

CE 202 INTRODUCTION TO PROBABILITY & STATISTICS FOR CIVIL ENGINEERS

Required Course

Spring 2009

Instructors: Gökmen Ergün

Course Data: Hours: TTW 788, Room: **Tuesday** M2230, **Wednesday:** 3120

Course Description (2002 Catalog):

CE202 Introduction to Probability and Statistics for Civil Engineers. (3+0+0)3

Descriptive statistics. Sets, events, and probability. Random variables, discrete and continuous distributions. Mathematical expectation and correlation analysis. Discrete probability distributions, Poisson process. Continuous probability distributions. Introduction to reliability theory and failure. Functions of random variables. Introduction to estimation theory. Simple and multiple regression, least squares. Statistics of extreme events. Testing of hypothesis. Civil engineering applications.

Course Objectives: This course is designed to equip the students with a working knowledge of probability, statistics, and modeling in the presence of uncertainties. The major objective of the course is to help the students to develop an intuition and an interest for random phenomena, and to introduce both theoretical issues and applications that may be useful in real life.

Textbook:

Walpole, R.E., Myers, R.H., Myers, S.L., and Ye, K., “*Probability and Statistics for Engineers and Scientists*”, 8th Ed., Prentice Hall, 2007. (older editions in the library under TA340.W35).

Ref. Books:

Ross, S.M., “*Introduction to Probability and Statistics for Engineers and Scientists*”, Wiley, 1987. TA340.R67.

Curricular Context

This required course provides the foundation for modern concepts of reliability, system analysis, risk analysis and risk management through applications of mathematical knowledge to probability and statistics.

Computer Usage: Students are encouraged, but not required, to use software (Excel and SPSS) for data analysis and model building.

Laboratory Sessions: N/A

Class Policies: **Quiz:** at least 4 will be given, total for 15% of the final grade. The best (n-1) quizzes will be considered for grading.

Midterm: two exams, 25% each of the final grade

Final Exam: 35% of the final grade

Note: Quiz questions will be from the problems solved in the previous classes or the suggested problems (see table below)

Contribution of the Course to Program Outcomes:

This course is intended to contribute to the following program outcomes:

- ✓ (a) An ability to apply knowledge of mathematics, science and engineering
- ✓ (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- ✓ (c) An ability to identify, formulate and solve engineering problems
- ✓ (k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice

Course Assessment: Course will be assessed on the basis of the accomplishments regarding the course objectives and the contributions to the program outcomes. The evaluation will consist mainly of the responses from the students, who will provide their comments to various course related questions in the final week of the semester. The course will also be evaluated by the regular student evaluation forms that are used at the end of the semesters.

Week	Topics	Reading Assignments	Suggested Problems	Objectives
1	Introduction to Data Analysis Descriptive Stat,st,cs. and Probability (sample space, events)	Chapter 1	1.6, 1.12, 1.14, 1.25,	To introduce basic statistical tools and representations that the students are likely to encounter in practice
2	Probability (Sample Space, Events, counting, permutations, combinations.	Sect. 2.1 - 2.4	2.5, 2.11, 2.15, 2.16, 2.27, 2.35, 2.43	To develop notions of possible and favorable outcomes of an experiment; intuitive probability
3	Basic axioms of prob., conditional prob., independence, Bayes' Rule	Sect. 2.5 - 2.8	2.53, 2.61, 2.65, 2.73, 2.79, 2.85, 2.93, 2.992.101, 2.105	To introduce the mathematical foundations of the theory of probability
4	Random variables (RV), discrete and continuous probability distributions, joint distributions,	Sect. 3.1-3.4.	3.5, 3.9, 3.17, 3.21,3.29,3.29, 3.43, 3.49, 3.55, 3.59, 3.75,	To introduce the concepts of random variables and distributions
5	Mathematical expectation, Variance and Covariance of Random Variables, Means and Variances of Linear combinations of RV.s	Sect. 4.1-4.3	4.5, 4.11, 4.17, 4.23, 4.35, 4.41, 4.47, 4.55, 4.57, 4.69	To introduce the notion of expectation and to clarify the use of probabilistic approaches
6	Chebyshev's Theorem MIDTERM I		4.67, 4.73, 4.91, 4.93,	To introduce Chebyshev's theorem
7	Some Discrete prob. dist.,	Chapter 5	5.9, 5.15, 5.25,5.27, 5.35, 5.45, 5.53, 5.57	To present some of the often encountered discrete probability models and to discuss their applications
8	Some Continuous prob. dist., (uniform, normal, normal approximation to Normal)	Sect.. 6.1-6.5	6.5, 6.9, 6.11, 6.13, 6.17, 6.25, 6.27, 6.33, 6.37	To present some of the often encountered continuous probability models and to discuss their applications
9	Some Continuous prob. dist., (gamma, exponential, Chi-square, lognormal) , normal approximation to Normal)	Sect. 6.5-6.9	6.39, 6.45, 6.51, 6.53, 6.57	To present some of the often encountered continuous probability models and to discuss their applications
10	Fundamental Sampling Distributions and Data Descriptions , MIDTERM II	Chap. 8	8.5.8.7, 8.19, 8.25, 8.43,8.49, 8.53, 8.59, 8.67	To familiarize the students with the use of data in constructing probabilistic models for real life applications
11	One-and Two-Sample Estimation Problems	Sect. 9.1-9.13	9.5, 9.7, 9.15, 9.37, 9.41, 9.43, 9.49, 9.53,9.65,9.71, 9.77,	To outline the purpose of statistical inference, explain the estimation of population parameters.
12	One- and Two-Sample Tests of Hypotheses	Sect. 10.1-10.13 10.	10,7, 10.15, 10.19, 10.25, 10.31, 10.39, 10.41, 10.43, 10.59, 10.61, 10.73, 10.77	To introduce the procedures that lead to the acceptance or rejection of statistical hypotheses.
13	Linear regression, order statistics	Sect. 11.1 - 11.7	11.3.11.7, 11.19, 11.23, 11.33	To present regression, curve fitting, and least squares concepts for engineering analysis