

Math 30530: Introduction to Probability, Fall 2012

Final Exam

General information

When is the exam?

Tuesday December 11 at 1.45pm in Galvin 283.

What does the exam cover?

Ward and Gundlach:

- Chapters 1 through 26
- Chapters 28 through 33
- Chapters 35 through 39

What is the format?

The questions will be similar to those from the midterms, all free responses, with at least one question consisting of quick short parts.

What can I do to prepare?

- Review the material! Know:
 - the basic objects of probability: experiments, outcomes, events, probability
 - how to manipulate events using union, intersection, complementation, De Morgan's laws
 - the basic rules of probability
 - the various consequences of the rules, including inclusion-exclusion
 - independence, conditional probability, Bayes' theorem
 - what a (discrete) random variable is, what its mass function and cumulative distribution functions are
 - what the joint mass function of two random variables is, and what it means for two random variables to be independent

- the expected value of random variables, sums of random variables, and functions of random variables
- the variance of a random variable, and the variance of sums of independent random variables
- the expectation of variance of a linear function of a random variable
- for each of the following named families of discrete random variables, know when to use a member of the family, what the parameters of the random variable are, what the possible values are, what the mass function is, and what the expectation and variance are:
 - * Bernoulli
 - * Binomial
 - * Geometric
 - * Negative Binomial
 - * Hypergeometric
 - * Discrete uniform
 - * Poisson
- the assumptions underlying the Poisson process
- the basic rules of counting
- the four fundamental counting problems: selecting r items from a set of size n , with and without replacement and with or without order mattering.
- density and CDF of continuous random variables, how to convert from one to the other, and how to calculate probabilities with each of them
- joint densities of pairs of random variables, and how to calculate probabilities involving two random variables
- independence of pairs of random variables
- how to calculate the expectation and variance of a continuous random variable
- how to calculate the expectation of a function of a continuous random variable, and the expectation of a function of a pair of continuous random variables
- how to calculate the distribution function of a function of a continuous random variable, and of a pair of continuous random variables, and how to calculate the density in this case
- the median of a continuous random variable
- for each of the following named families of continuous random variables, know when to use a member of the family, what the parameters of the random variable are, what the possible values are, what the density function is, and what the expectation and variance are:
 - * Uniform
 - * Exponential

- * Normal
- * Gamma
- the density of the minimum of two or more independent exponential random variables
- the difference between the standard normal and the general normal, and how to move from one to the other by a linear transformation
- how to read probabilities off a standard normal table
- the distribution of the sum of independent normal random variables
- the central limit theorem
- approximating the binomial random variable with a normal
- approximating the Poisson random variable with a normal
- how to calculate and interpret the covariance and correlation coefficient of a pair of random variables
- Chebyshev’s inequality and the weak law of large numbers

As well as reviewing your class notes and the textbook (pay particular attention to the textbook’s review chapters, 12, 20, 23, 30, 38), there are notes on counting and the named discrete and continuous random variables on the course page.

- Do plenty of questions! Basically any exercise from the book is appropriate; in particular there are review problems at the end of Chapters 12, 20, 23, 30, 38 and 45 (what’s nice is that these chapters are reviewing multiple topics, so the title of the chapter doesn’t immediately give away what the questions are testing; this replicates the exam situation). By Friday, all homework solutions should be up on the course website for you to review. At the end of this document I’ve included links to some old exams for you to look at.
- Come talk to me! I’ve tentatively set office hours for the following times:
 - Friday 3-4, HH248
 - Sunday 3-4, HH248
 - Monday 2.30-3.45, HH248
 - Tuesday 11-noon, HH248

Some review problems

- Here’s the MATH 30530 Fall 2011 final (ignore question 9): http://nd.edu/~dgalvin1/30530/30530_F11/30530F11_final.pdf
- Here’s the MATH 30530 Fall 2011 final: http://nd.edu/~dgalvin1/30530/30530_F09/30530F09_final.pdf