ENG MN308 Statistics and Quality Engineering
and
ENG EC381 Probability in Electrical and Computer Engineering

Course Information

Time and Place: PHO 203, MW 12-2.

Lecturer: Yannis Paschalidis, 15 St. Mary's St., Room 221, tel: 617-353-0434, `yannisp@bu.edu`, `http://ionia.bu.edu/`. Office hours: By appointment. The best way to reach me is via e-mail.

Scope: This very fundamental course deals with the nature, formulation, and analysis of *probabilistic* situations. We will introduce fundamental concepts in probability, stochastic processes, and statistics and apply them to study topics from *quality engineering*. As we develop the key principles, we will discuss problems from several application areas to demonstrate the extraordinary breadth of the material. We will however, focus on applications in *detection theory*, and *quality control methods*, and touch upon some *design of experiments* (off-line quality control) concepts.

Prerequisites: Basic calculus (including multivariate). No previous experience with probability is assumed.

Textbooks: There is a required textbook for the course:
[YG] Roy D. Yates and David J. Goodman, *Probability and Stochastic Processes*, Wiley, 2nd Edition, 2005.
It is available at the BU bookstore. We will refer to this book as [YG] in the course handouts.

The material on sampling distributions, parameter estimation, analysis of variance, and applications to quality control and reliability will be based on:
[HM] W. W. Hines, D. C. Montgomery, D. M. Goldsman, and C. M. Borror, *Probability and Statistics in Engineering*, 4th Edition, Wiley, 2003.

Grading: There will two quizzes and a final exam. Your grade will be formed as follows:

1. 15% Homework.
2. 40% Quizzes.
3. 40% Final.
4. 5% Attendance and class participation.

Attendance: You will find that active class attendance and compilation of class notes are essential in this course. The concepts we will cover are fundamental, have applications in almost every area of engineering and science, and will be novel to most of you. Because the topics we will cover build upon each other, if you fall behind you may find that you are lost and not able to follow the lectures. The material introduced in class is at times conceptually subtle and will have to mature in

your mind before you become comfortable with it. The probability that simply intensive studying immediately before exams will suffice is miniscule !

Homework: Homeworks will be assigned weekly. They will be due one week after the date issued. Deadlines will be strictly enforced. Although homeworks represent only 15% of the grade you will find that they are *essential* to the learning process. I strongly encourage you to work on them independently. Especially in probability it is easy to follow another person's solution but much harder to come up with your own. Past experience has shown that the performance in the exam is highly correlated with your ability to solve problem sets on your own !

Rules of Conduct: You *may* collaborate in study groups on the solution of homeworks. An *acceptable* form of collaboration is to discuss possible approaches for solving the problems and then have each one fill the details and write her/his solutions independently. Copying the solution that someone else has written is *unacceptable* and at times transparent. If you do collaborate you *should* acknowledge your collaborators in the write-up for each problem. I view this as essential !

Needless to say that I expect students to adhere to basic, common sense concepts of academic honesty; presenting another's work as your own or cheating on exams will not be tolerated.

Course Material: Most of the course material will be posted on the Web. The URL for the course is `http://ionia.bu.edu/` (select MN308/EC381 in the "Teaching Menu").

Other books on the topics covered in the course are:

- W. Feller, *An Introduction to Probability Theory and its Applications*, Volume I, 3rd Edition, Wiley, 1968.
  The classic text for probability courses. Excellent and extensive coverage.

- A. Papoulis, *Probability, Random Variables, and Stochastic Processes*, 3rd Edition, McGraw Hill, 1991.
  Typically used for more advanced courses on Estimation and Stochastic Processes. Has a good coverage of introductory probability and statistics. Excellent reference book.

- S. Ross, *A First Course in Probability*, Macmillan, 1976.
  Similar coverage with Drake's book.

- S. Ross, *Introduction to Probability and Statistics for Engineers and Scientists*, Wiley 1987.
  Discusses a number of applications in engineering.

- D. P. Bertsekas and J. N. Tsitsiklis, *Introduction to Probability*, Athena Scientific, 2002.

- G. Taguchi, *Taguchi Methods: Design of Experiment*, ASI Press, 1993.

Syllabus (tentative)

0. Introduction, motivation, and overview (1 lecture).
1. Sets, events, and foundations of probability (3 lectures).
2. Discrete random variables (3 lectures)
3. Continuous random variables (3 lectures).
4. Pairs of random variables (4 lectures).
5. Hypothesis testing and applications in detection theory and acceptance sampling (3 lectures).
6. Sums of random variables and limit theorems (2 lectures).
7. Markov chains and applications to queueing systems (3 lectures).
8. Sampling distributions, parameter estimation and applications to quality control and reliability (3 lectures).
9. Analysis of variance and design of experiments (1 lecture).