MAE 301 Applied Experimental Statistics

Spring 2017

Classes: TTh 4:30-5:45, Tempe SHESC 340

Class Website: ASU Blackboard System Log on: https://myasucourses.asu.edu or http://my.asu.edu

Instructor: Yongming Liu

Contact Info: E-mail: yongming.liu@asu.edu Office: ERC 419, (480)965-6883

TAs: Haoyang Wei (hwei20@asu.edu)

Office Hours: TTh: 2-4, ERC 419 (Liu)
Open door policy: If I am in my office and the door is wide open, you can walk in for questions. You can always send me emails to request individual meetings.

Text: There is no required textbook. Some handouts from existing textbooks will be delivered during the semester. The following text is recommended for additional readings.

Walpole, R. E., Myers, R. H., Myers, S. L., & Ye, K. Probability and statistics for engineers and scientists. Pearson Education. 9th edition. ISBN: 0134115856

Course Description: This is a comprehensive course introducing students to key concepts in probability and statistics with engineering applications. Emphasis is placed on modeling variation in observations, characterizing its distribution, and making inferences with regards to quality assurance and control. Fitting multivariate models, experimental design and hypothesis testing are all critical skills developed in the course. All topics are developed utilizing data from engineering projects, simulations, and laboratory experiences.

Pre-requisites: MAT242, MAT 342 or MAT 343 with a grade of C or better.

Course Outcomes:
The focus of the course will be on developing students' conceptual understanding of statistical theory with the goal of effective design and conduct of experiments. Extensive use of professional software for data analysis will be required.

Statistics is a branch of mathematics that is integrally tied to its areas of application. The questions of interest for engineers are, therefore, fundamental to engineering statistics. Students will be engaged in designing experiments, analyzing data, critiquing the work of others, and in technical writing utilizing statistical arguments

Course Learning Outcomes

As a result of taking this course you will:

1. gain the ability to characterize the expected outcomes of an event, including assumptions behind measures, sources of error, effects of interactions among variables, and methods of sampling;
2. be able to design and conduct experiments to test the outcomes of engineering designs;
3. be able to model relationships among variables using uni- and multivariate methods;
4. demonstrate understanding of and ability to apply the theory of sampling, including the concepts of power and inference, to the design and communication of experimental methods and outcomes.
5. know and be able to apply the most common statistical tests..

Course Requirements

Attendance

Attendance is required for all sessions.

If you are ill, or have unforeseen circumstances hit your family (e.g., deaths in the family or other circumstances requiring your presence there instead of class), if you require accommodation for religious practices, or if you are engaged in University-Sanctioned Activities (as defined in ACD 304–02) let me know BEFORE class, preferably as soon as you find out. That way, we can make alternative arrangements for you to make up any excused absences or missed assignments affected by excused absences.

Unexcused absences, like just not showing up, sleeping in, going on a dream vacation, etc., are just that, UN-excused. You may choose to skip class, but you must also then, pay the consequences in lost learning and associated points on assignments.

Assignments

Assignments must be turned in when they are due. No late assignments will be accepted. Exceptions to this include only excused absences due to documented illness and other unforeseen circumstances as listed in the Academic Affairs Manual (ACD) and Student Affairs Manual (SSM). http://www.asu.edu/aad/manuals/index.html

Disability Accommodations

Suitable accommodations will be made for students having disabilities and students should notify the instructor as early as possible if they will require accommodation. Such students must be registered with the Disability Resource Center and provide documentation to that effect.

Academic Integrity

ASU expects and requires all its students to act with honesty and integrity, and respect the rights of others in carrying out all academic assignments. Each instructor, department, and college has specific policies related to academic integrity and how cases of dishonesty are handled.

For this class, ALL work, unless specified in writing by the instructor, is to be the **individual's own work**. Any reference to or use of the work of others must be cited. Any direct copying of the work of other students or of any materials available on the internet, or in books or other media, and passing it off as one's own work is considered **plagiarism**, and is a violation of ASUs student code of conduct (see https://provost.asu.edu/index.php?q=academicintegrity). This will result in

no points for the assignment and the student will be referred to the Associate Dean for Academic and Student Affairs for disciplinary action up to and including a grade of XE for academic dishonesty, suspension, or expulsion.

For **team** assignments, the work must represent **significant** contributions from all members of the team. Rules for plagiarism and other academic dishonesty issues apply to individuals within the teams for which any dishonest actions are found.

Grading:	In class quiz (random)	5%
	Homework	20%
	Semester-long project	25%
	Midterm	20%
	Final	30%

Your final course grade will be based on the percentage of total points you earn during the semester as follows:

A: 100%-90%
B: 89%-80%
C: 79%-70%
D: 69%-60%
E: below 59%

There will be no plus or minus grades given. If you want the rewards, work hard and you will have every opportunity to be successful at the highest level.

How to be successful in this course

Hard work wins. Each of you has the capacity to be a top-notch engineer. You have already demonstrated this capacity by being successful in your earlier courses. To turn this capacity into successful skills and knowledge, you need to work hard. Any gaps in your prior knowledge can be overcome with effort—applied in focused activities. Here are some ways to focus your effort:

1. Talk to your professor. Ask advice. Go to office hours and focus on aspects of the course you may be unclear about.
2. Turn in assignments early and ask for feedback. Your professor will help you revise the assignment, to overcome difficulties, and to learn more if he can see how you are doing *before* he has to grade it!
3. Utilize the tutoring center organized by the Associate Dean for Academic and Student Affairs.
4. Work Together! Organize Study Groups. People who study in groups do better than people who study alone. That is a well-researched finding.
5. Do ALL your work. In fact, don't just do all your assigned work, do some *extra* problems or *harder* projects to stretch yourself and to test your comprehension and skill for the required work.
6. When you receive feedback from your professor on your work. Use that feedback to learn—go over what you had difficulty with and learn it. If you did poorly on an assignment. Do it again

to show to yourself and your professor that you can learn from mistakes and that you are serious about being a good engineer. All engineers mess up some initial tasks. They use these mini failures to help them be successful in the long run.

Detailed course topics:

- Introduction to Statistics and Data Analysis
  - Measurement error and variability
  - Central limit theorem
  - Mathematical expectations
  - Data visualizations
- Probability distributions
  - Basic probability theory
  - Discrete distributions
  - Continuous distributions
  - Determination of distribution from observed data
- Hypothesis testing
  - Errors
  - Confidence interval
  - Different testing methods
  - Two-sample test
- Regression
  - Introduction to regression
  - Simple linear regression
  - Multiple linear regression
  - General linear regression for certain type of non-linear models
- ANOVA and experimental design
  - Analysis-of-variance (ANOVA)
  - Randomized block design
  - Factorial design
  - Response Surface Methodology
- Advanced topics
  - Bootstrap
  - Bayesian statistics

The syllabus is prepared by Dr. Yongming Liu on 01/02/2017. Part of the syllabus is from the syllabus by Prof. James Middleton (fall 2016) in order to keep the consistent course objectives, outcomes, and grading systems.