* at 10am, and 11am, respectively. **You will *not* be allowed to use a calculator, notes or books of any kind.**

The exam will cover sections §12.4, 12.5.1, 8.1, 9.1, 9.2, 9.3. This week we will just wrap up 9.3 and do more examples. On Friday, we will just review.

Note that we have covered things in a slightly different order than the book, we did not cover all the material in the book, and we talked about a few things slightly differently than the book. You are not responsible for anything we haven't covered in class or on the homework. However, you are responsible for everything we have done in class and on the homework, so please do review your notes and homework assignments.

If you have any questions or concerns, please email me or come to see me. I will have my usual office hours, but also extra office hours on Friday afternoon. I will announce the exact time and place soon.

### Study guide

You should be comfortable with all the examples from class and the homework questions you had to do on the previous homework assignments and the current one that you have to hand in on Friday. In addition to these, I will give you some practice problems on the material that we will be discussing this week on Monday. You will not have to hand those in. It would probably be a very good idea to do the current homework early, so that you have time over the next week to ask questions about it, to do the practice questions I will give on the newer material where I think you need more practice, and also to review your old homework and figure out where you are having trouble.

If by any chance you have not done the homework by yourself until now, I advise you to redo it all by yourself now.

### Syllabus

Here are some things you should be comfortable with.

- discrete random variables
  - what discrete random variable are;
  - what the probability mass function is;

- what the cumulative distribution function is (and how to plot it);
- how to find the cumulative distribution function from the mass function and vice-versa;
- Bernoulli and binomial random variables;
- definition of mean  $E(X)$  and variance  $var(X)$  of a random variable  $X$ ;
- finding  $E(g(X))$  for a real-valued function  $g$ ;
- using the propositions we proved about  $E(X)$  and  $var(X)$  to compute these in specific examples;

- continuous random variables

- what a continuous random variable is;
- what a probability density function is;
- what it means for  $f$  to be the probability density function for a continuous random variable  $X$  (i.e. how the probabilities that the values on  $X$  lie in certain intervals are calculated in terms of  $f$ );
- what the cumulative distribution function is;
- how the probability mass function and the cumulative distribution function are related and how to compute one in terms of the other;
- expected value  $E(X)$ ,  $var(X)$  and the properties of these that we have shown;

NOTE: you should be comfortable with integration, improper integrals and L'Hopital – as you have seen these show up in computations of  $E(X)$  and  $var(X)$  of continuous random variables.

- differential equations

- what a differential equation is;
- how to check if a particular function is a solution of a differential equation;
- separable differential equations: when is an equation separable, general method of solution, finding a specific solution given an initial condition;
- general solution of  $\frac{dy}{dt} = f(t)g(y)$ , and finding a specific solution using an initial condition;

NOTE: you should be comfortable with integration by parts – as you have seen, this shows up in finding the solutions to such equations.

- linear algebra

- addition, subtraction, scalar multiplication of matrices;
- matrix multiplication for matrices (of any size);

- identity matrix, inverse matrices (definition and formula for inverse of a 2x2 matrix)
- determinant of a 2x2 matrix, invertible/non-invertible matrices;
- using matrices to solve linear equations, when is there a unique solution (and when are there 0 or infinitely many solutions);
- linear transformations  $\mathbb{R} \rightarrow \mathbb{R}$  and their geometric interpretations (in the cases where we can give an obvious interpretation)
- eigenvectors and eigenvalues of a 2x2 matrix (definition and how to find them)– this we will cover on Wednesday;