CE 311S: Elementary Probability and Statistics for Civil Engineers

Fall 2008 (#15570 & 15575)
2:00-3:30pm Tu/Th, 6.406 ECJ (Kockelman)

I. Office Hours for Instructor, Dr. Kara Kockelman

Mondays 2:00 - 4:00 pm & Tuesdays 3:15 – 5 pm, 6.904 ECJ
Or, by appointment: 471-0210 (office phone number) kkockelm@mail.utexas.edu

II. Prerequisites

According to the College of Engineering Catalog, the following prerequisite must be satisfied before enrolling in CE311S: Mathematics 408D or 808 (Sequences, Series and Multivariate Calculus). It is extremely important that students demonstrate competency with calculus at the beginning of the semester: Calculus is a pillar of many statistical concepts.

III. Grading

For purposes of grading, the performance of students enrolled in CE 311S will be assessed using the following scoring system:

Participation (& Quizzes)	7.5%
Homework	15%
Labwork	7.5%
In-class Exams 1, 2 & 3	12.5, 15, 17.5% of score/grade, respectively (45% total)
Final Exam	25%

While the design of the course aims for overall scores such that A's, B's, C's, and D's are earned by those averaging 90, 80, 70 and 60 or above overall, final grades deviate from these thresholds to recognize a loose curve. Please inquire with the professor if you are interested in snapshot of your overall performance at any time.

The instructor may administer *un*announced quizzes periodically, based on reading. (These will not be difficult, if you stay up with the reading!) Students should come to class prepared to contribute to each class's lecture and discussion by staying up-to-date with homework and reading.

A student grader will be assigned for homeworks. Questions for this grader should be submitted in writing with assignments (& clearly addressed to the reader).

IV. Homework Assignments

Homework problems will be assigned weekly and must be handed in at the ***beginning*** of the period in which they are due. After this time, they will be considered late and given *no credit*. However, ***all*** *assigned problems* ***must*** *be completed* (within 3 weeks of their due date and at least one week before the final exam) or a student's participation score will be negatively impacted. Students are encouraged to discuss & work on homework problems with other CE311S students, but all problems must be completed by the student him/herself; no copying will be permitted. The lowest homework score will be disregarded.

Homework Solutions: The use of unauthorized sources of homework solutions (e.g., websites like cramster and previous semester student solution copies, etc.) is considered scholastic dishonesty and a violation of UT's Standard of Academic Integrity. Please see http://deanofstudents.utexas.edu/sjs/acint_student.php, and let me know you see this happening.

ECJ 6.706 (across the hall from Dr. K's office in ECJ 6.9) will be reserved each Monday from 3:30 pm until 5:30pm for the TA's office hours and for your use, for team-based studying and homework

discussions. Please make use of this opportunity to work together, and do call upon us during that time. We look forward to working with you!

V. Examinations

The in-class exams** are *tentatively* scheduled & the final exam is formally scheduled for the following dates:

In-class Exam 1:	Thursday, September 25
In-class Exam 2:	Thursday, October 23
In-class Exam 3:	Thursday, November 20
Final Exam:	Thursday, December 11, 9– noon

Make-up exams will *not* generally be given to any student. If a student is absent from a scheduled exam due to medical or other problems beyond her/his control and can plainly demonstrate this, the instructor can choose to give the student a completely different exam, additional assignments, and/or change the weighting of the student's various graded contributions.

VI. Laboratories/Discussion Sections

Lab/discussion sections will take place every week in 3.402 ECJ on Wednesdays 11-noon (#15570) and 1-2 pm (#15575). Lab periods will emphasize problem-solving via computer-based lab work and will offer reviews before each of the three midterm exams. Any assigned lab work is mandatory and must be turned in within 7 days of the lab period, or a student's participation score will be negatively impacted.

The course's Graduate *Teaching Assistant* is Mr. Paul Rebeiz (ppr00@aub.edu.lb) . Paul's office hours will be held in 6.706 ECJ, on Mondays from 3:30p to 5:30 pm.. Paul also will be available, as desired, by appointment. Undergraduate student David Wald (dwald3325@sbcglobal.net) will serve as a *Tutor*, to help reinforce key concepts and provide a sounding board for all aspects of undergraduate life in engineering! His office hours will be announced during the first week of class. Please contact him for individual assistance as well.

VII. Text and Reader/Notes

The required textbook for this course is *Probability and Statistics for Engineering and the Sciences* by Jay L. Devore, 7th Edition, Brooks/Cole/Thompson Learning, 2007. PowerPoint slides used by the instructor are available at http://www.ce.utexas.edu/prof/kockelman/public_html/ce311slectures1-5.pdf, http://www.ce.utexas.edu/prof/kockelman/public_html/ce311slectures6-9.pdf, and http://www.ce.utexas.edu/prof/kockelman/public_html/ce311slectures10-13.pdf.

Lab information and assignments are available via Blackboard at http://courses.utexas.edu. Students can log on using their UTEID and password. Other key materials will be made available via email. (Due to departmental budget constraints, copying will be minimal.)

Students may wish to consult other texts for additional insights and different presentations of course material. Recommended supplemental texts include *Schaum's Outline of Probability & Statistics* (with lots of solved problem examples), Ang and Tang's *Probability Concepts in Engineering Planning and Design* (1975), J. Rice's *Mathematical Statistics and Data Analysis* (1995), and D. Freedman et al.'s *Statistics* (1998). Many other probability and statistical texts exist, and all are likely to be helpful in some form.

A *great site* for links to a wide variety of interactive animations of statistical concepts (such as expected value calculations, the Central Limit Theorem, sampling, confidence intervals, and regression) is http://davidmlane.com/hyperstat/Instructional_Demos.html. (Note: To view the applets, one may need

specialized Java & MathML plug-ins, which can be downloaded via http://www.java.com/en/index.jsp & http://www.dessci.com/en/products/mathplayer/welcome.asp.)

VIII. Add/Drop Dates

From the 1st through the 4th class day, an undergraduate student can drop or add a course on ROSE or TEX. From the 5th through the 12th class day, a student can drop through ROSE or TEX; adds must be done in the department offering the course. For any drops beginning with the 13th class day, a student must initiate the drop process in the office of the Dean (ECJ 2.200). Departmental advisor and instructor approval may be required; poor course performance is insufficient reason for such approval.

IX. Evaluation Plan

The College of Engineering Course/Instructor Survey will be used as the basic evaluation tool. All students are encouraged to submit written comments during this survey. Other formal assessment opportunities are likely to arise mid-semester; and students are strongly encouraged to provide feedback at any time during the course, in person, via other students or anonymously, to the TA and/or the instructor.

X. Other Information

1. The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. Any student with a documented disability (physical or cognitive) who requires academic accommodations should contact the Services for Students with Disabilities area of the Office of the Dean of Students at 471-6259 as soon as possible to request an official letter outlining authorized accommodations. For more information, contact that Office, or TTY at 471-4641, or the College of Engineering Director of Students with Disabilities at 471-4321.
2. According to *The General Information Catalog* "a student who is absent from a class or examination for the observance of a religious holy day may complete the work missed within a reasonable time after the absence, if *proper notice* of the planned absence has been given". The deadline for proper notification of such an absence is the fifteenth day of the semester.
3. Students in this section of CE311S are encouraged and authorized to work on homework assignments together and prepare for exams together. However, all written work handed in by a student is considered to be his/her own work, prepared without *unauthorized* assistance. To ensure your actions never compromise your and our class's integrity, please visit http://deanofstudents.utexas.edu/sjs/acint_student.php. Students who violate University rules on scholastic dishonesty (*e.g.*, anything which gives unfair academic advantage to a student) are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. An "F" grade will be the recommended penalty in most cases of scholastic dishonesty. One should refer to the Student Judicial Services website at http://www.utexas.edu/depts/dos/sjs/ to access the official University policies and procedures on scholastic dishonesty as well as further elaboration on what constitutes scholastic dishonesty.
4. *Math & statistics tutors* and other learning assistance can be obtained via the Learning Skills Center (Jester Center, 471-3614). See http://www.engr.utexas.edu/current/services/jester.cfm.

XI. Course Objectives, Questions, Content, & Schedule

CE 311S covers many aspects of probability and statistics, both theory and application. There are three basic themes:

- Data follow distributions (DFD),
- Distributions provide probabilities (DPP),
- Probabilities permit prediction (PPP).

These themes, and their supporting material, are highly relevant to the planning and design of civil engineering systems, including forecasting demand and system operations, enhancing investment and management decisions, predicting loads and component strength, and setting policy. The course's focus is the application of probabilistic and statistical tools for data analysis, hypothesis testing, and prediction. Its primary objective is an understanding of uncertainty, such that students can more effectively tackle a variety of key civil engineering problems. More specifically, by the end of this course students should be able to:

- apply laws of probability to random processes,

- use sample data to estimate parameters governing these processes, and
- undertake tests of experimental hypotheses.

Many questions are core to these objectives. Students in this course will seek to answer the following question types:

- Knowing the process that underlies a series of random events, what are the probabilities of various combinations of outcomes, in one realization of the event – and in a series?
- Given a set of data (from a roadway intersection, airport runways, a series of buildings, concrete slump tests, etc.), what distribution best represents the data? What are the key parameters characterizing that distribution? How can we use that distributional assumption to predict outcome probabilities (e.g., the probability of minimal delay, of crashes, building failure, building lifetime, concrete durability)?
- Given a set of data, how can we relate the results to policymakers, adequately characterizing the uncertainty in our results? (In other words, what is the variance in our estimates?)
- Given a variety of predictor/explanatory variables (e.g., materials, mixing, and placement techniques used), what models best predict the experimental outcomes (e.g., concrete strength at 28 days)? What is the marginal impact of each explanatory variable – is it positive or negative, strong or weak, only somewhat or highly uncertain?

To attain our objectives and answer these questions, we will systematically proceed through a series of topics, each with specific objectives. A listing of the course topics (and related chapters for reading) is shown here.

TOPICS TO BE COVERED

Lesson 1. Introduction – Chapter 1
Lesson 2. Describing our Data – Chapter 1 (Note: Students may skip the boxplot discussions [pp. 35-39].)
Lesson 3. What's the Likelihood…? Probability Theory – Chapter 2
Lesson 4. Discrete Random Variables – Chapter 3

In-class Exam 1: Thursday, September 25

Lesson 5. Discrete RVs – Chapter 3
(Note: Students may skip hypergeometric & negative binomial materials [pp. 116-121].)
Lesson 6. Continuous RVs – Chapter 4
Lesson 7. Continuous RVs: Gamma & Exponential Distributions – Chapter 4
(Note: Students may skip the Weibull and Beta distribution materials, as well as probability plots [pp. 163-179].)

In-class Exam 2: Thursday, October 16

Lesson 8. Bivariate & Multivariate Distributions – Chapter 5
Lesson 9. Distributions of Statistics: Combining RVs – Chapter 5
Lesson 10. Putting Bounds on Our Estimates: Statistical Inference & Confidence Intervals – Chapter 7

In-class Exam 3: Thursday, November 6

Lesson 11. Large & Small Sample Confidence Intervals (Normal & t Distributions) – Chapter 7
Lesson 12. Testing our Hypotheses – Chapter 8
Lesson 13. The Value of Explanatory Variables: Linear Regression Models – Chapter 12
Review for Final Exam

Final Exam: Thursday, December 11, 9 – noon