ISyE 2027

Probability with Applications

T–Th 3:05–4:25

Instructor: R. D. Foley
Office: 428 Groseclose
E-mail: rfoley@isye.gatech.edu (please put 2027 in subject line)
Office Hours: tba and by appt.
Prerequisites: Math 1502 or 1512 or equivalent

The text for the course is Probability and Statistics for Engineers and Scientists by Anthony Hayter. Currently, this book is also the text in ISyE 2028. Quite a few students have mentioned that The Probability Tutoring Book written by Carol Ash and published by IEEE Press helped them a lot in this course.

We will cover the first 5 chapters of our text, which include the following topics:

1. Sample Spaces, Events, and the Axioms of Probability
2. Random Variables
3. Expectations
4. Discrete Distributions
5. Continuous Distributions
6. Normal Distribution

The grading will be based on two tests (25% each), a final (30%), and homework (20%). Some of the homework assignments may involve Maple, Excel or Minitab, which are available in the undergraduate computer lab. On the day that homework is due, please place your homework on the desk in the front of our classroom. Our first test is scheduled for Thursday, September 19th and the second for Thursday, November 7th During tests, you will not be allowed to use books, notes, or calculators. Usually, there will be no partial credit on test problems. Makeup tests will not be given unless prior arrangement is made with the instructor. You are allowed to consult with others on homework problems; however, do not simply copy someone else’s work and submit it as your own. During class, Goldsman’s cell phone policy is in effect.

Students often find a first course in probability difficult. However, the ideas and material in this course will be used in most of the ISyE courses. Consequently, it will be a big advantage if you learn this material well; otherwise, you will be handicapped in future courses. Doing and understanding the homework problems will help you learn the material. The first homework should be on the back of this sheet. Late homework will not be accepted. I will post information such as old tests on our course web page at:

<http://www.isye.gatech.edu/people/faculty/Robert_Foley/classes/2027/ie2027.html>

Graduate students in the probability and statistics lab are available for answering questions during their office hours. Updated information about their office hours and the location of the lab should be at

<http://www.isye.gatech.edu/HelpLabs/ProbStat/>
1. Let the universal set \( S = \{1, 2, \ldots\} \). Let \( A \) denote the multiples of 3 in \( S \), and \( B = \{5, 6, \ldots, 15\} \). What are \( B' \), \( A \cap B \), \( A \cup B \), and \( B' \cap A \) (where \( B' \) denotes the complement of \( B \))? 

2. Let the universal set \( S = [0, 4) \). Let \( A = [0, 8/3) \) and \( B = [7/3, 3) \). What are \( A' \), \( A \cap B \), \( A \cup B \), and \( A' \cap B \)?

3. Compute \( \sum_{n=0}^{\infty} (1/6)^n \), and \( \sum_{n=0}^{\infty} (1/6)^n/n! \).

4. Compute \( 5! \) and \( \binom{n}{3} \) where \( \binom{n}{k} = \frac{n!}{k!(n-k)!} \).

5. Is \( \sum_{n=1}^{\infty} 2/n \) finite or infinite? Is \( \sum_{n=1}^{\infty} 2/n^2 \) finite or infinite?

6. Compute \( \sum_{n=0}^{\infty} 2^n \) and \( \sum_{n=0}^{\infty} (-2)^n \).

7. Compute \( \int_0^5 4x^3 \, dx \), \( \int_0^{\infty} (1/4)e^{-(1/4)x} \, dx \) and \( \int_0^{\infty} (1/4)xe^{-(1/4)x} \, dx \).

8. Compute \( \int_{x=0}^{\infty} \int_{y=0}^{x} 3xy \, dy \, dx \) and \( \int_{x=0}^{\infty} \int_{y=0}^{\infty} e^{-(5x+4y)} \, dy \, dx \).

9. Find the value of \( x \) such that \( e^{-x/3} = 1/2 \).

10. Differentiate the following with respect to \( x \): \( \int_0^{x^2} e^{t^2 + x} \, dt \). Hint: Leibniz’s formula is usually used to compute the derivative of such integrals, and we will need this when analyzing the news vendor problem. You can look for Leibniz’s formula in most calculus books or on the web at:

   http://web.mit.edu/18.02-esg/www/18.02IS/notes.html