FALL 2005
CE 193: ENGINEERING RISK ANALYSIS
Tu Th 12:30-2:00PM, 406 Davis Hall
http://www.ce.berkeley.edu/Courses/CE193/

Prerequisites: Upper-division or graduate standing.

Course Objectives: The course introduces the basic notions and methods of probability theory, statistics and decision through their application to civil engineering problems. We will start from the very beginning, but go quite far. Emphasis is placed on probabilistic modeling and analysis of civil and environmental engineering problems, Bayesian statistics, risk analysis, and decision under uncertainty. For undergraduate students, this course provides a solid base in applied probability and Bayesian statistics as used by engineers, and introduces them to the increasingly important topic of risk analysis. For graduate students, in addition, this course provides a strong background for pursuing more advanced courses on non-deterministic methods, such as CE226, CE229, CE268, CE290E, ME274 and NE275.

Class Notes/Reference Textbooks: Class lecture notes are posted on the course website. No textbook is required. However, outside reading from any of the reference texts listed below would be beneficial. Relevant sections from the first three textbooks are indicated in the attached outline.

Ang, A. H-S., and Wilson, H. Tang, *Probability Concepts in Engineering Planning and Decision, Vol. I, Basic Principles*, J. Wiley, New York, 1975. (An elementary book; good for first reading. We will go well beyond this book.)

Ang, A. H-S., and W. H. Tang, *Probability Concepts in Engineering Planning and Decision, Vol. II, Decision, Risk and Reliability*, J. Wiley, New York, 1983. (Chapters 2 and 4 are relevant to this course.)

Benjamin, J. and C. A. Cornell, *Probability, Statistics and Decision for Civil Engineers*, McGraw-Hill, New York, 1970. (A good reference book, but too old and too detailed in places. In some areas we will go beyond this book.)

Kottegoda, N.T., and R. Rosso, *Probability, Statistics, and Reliability for Civil and Environmental Engineers*, McGraw-Hill, New York, NY, 1997. (A good reference for data analysis and classical statistics applications in civil and environmental engineering.)

Homework: Weekly assignments with due dates will be posted at the website. The homework will be graded and returned. A solution set will be placed on the website after the due date. Students are encouraged to use Excel, Matlab or Mathcad in preparing their solutions. However, you must show the steps of the analysis, not only the final result.

Exams: There will be two midterm and one final examinations. The midterm examinations are tentatively scheduled for Tuesday October 6 and Thursday November 10. The final examination is scheduled for Tuesday, December 19, 12:30-3:30 PM.

Grading: 20% homework, 20% each midterm, 40% final.

Instructor:	**Graduate Student Instructor:**
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Course Outline

Topic	Lectures	Reference text		
		A&T-I	A&T-II	B&C
Introduction and review of course outline	1	ch 1		ch 1
Basic notions of set theory and probability: Sample space and events; conditional probability; statistical independence, total probability; Bayes' theorem.	3	ch 2		2.1
Random variables: univariate and multivariate distributions, expectation, moments.	4	3.1,3.3		2.2,2.4
Functions of random variables: distributions, moments; first and second-order approximations.	3	ch 4		2.3
Probabilistic models for engineering analysis: Bernoulli sequence, binomial distribution, Poisson and related distributions, Normal and related distributions, Extreme-value distributions, Other distributions used in statistics.	9	3.2	ch 4	3.1-3.6
Statistical inference: Point and interval estimation Maximum likelihood estimation Bayesian estimation and updating Conjugate distributions	5	ch 5,8		4.1,ch 5
Introduction to decision theory: Basic notions of utility theory Decision tree Terminal analysis Pre-posterior analysis Decision problems in estimation	4		ch 2	ch 5,6