Engineering Statistics and Quality Control, 36-220

Fall 2005

Statistics is the branch of science which deals with accidents, uncertainty, variability, irreproducible results and mistakes. The first goal of this course is to introduce you to some of the mathematical tools statisticians have devised to handle randomness, uncertainty and error. These tools are based on probability theory, and the mathematical fact that large collections of individually random events display predictable patterns. The other goal of the course is to help you see how these tools can help you do better engineering. Because many of the calculations involved are tedious, you will also learn how to use MINITAB, an entry-level statistical computing package. The emphasis is not on the mechanics of the calculations, but on the basic concepts, the core mathematical ideas, and knowing which kind of calculation to do when.

Instructors

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Stuff to Read

TEXTBOOK: Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, 6th edition (2004) is *required*, and should be at the campus bookstore. As a supplement, I strongly recommend Larry Gonick and Wollcoot Smith, *The Cartoon Guide to Statistics* (1993, ISBN 0062731025).

COURSE WEB SITE: This syllabus, homework assignments and solutions, labs, and any supplemental material for this course will be available from the course web-page, `http://www.stat.cmu.edu/~cshalizi/36-220`. Homework

assignments will be posted at least one week before they are due; homework solutions, after the homework is due.

Class Times and Policies

LECTURES are Mondays and Wednesdays, 11:30am–12:20pm, in Hamerschlag Hall B131. N.B., the Friday lecture listed in the time-table *does not exist.* Lecture will be the main place where new concepts and methods will be introduced and explained. Because you will, of course, read the textbook carefully, I will try to present things in a way which is at least a little different than Devore does. Hopefully, at least one of us will be useful to you! No newspapers, no e-mail, and *definitely* no cell phones.

LABS are scheduled as follows:

Section	Time	Room
A	F 11:30–12:20	Baker Hall 140EF
B	W 12:30–1:20	Baker Hal 140C
C	F 11:30-12:20	Fine Arts Building 317

The labs are **mandatory**. Because of the schedule, there are **no** make-up labs. If you miss one, you will get a zero for that lab. If you think you had a good reason to miss it, please talk to either me or your TA; better yet, come see us *before* you miss the lab. All labs will count equally towards your grade.

Stuff to Do

HOMEWORK: There will be weekly homework assignments taken from the textbook. The assignments will be found on the course website, and, unless otherwise noted, are due Wednesdays by 11:30 am: in my mailbox is best, handed in at the beginning of lecture is OK, and e-mail is tolerable. Please do not e-mail your homework to your TA. Since solutions will be posted as the assignments are due, **no late work will be accepted**. You will be graded on correctness, not effort; however, partial credit will be given. All homework assignments will count equally towards your grade. The point of the homework is to make you practice using the ideas of the course, since this is the only way you will really learn them. You are encouraged to discuss the homework with each other, but **you must turn in your own work**. Submitting work done by someone else is pointless; it is also cheating, and will be dealt with harshly (`http://www.cmu.edu/policies/documents/Cheating.html`).

EXAMS: There will be one midterm, which will cover all of the material up to that point in the class; the final will cover the whole course. Both exams will be closed book and closed notes, but you can bring one 8.5×11 "cheat sheet" of notes, formulas, etc. to the mid-term, and two to the final. A calculator will be helpful. Cheaters *will* be caught, and punished harshly.

The date for the final exam is set by the university during the semester, and may be as late as December 20th. **Do not** plan to be able to leave for vacation on or before the 20th! I will tell the class the date of the final as soon I know it myself.

Do not miss exams. If there is a *very* compelling reason why you cannot make the schedule examination dates, please get in touch with me (not your TA) as soon as possible, preferably *before* the exam. Otherwise, you will get a zero. **Do not miss exams.**

Grading: Labs will be 15% of your grade, homework 25%, the midterm 25%, and the final 35%.

Lab Schedule

Subject to change. Updates, if any, will be announced in lecture and posted on the course website.

August 31, September 2	**NO LAB**
September 7, 9	Lab 1: Introduction to Minitab; describing data
September 14, 16	Lab 2: Venn diagrams, probability rules
September 21, 23	Lab 3: Discrete probability distributions
September 28, 30	Lab 4: Continuous probability distributions
October 5, 7	Lab 5: The central limit theorem
October 12, 14	Lab 6: Control charts
October 19, 21	**NO LAB** (midterm)
October 26, 28	Lab 7: Point and interval estimates
November 2, 4	Lab 8: Confidence intervals
November 9, 11	Lab 9: Hypothesis testing
November 16, 18	Lab 10: Simple regression
November 23, 25	**NO LAB** (Thanksgiving)
November 30, December 2	Lab 11: Multiple regression
December 7, 9	**NO LAB** (review week)

Lecture Schedule

Subject to change. Updates, if any, will be announced in lecture and posted on the course website.

August 29	Course overview; Descriptive statistics	Reading: ch. 1	
August 31	Probability (I)	Ch. 2.1, 2.2	
September 5	Labor Day — no lecture		
September 7	Probability (II)	Ch. 2.3–2.5	HW 1 Due
September 12	Probability (III)		
September 14	Discrete random variables (I)	Ch. 3	HW 2 Due
September 19	Discrete random variables (II)		
September 21	Continuous random variables (I)	Ch. 4	HW 3 Due
September 26	Continuous random variables (II)		
September 28	Multiple random variables	Sec. 5.1, 5.2	HW 4 Due
October 3	Central limit theorem	Sec. 5.3, 5.4	
October 5	Propagation of errors	Sec. 5.5, handout	HW 5 Due
October 10	Quality control (I)	Ch. 16.1–16.5	
October 12	Quality control (II)		HW 6 Due
October 17	Mid-term review: all material to date		
October 19	**Midterm Exam**		
October 24	Point estimation	Ch. 6	
October 26	Confidence intervals (I)	Ch. 7	HW 7 Due
October 31	Confidence intervals (II)		
November 2	Hypothesis testing (I)	Ch. 8.1, 8.5	HW 8 Due
November 7	One-sample hypothesis tests	Ch. 8.2–8.4	
November 9	Two-sample hypothesis tests	Ch. 9	HW 9 Due
November 14	Simple regression (I)	Ch. 12	
November 16	Simple regression (II)		HW 10 Due
November 21	Analysis of variance; design of experiments	Ch. 10	
November 23	Thanksgiving — no lecture		
November 28	Multiple regression	Ch. 13.4, 13.5	
November 30	Nonlinear regression	Ch. 13.1–13.3	HW 11 Due
December 5	Final exam review (I)		
December 7	Final exam review (II)		HW 12 Due

The final exam could be as late as December 20.