6.434J/16.391J
Statistics for Engineers and Scientists — February 9
MIT, Spring 2006 — Handout #1

Syllabus

Prerequisites

A strong background in Probability (e.g., 6.041), Calculus of Several Variables (e.g., 18.02), and some familiarity with Linear Algebra (e.g., 18.06), or permission of the instructor.

Time and Place

Tuesday and Thursday, 1:00pm - 2:30pm, Room 56-154

Credits

This is a twelve credit H-level subject (3-0-9).

Course Webpage

`http://web.mit.edu/fmkashif/www/6.434J-16.391J.htm`

Reference Textbooks

1. Edward J. Dudewicz and Satya N. Mishra, *Modern Mathematical Statistics*, New York: John Wiley & Sons, 1988.

2. Harry L. Van Trees, *Detection, Estimation, and Modulation Theory, Part I. Detection, Estimation, and Linear Modulation Theory*, New York: John Wiley & Sons, 2001.

3. Robert V. Hogg and Allen T. Craig, *Introduction to Mathematical Statistics*, Upper Saddle River, NJ: Prentice Hall, 1995.

4. A. Doksum, *Mathematical Statistics: Basic Ideas and Selected Topics, Vol I*, Upper Saddle River, NJ: Prentice Hall, 2001.

5. John A. Rice, *Mathematical Statistics and Data Analysis*, Belmont, CA: Duxbury Press, 1995.

Reference textbooks will be available in the reserve section of Barker library.

Basic Information

	Instructor†	Teaching Assistant	Course Assistant
Name	Professor Moe Win	Faisal Kashif	Irene Keliher
Office	32-D658	32-D674A	32-D668
Phone	(617) 253-9341	(617) 324-0175	(617) 253-0197
Email	moewin@mit.edu	fmkashif@mit.edu	irenek@mit.edu
Office hours	Tue 2:30pm-3:30pm, Room 32-D658	Wed 10:30am-11:30am, Room 32-044E	9:00am-5:00pm

Course Grade

The final grade is based on our best assessment on your understanding of the material. The final grade will be roughly calculated according to the following distribution:

Problem Sets/Projects:	50 %
Midterm 1:	25 %
Midterm 2:	25 %

Homeworks

Each homework is due in class on the assigned date. Collaboration and discussion among students is permitted, however the final solution must be your own and written independently. For MATLAB based problems, submit your code by email by the due date and attach the print-out of the same with the homework.

†Guest lecturers may present several lectures on relevant special topics.

6.434J/16.391J:
Statistics for Engineers and Scientists

Rigorous introduction to fundamentals of statistics motivated by engineering applications and emphasizing the informed use of modern statistical software. Topics include sufficient statistics, exponential families, estimation, EM algorithm, hypothesis testing, measures of performance, notion of optimality, and introduction to random matrix theory.

Outline: (subject to change)

1. Basic Material
    - Probability Theory
    - Generating Random Variables, Monte Carlo methods
2. Estimation Theory
    - Estimation Methods (e.g; ML, MAP, MMSE)
    - Desirable properties:
        - Performance measures
        - Confidence Intervals
        - Bounds
        - Information Inequality
    - Data Reduction, Sufficiency, Minimal Sufficiency
    - Exponential Families
3. Hypothesis Testing / Detection Theory
    - Binary Hypothesis Testing
    - M-ary Hypothesis Testing
    - Composite Hypothesis Testing
    - Performance measures
4. Advanced Topics
    - EM Algorithm
    - Random Matrix theory
    - Belief propagation