Math 3100. Spring 2016. Brief study guide for the final.

The final will be given on Saturday, May 7, 9am-12:10pm, in our usual classroom Monroe 211. It will cover material from the entire course, with more emphasis on topics covered since the second midterm.

Below is the list of main topics that can appear on the final. For each topic I list the most relevant problems from homework, quizzes and the midterm. For most topics in the second half of the course I list the lectures where the corresponding material was covered (notes from all those lectures are posted on collab) as well as the corresponding book sections. For some topics I also list the main concepts, techniques and theorems you need to know.

(1) **Probability laws.** HW 1.8, midterm #1, HW 2.1, 2.2, 3.7

(2) **Conditional Probability.** You need to know the definition of conditional probability, the tree diagram method, total probability theorem and Bayes' rule. HW 2.3-2.8, 3.1-3.3, 3.9, quiz 1.2, midterm #2

(3) **Independence of events and random variables.** You need to know the definition of independence of events and random variables (both discrete and continuous), how to prove that two events/random variables are independent/not independent. HW 3.4-3.8, 10.1, 10.7

(4) **Counting.** HW 4.1-4.10, quiz 2.1, midterm #3; see also problems from the Durrett handout

(5) **Expectation and Variance.** You need to know the definition of expectation of a random variable (discrete and continuous), the definition of variance (and the simplified formula) and their basic properties (expectation of the sum is equal to the sum of expectations etc.). You need to know the formulas for the mean and variance for Bernoulli, binomial, geometric, Poisson and normal distributions, preferably with proofs; in any case you need to know the general techniques used in those proofs including the differentiation trick. HW 5.3-5.6, 7.3, 7.5, quiz 2.2, midterm #4,5; see also problems after Chapter 6 from the Durrett handout.

(6) **Covariance and Correlation.** Lectures 21 (part 2) and 22 (part 1), § 4.2. HW 10.7, 11.1-11.4, quiz 5.1

(7) **Generating functions.** HW 6.1-6.4

(8) **General properties of PDFs and CDFs.** Lecture 14, § 3.1,3.2. HW 7.1-7.2, 7.6-7.8, quiz 3

(9) **Computing marginal PDFs and joint CDFs from joint PDFs.** Lectures 17 (part 1), 18 (part 1), 19 (part 1) and 21 (part 2), § 3.4. HW 8.5, 9.1, 9.2, quiz 4

(10) **Computing PDFs and CDFs of functions of continuous random variables.** Lectures 17 (part 2) and 27, § 4.1. HW 8.1, 9.3-9.6, 10.2, 10.3, 10.6

(11) **Conditional PDFs and CDFs.** Lectures 19 (part 2), 20 (part 1), § 3.5. HW 10.4, 10.5

(12) **Markov and Chebyshev inequalities and the Law of Large numbers.** Lecture 22, § 4.1,4.2. HW 11.5-11.7, 12.1, quiz 5.2; see also problems after Chapter 6 from the Durrett handout.

(13) **Central Limit Theorem.** Lectures 23-25, § 4.4. HW 12.2-12.7, HW12A.1-12A.3, quiz 6; see also problems after Chapter 6 from the Durrett handout.

(14) **Poisson Approximation.** Lecture 11 (part 2); end of § 2.2. HW 6.6, 12.4; see also problems after Chapter 2 from the Durrett handout.

(15) **Normal Random Variables.** Lectures 15 (part 2) and 26, § 3.3 and parts of § 4.1. HW 8.3, 8.4