

Civil Engineering Data Analysis (CE264)

Course: CE 264 (Data Analysis for Civil Engineering Applications)

Semester: Fall 2009

Time: Lecture on Mondays & Wednesdays 12:30 – 1:20 PM,

Lab on Mondays 2:00 – 4:50 PM

Location: Lecture in room SH-21 & Lab in room MR-506

Instructor: Prof. Hansong Tang

Office: Steinman Hall-CCNY, T-185, Tel: 212-650-8006

Office Hours: Wed, Thur, 2:00 – 4:00 PM

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Course Description: Role of statistics and probability in civil engineering. Measurability and variability. Data collection. Descriptive analysis. Presentation of data in the context of civil engineering. Numerical descriptive statistics. Probability distributions and their application to civil engineering. Introduction to inferential statistics. Applications of civil engineering quality control. Linear correlation and regression analysis.

Software: Microsoft Excel or Matlab

Textbooks:

- Probability Concepts in Engineering (Emphasis on Applications to Civil and Environmental Engineering), by *Alfredo H-S. Ang and Wilson H. Tang*; Wiley.

Any introductory level of statistics and probability book will be useful for this class. Following are a few reference books that you can use:

- Applied Statistics for Engineers and Scientists; *David M. Levine, Patricia P. Ramsey, and Robert K. Smidt*; Prentice Hall. (Optional)
- Probability and Statistics for Engineers; *Irwin Miller, John E. Freund, & Richard A. Johnson*; Prentice Hall. (Optional)
- Basic Engineering Data Collection and Analysis; *Stephen B. Vardeman and J. Marcus Jobe*; Duxbury Thomson Learning. (Optional)
- Guide to Microsoft Excel 2002 for Scientists and Engineer (Third Edition), by *Bernard V. Liengme*; Butterworth-Heinemann. (Optional)

Communication: Class communications, such as posting the assignments and submitting their solutions, will be through the “blackboard”. Therefore, you need to obtain a user ID and a password to the “blackboard”.

Grading:

- 20% Homework (10% homework & 10% lab assignments)
- 40% Midterm Exams (30% Exams, 10% Class Quizzes)
- 10% Project
- 30% Final Exam

Preliminary Schedule, CE264, Fall 2009

Weeks	Days	Topics	Chapters
1	Mon. (Aug. 31) Wed. (Sept. 2) Lab.	Introduction to Statistics, Date Descriptors Introduction to Excel (calculations & graphs)	1
2	Mon. (Sept. 7) Wed. (Sept. 9) Lab.	Labor day Fundamental of Probability Models Fundamental of Probability Models	2
3	Mon. (Sept. 14) Wed. (Sept. 16) Lab.	Fundamental of Probability Models Analytical Models for Random Variables Fundamental of Probability Models	2 & 3
4	Mon. (Sept. 21) Wed. (Sept. 23) Lab.	Holiday Continuous Probability Distributions Continuous Probability Distributions	3 Exam 1
5	Mon. (Sept. 28) Wed. (Sept. 30) Lab.	No class Continuous Probability Distributions Continuous Probability Distributions	3
6	Mon. (Oct. 5) Wed. (Oct. 7) Lab.	Continuous Probability Distributions Discrete Probability Distributions Continuous Probability Distributions	3
7	Mon. (Oct. 12) Wed. (Oct. 14) Lab.	Columbus day Discrete Probability Distributions Discrete Probability Distributions	3
8	Mon. (Oct. 19) Wed. (Oct. 21) Lab.	Discrete Probability Distributions Functions of Random Variables Discrete Probability Distributions	4 & 6 Exam 2
9	Mon. (Oct. 26) Wed. (Oct. 28) Lab.	No Class Statistical Inference & hypothesis Testing Statistical Inference & hypothesis Testing	6
10	Mon. (Nov. 2) Wed. (Nov. 4) Lab.	Statistical Inference & hypothesis Testing Statistical Inference & hypothesis Testing Statistical Inference & hypothesis Testing	6
11	Mon. (Nov. 9) Wed. (Nov. 11) Lab.	Linear Regression Linear Regression Linear Regression	8
12	Mon. (Nov. 16) Wed. (Nov. 18) Lab.	Linear Regression Linear Regression Linear Regression	8
13	Mon. (Nov. 23) Wed. (Nov. 25) Lab.	Linear Regression Thanks Giving Linear Regression	
14	Mon. (Nov. 30) Wed. (Dec. 2) Lab.	Linear Regression Linear Regression Linear Regression	8 Exam 3
15	Mon. (Dec. 7) Wed. (Dec. 9) Lab.	Linear Regression Review Review	8
16	Dec. 15 - 21	Final Exam	

Outline of Course CE264: Data Analysis for Civil Engineering Applications

Chapter 1: Introduction of Statistics & Definitions:

- Types of Data and Variables; Frequency; Frequency Distribution; Histogram; Scattergram; Main Descriptors; Uncertainty & Outliers.

Chapter 2: Fundamental of Probability Models:

- Sample Space; Events; Venn Diagram & De Morgan's Rule.
- Probability of an Event; Properties & Rules of Probability; Conditional Probability; Total Probability.

Chapter 3: Analytical Models for Random Phenomena:

- Random variables; Analytical Descriptors (Mean, Expectation, Variance, Standard Deviation)
- *Continuous Probability Distribution:* Probability Density Function; Normal (Gaussians) Probability Distribution; Properties of Normal Curve; Lognormal Distributions; Exponential Distribution.
- *Discrete Probability Distribution:* Probability Mass Function; Binomial (Bernoulli) Probability; Continuity correction for Binomial Probability; Poisson Probability; Hypergeometric Random Distribution; Gamma Distribution; Geometric Distribution.

Chapter 4: Function of Random Variables:

- Concept of Sampling Distributions; Impact of Sample Size on Sampling Distribution; Sampling Distribution of the Mean and the Central Limit Theorem.

Chapter 6: Inferences from Observational Data:

- An Estimator or Point estimator; Confidence Interval; Estimation of Population Mean, Proportion, and Variance; Student's t Distribution; Chi-Square Distribution.
- Confidence Interval and Hypothesis Testing; Null and Alternative Hypotheses; Test Statistics and Rejection Regions; Critical Values; One- or Two-Tailed Test; Standardized Test Statistics; Testing Population Mean, Proportion, and Variance.
- Determining Target Parameters; Comparing Two Population Means, Proportions, and Variances;

Chapter 8: Regression and Correlation Analysis:

- Introduction to the Regression Model; Parameters of the Simple Linear Regression Model; Linear Regression Model Assumptions; Measuring Variability around the Least Square Line; Correlation Coefficient; Covariance; Coefficient of Determination; Confidence Interval in Regression; Inference about the Slope of Regression Line & the Correlation Coefficient; Confidence Intervals for Mean and Prediction Values; Residual Analysis.
- General Multiple Regression Model; Computation of Coefficients of the First Order Multiple Regression Model using Least Square Method; Multi-Linear Regression Model.
- Non-linear Regression.