ECS526 : Summer Schedule

General Information:

Course: Statistics for Engineering (ECS526)
Instructor: Jorge Luis Romeu, Research Professor. Dpt. MAE.
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Required Textbooks: Probability and Statistics for Engineers and Scientists, (Walpole, Myers et al.) and "Readings" of the START sheets course supplementary material (available from SU Bookstore). In addition, there is a suggested Companion Text: A Practical Guide to Statistical Analysis of Material Property Data (Romeu et al.).
Schedule and Place: Thursdays 5:30 to 9:45 PM; in Room 211, Hall of Languages.
Time Frame: May 24 to July 26; Instructor reserves the right to reschedule a class, if necessary.
Office Hours: Right after class.

Course Objectives:

To review statistical theory and inference, to introduce engineering students to statistical thinking and to gain proficiency in the correct application of various statistical tools to data modeling and analysis.

Requirements:

Students are required to have an account in the SU computer system for email communication with the Instructor and among them. In addition, students will use statistical software to solve problems and do projects. They can either use their own personal computer or SU's system software. Finally, students will work in Teams, to prepare and present (in class and at the final) their collective class projects. A detailed explanation of the required group, in-course and final projects is appended to this Syllabus.

Course Syllabus (Optimal; see Web Page):

1. Probability (Ch. 2): sample spaces, simple and compound events. Counting rules. Event probabilities, conditional probability, independent events, Bayes rule.
2. Random Variables and Mathematical Expectation (Ch. 3 and 4): random variables, discrete and continuous probability distributions, empirical distributions, joint distributions, expectations, variance and linear combinations of random variables.
3. Probability Distributions (Ch. 5 and 6): Discrete probability distributions; Uniform, Binomial, Multinomial Hypergeometric and Poisson. Continuous probability distributions; Normal, Exponential and Normal approximation to the Binomial.
4. Random Samples and Sampling Distributions (Ch. 8): populations and samples; parameters and statistics; sampling distributions (t, F, Chi-Square).
5. Point and Interval Estimation (Ch. 9): classical estimation methods, estimation of mean, proportion and variance of single samples; paired samples and the estimation of the difference between two means/proportions and the ratio of two variances.
6. Hypothesis Testing (Ch. 10): theoretical development and framework, tests for the mean, proportion and variance of a single population; tests for two means, two proportions and two variances. One and two sided tests. Goodness of Fit tests; tests. Selection of sample size.

7. Correlation and Linear Regression (Ch. 11 and 12): simple linear regression, including model verification, residual analysis, multiple regression, selection of variables, choosing the best model. Lack of Fit. Variable transformations.
8. Analysis (ANOVA) of Variance (Ch. 13): one-way and two way ANOVAs, randomized experiments; random blocks; Factorial designs; model verification and residual analysis.
9. Other topics (Design of Experiments; Quality Control, Non Parametrics) as time allows, from the remaining chapters of the Walpole, Myers et al.

Grade Determination:

The course final grade will be based upon the following four weighted components:

1.	First Exam (around 1/3 into the course)	25%
2.	Second Exam (around 2/3 into the course)	25%
3.	Final Project (due the last day of class)	25%
4.	Weekly presentations, quizes, class participation	25%

ECS 526 Teams and Final Project

Engineers use statistics to solve problems and to take decisions under uncertainty. In addition, engineers often work in pluridisciplinary Teams and must be able to present their work to peers and non-technical personnel. Toward these goals, study groups (Teams) of four to six students, will be formed the first day of class. Students are free to exchange groups with another, as long as the Teams remain of the same size.

Teams will work collectively and will communicate via email, phone, weekly meetings, etc. There will be a Team Leader assigned to each group the first day and an elected one will replace it after their first meeting. Teams will present assigned material in each class, developed using statistical and simulation software (working with statistics software is one of the main course objectives). Presentations are then discussed and critiqued by their peers and graded (for 20% of the final grade). In addition, each Team will deliver a final project (for 25% of the grade) the last day of class. There is a different project for each Team. Consultation is fine. Teams work individually.

The objective of the final project is the utilization of the course material to solve a real-life problem. Each Team will receive a problem (in the form of a simulation program) from the Instructor during the first two weeks of the course. The Team will then work on stating the physical problem in statistical terms, in running the simulation to collect data, and in applying as many of the course's statistical procedures to it as possible. The final grade of each project depends (i) on quality and correctness of procedures implemented as well as (ii) on number of applicable course elements developed in the project.

At the end of the course, each Team will present their project to the group, which will discuss and criticize it. The Team will hand in a complete (hard and computerized) copy of their work to the Instructor (not returned) and will provide copies for each member, as part of the course documentation. Power point presentations are strongly recommended.

Updated: v/07

ECS526 SUMMER COURSE OUTLINE:

Class 1: Introduction; descriptive data analysis (EDA); Probability; Statistical Concepts of statistical distributions. Corresponds to Classes 1 and 2 of the Fall Semester schedule. Readings correspond to Chapters 1 though 4 of the Walpole Myers textbook and weeks 1 and 2 for the START sheets (SU red booklet).

Class 2: Discrete and continuous distributions; transformations. Corresponds to Classes 3 and 4 of the Fall Semester Schedule. Readings correspond to Chapters 5, 6 and 7 of W-M textbook and weeks 3 and 4 of the START Sheets readings.

Class 3: Test #1. Will have two parts: one in-class (2 hours, individual work) and one group take-home. The test will start at 5:30 pm to 7:30 pm. Then you will receive a sealed envelope per group with instructions for Part II. We will then review the test and start discussing CLT and Sampling Distributions topics.

Class 4: CLT; sampling distributions; t and F distributions; confidence intervals (CI) for one and two means, proportions, variances, etc. It corresponds to Classes 5 and 6 of the Fall Schedule. Readings correspond to Chapters 8 and 9 of W-M, START sheets are from weeks 5 and 6 of the Fall schedule.

Class 5: Industrial applications of CI and Quality Control; review of midterm projects. Corresponds to Class 7 of the Fall Schedule and Chapters 9 and 17 of W-M. Readings are from week 7 of the Fall schedule.

Class 6: Intro to Hypothesis Testing; the one sample case. Corresponds to Class 8 of Fall and Readings from Chapter 10 of W-M and STARTs from week 8 of the Fall schedule.

Class 7: Hypothesis Testing (end); the two-sample case; non parametrics. Corresponds to Class 9 of the Fall. The Readings are from Chapter 10 and 16, of W-M. The STARTs are from week 9 of the Fall schedule.

Class 8: Introduction to Regression/ANOVA; Review for Test #2. Corresponds to Class 10 and 11 of Fall Schedule. Readings from Chapter 11 and 13 of W-M and STARTs from weeks 10 and 11.

Class 9: Two-hour, in-class test on CI/testing topics (Chs 8 through 10). After that, more regression/ANOVA; residual analysis. Readings from W-M Chapters 12 and 14 (selected topics) and STARTs for weeks 12 and 13. Consultations on the final Project.

Class 10: Extensions in regression/ANOVA modeling. Presentation of projects (ppt) for corrections and refinements. Questions/answers. Final Projects are due on Friday.

Classes are Thursdays, 5:30 to 9:45 PM, in HL 211. Students are required to have an SU computer account and to monitor their emails at least twice a week.