Quality Control and Statistics for Engineers

Course Policies and Syllabus

Instructor: Pantelis Vlachos BH 232K vlachos@stat.cmu.edu x8-1883 Mon 12:30-01:30pm or by appt.
Head TA: J.R. Lockwood BH 232D jlock@stat.cmu.edu x8-1884 TBA
TA: Woncheol Jang BH 232D wjang@stat.cmu.edu x8-1884 TBA
TA: Sam Behseta PH 226D sbehseta@stat.cmu.edu x8-3970 TBA
TA: Ricky Rambharat BH 132M sb2@stat.cmu.edu x8-2724 TBA

(All TA office hours will be held in SC 219)

Lectures: MF 11:30–12:20 — PH 100

Labs:
- Section A: T 02:30–03:20pm —BH 239
- Section B: W 09:30–10:20am —BH 239
- Section C: W 11:30–12:20pm —BH 239
- Section D: W 12:30–01:20pm —BH 239

WWW: http://www.stat.cmu.edu/~vlachos/220/

Required Text Statistical Methods for Engineers 1998, by G. Geoffrey Vining, (Duxbury/ITP), Cincinnati

Prerequisites
A solid understanding of first year calculus. This means that you must be able to integrate and differentiate standard functions (polynomials, exponentials, and logarithms), and you must understand the basic applications of calculus (finding areas, maximizing/minimizing functions, etc.).
Sufficient familiarity with computers to enable you to run several statistical programs.

Course Goals
The environment in which American industry is operating has dramatically changed over the last two decades, and further dramatic changes are likely. Foreign competition has intensified, and many products invented in America are no longer manufactured in America (e.g. consumer electronics). The causes for this are very complex, but one aspect is the significant improvements in product quality of foreign competitors’ products compared with comparable American products (e.g. American versus Japanese automobiles 15 years ago). Many American companies have embraced quality improvement programs (often called Total Quality Management or TQM). Moreover, some of these companies are expecting the engineers they hire to have training in quality improvement methods and ideas.
Statistics is an intrinsically important discipline in quality improvement, because improving quality means gathering and analyzing data to assess the state of a process, experimenting with methods to improve the process and assessing the benefits of alternative process designs. This course will introduce you to the
principles of statistical data analysis and modeling, statistical process control, and quality improvement. Upon successful completion of this course, you will have skills which will be useful not only for the rest of your studies at Carnegie Mellon but also in your career as a professional engineers. You will have learned the basic topics of statistics and quality control that you need to know to perform successfully in a summer internship or job interview.

While the goal of this course is to prepare you specifically to use statistics in your professional life, many of you will find that you will use your statistical training just as much outside of your job. Anytime you read a magazine or watch the news, you are inundated with various statistical findings that are being used to influence what food you eat, what medicines you take, what positions you hold on political issue, and how you vote. In order to make intelligent choices based on these statistical facts, it is helpful to have a basic working knowledge of statistical methods. As a result, an additional goal of this course is to make you a sophisticated and discriminating consumer of statistics in your day to day lives.

Coursework

Course Organization The course is organized so that you receive two lectures of new material on Friday and the following Monday. You then have a computer lab to practice the new material on Wednesday and homework on the new material due that Friday. The lectures will be delivered by Pantelis Vlachos, except for the week of November 8, when J.R. Lockwood will be the instructor. J.R. is the Head TA for the course, which means that he will be taking care of important organization issues, as well as making final decisions regarding labs and grading. J.R. will also be your main contact for the course. You should direct all questions requests to him, preferably via email. Feel free to cc me on them.

Homework Homework assignments will be due every Friday, except for weeks with exams. You should always show all of your work. You will not receive credit for simply writing down a numerical answer. Many students find some of the calculations simple enough to do in their heads, but there is no way for us to distinguish good mental math from cheating if explicit work is not shown. This holds even for the easy questions.

Computer output should always be edited and labeled. Homework should always be legible and stapled. You are allowed to collaborate with others on the homework, but your write-up should be your own. Be aware that homework is an important tool for you to learn the course material. Those who do not make an effort to work and understand the homework problems generally suffer on the exams. Homework must be handed in during class. If you can’t attend the class, make sure somebody else hands it in for you. There is no provision for handing in assignments before or after they are due. Students should hand in assignments even if they are incomplete. Assignments are not to be placed in either the instructor’s or graders’ mailboxes. Homework solutions will be available at a later lecture. There will be a total of 12 homework assignments. I will drop your lowest homework grade at the end of the course.

Labs There will be a computer lab once a week (for section A on Tuesday, and for the remaining sections on Wednesday). These will be used to practice the material that has been taught in the previous two lectures. During the short probability section of the course, you will be doing paper and pencil exercises and simulating probability distributions. After that, the majority of lab time will be spent analyzing real world data using the statistical software MINITAB.

Failure to attend and participate in the labs on time will affect your grade. You should be in the classroom no later than 10 minutes after the lab starts. Failure to do so will result in getting no credit for it. If you miss a lab, regardless of the reason, you should download it from the course web page and complete it on your
own time. There are no make-up labs. *Do not* try to attend another lab section. All lab sections are filled to capacity, and we do not have the space for switchers. If you have a credible reason for absence or coming in late, such as a documented medical excuse, you should provide that information to me. If your excuse is accepted, you will not be penalized for missing the lab section.

You should keep good track of all the labs we go through. Many notions, software tricks and ideas will be repeated in forthcoming lab exercises and you will be expected to know them. Lab TAs have little time to explain topics covered in previous labs, especially sequences of computer operations necessary for doing a particular statistical technique. This is another reason for making sure that missed labs are made up individually.

**Exams**  There will be two exams during the course and a final. The exam dates are: Friday, September 24 and Friday, October 29. The two mid-course exams will be administered during class time. **No makeup examinations** will be given. A student who misses an examination because of a medical reason must provide *documented* evidence of medical incapacitation to the professor. Other reasons for missing an examination must be discussed with the professor as soon as possible before the day of the examination and each case will be considered on an individual basis. The overall course grade for a student who misses an examination with a valid reason will be based on that student’s remaining course work. *A student who misses an examination without a valid excuse will receive a grade of zero on that examination.* Please plan ahead and make sure that you can attend the exams. *Please note that I have no control over the scheduling of the final exam. Be prepared for an exam on the final day of the exam period just in case that is when the exam is held.*

The examinations will be closed book and closed notes, except that you may use one 8 1/2 in. by 11 in. sheet of paper with whatever formulas, facts or explanations you find helpful. If calculations are required (and they may be), you will be expected to provide your own calculator. Sharing of calculators during examinations will not be allowed.

**Final Grades**  Final course grades will be based on the following breakdown:

- Lab Participation: 10%
- Homework Assignments: 20% (all assignments combined)
- Two Exams: 20% each
- Final Exam: 30%

**Course Materials**  Selected course materials will be available via the World Wide Web at [http://www.stat.cmu.edu/~vlachos/220/](http://www.stat.cmu.edu/~vlachos/220/)

**Bulletin Board**  Please subscribe to the course bulletin board: *academic.stats.36-220@andrew.cmu.edu.* We will use it to communicate announcements to the class.

**Cheating**  Cheating and/or plagiarism will not be tolerated. Please see the *CMU Student Handbook* for definitions of cheating and plagiarism, and the severe consequences of such behaviors.
Study Tips for Statistics or How to Use Your Study Time More Efficiently

1. Be aggressive about asking questions during the class. If you are confused there is a good chance that someone (or everyone) else is also confused. If it turns out that everyone else does understand, then I'll explain the concept after class.

2. Read your lecture notes over within 24 hours of lecture (or at least once before the next lecture).
   - Highlight or make marginal notes for important words and concepts. This will help fix ideas and will help you to actively learn the material. This review should take about 20-30 minutes and really yields a large return.
   - Re-do examples yourself, step by step, with pencil and paper. Examples often look easy when explained in class, but turn out to be much harder when you do them yourself.
   - Write down questions about things you do not understand. Bring these questions to the next lecture or to office hours and ask them.

3. **DO HOMEWORK PROBLEMS.** Actively doing problems is the only way to learn the material. Exam questions will probably be similar to homework problems.
   - Start early. Do not leave assignments until the night before they are due.
   - Try doing the problems yourself before discussing them with other people.

4. Make aggressive use of office hours. Ask thoughtful questions about things that you do not understand. Bring in problems that you cannot do. In other words, if you do (1)-(3) above, it will be much easier to isolate what is giving you trouble.

5. **Review solutions** to assignments and exams. Just because you do not lose points on a homework question does not necessarily mean you fully understand the question and answer. Also, the solutions should serve as a model for how to write, using proper sentences and paragraphs, discussions and interpretations of data analyses.

6. Please note that spending a lot of time working on a homework assignment or studying for an exam does not in itself entitle or guarantee you a good grade. It is necessary but not sufficient. Correctness and completeness of answers and the ability to communicate this clearly is essential for full credit.

7. We will make every effort to help you learn the course material, but you must also make an effort to utilize the resources that are made available to help you. Please come talk to us - not only when you are having trouble but also when things are going well.