FINAL EXAM INFORMATION

Math 262, Fall 2023

The final exam will consist of a short take-home portion, distributed on December 11 and due at the final exam session on December 15, and an in-class portion on December 15. The exam will test your knowledge of concepts, definitions, and theorems, as well as your ability to solve problems involving distributions of random variables, from all sections that we have studied in the textbook, except for the sections about simulation. The exam will be cumulative, with emphasis on the material from Chapter 4.

Take-Home

The take-home portion of the exam will contain a few problems similar to the homework problems in this course. For this part of the exam, you may refer to your own notes, materials that the professor has posted on the course web site, the textbook, and computational technology (e.g., *R*, *Mathematica*, *Wolfram Alpha*, a calculator). **Do not consult other people, web sites, etc.** The St. Olaf Honor Code applies to this exam.

In-Class

The in-class portion of the exam will focus on the concepts of probability theory that we have studied this semester. You will be asked to solve problems involving random variables and to compute some probabilities. Books, notes, and internet-capable devices will not be permitted during the in-class exam. Calculators will be allowed, but probably not very useful, as problems will not require much arithmetic. It may be necessary to evaluate some simple integrals (of polynomial and exponential functions).

Concepts and Theorems

You should be able to define, illustrate, use, and briefly summarize the following:

- sample space
- event
- probability (definition, 3 axioms)
- inclusion-exclusion principle
- fundamental principle of counting
- combination
- permutation
- selection with or without replacement
- counting when order does or does not matter
- conditional probability
- independent events
- law of total probability
- Bayes' rule
- discrete/continuous random variable
- probability mass/density function
- cumulative distribution function
- expected value, mean

- variance, standard deviation
- Chebyshev's inequality
- Bernoulli random variable
- binomial distribution
- geometric distribution
- negative binomial distribution
- Poisson distribution
- hypergeometric distribution
- uniform distribution
- normal distribution
- exponential distribution
- gamma distribution
- moment generating function
- joint distribution
- marginal distribution
- linear combination of random variables
- pdf of a sum of random variables
- conditional distribution
- conditional expectation
- covariance, correlation
- independent random variables
- distribution function method (for finding the density of a function of rvs)
- transformation theorem (univariate and bivariate)
- Central Limit Theorem
- Law of Large Numbers
- order statistics

Study Suggestions

- For each of the named distributions that we studied, what is something that can be modeled by a random variable of that distribution? What parameters are required to specify the distribution? What is the moment generating function?
- Make a list of key properties of moment generating functions. Why are they called "moment generating functions"?
- Work some of the *Supplementary Exercises* at the end of the chapters in the book, such as the following problems from Section 4.11: #154, **155**, 156, **157**, 158, 160, **161**, 164, **165**, 166, **167**, 168, **171**, 173, **175**, 177, **179**, 180, 181
- Review homework problems that you found to be difficult (solutions are on Moodle). Talk with the professor if you have questions about these problems.