Statistics 158:
Design and Analysis of Experiments

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Department of Statistics

UC Berkeley, Spring 2018

Syllabus

Lecture: Tu/Th 9:30-11a, 50 Birge Hall
Discussion Sections: F 12:00-2p (101) & 3-5p (102), 342 Evans

Instructor: Dr. Haiyan Huang
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Syllabus

About This Course: "To consult the statistician after an experiment is finished is often merely to ask him to conduct a post mortem examination. He can perhaps say what the experiment died of." – R. A Fisher

Prerequisites: STAT 134 and 135 (or consent of instructor). STAT 135 may be taken concurrently. STAT 133 is recommended.

Textbook: *A First Course in Design and Analysis of Experiments* by G. W. Oehlert (out of print, online) http://users.stat.umn.edu/~gary/Book.html

Additional readings will be posted on bcourses; Homework and exam questions will be based on the lectures!

Grading

Your final grade will be a weighted average of your average homework score (30%), midterm (20%), final (25%) and a team-project (25%).

- **Homeworks:**

  - Problem sets will be assigned throughout the semester, for a total of 6-7 assignments. You should download the assignments from bcourses. Each problem set is to be turned in about 7-14 days later in lecture.
  - Homeworks will be a combination of computational exercises and data analysis using the computer. Mathematical computations can be handwritten, all data analysis must be type written. R code must be given in the back of homework (more information about turning in homework will be provided by your GSI).
  - All students will have 5 late days that they may use for turning in homework after the due date. This will take the place of any

extensions due to sickness or conflicts, unless there are extenuating circumstances, so use them wisely.

- The final homework score will be the sum of all homework grades. This means that each assignment may not be counted equally.
- Not all problems will be graded, and you should review the solutions carefully for those problems for which you don't get graded feedback.
- Students can discuss homework assignments in groups of at most three. Each student must write up his/her own solutions individually, and must explicitly name any collaborators at the top of the homework. Any evidence of cheating will be subject to disciplinary action.

- **Midterm:** The in-class midterm is tentatively scheduled on Thursday March 8 (could be modified later based on the class pace).

- **Final:** The final exam will be cumulative. The exam is on Wednesday, May 9 (11:30am-2:30pm).

- **Project:**

  – There will be a project where you will conduct your own experiments. They will be done in small groups of 3 students. The project will have intermediate steps along the way to help you pace yourself and make sure that your experiment is progressing successfully. You will be graded on the quality of the writeup as well as the quality of the design and analysis. You will not be graded on the outcome of the experiment.

  – Each member of the group will also individually evaluate the other members of the group, and the evaluations will not be shared with other members of the group. If there is a problem that appears based on the evaluations, different students within the group may receive different grades, though I plan that this is the exceptional case. This can be true even if no member of the group "complains" about other students, but merely that I found that the division was inequitable, or that the group did not jointly contribute to the components enough

to deserve equal division of the grade (good or bad).

– After the first initial proposal is turned in, I will give people the opportunity to switch around in groups if it turns out the group is not working well. After this point, it will be difficult to change group membership. After that point, if you feel that there is a problem in your group, you may discuss it with me privately so as to find an equitable solution with respect to finishing the project.

– It is suggested that you start finding your teammates right after the first lecture.

Topics

- Analysis of variance and hypothesis testing

- Randomization

- Factorial designs

- Fractional Designs

- Blocking

- Repeated Measures / Split-plot designs

- Relation to Linear Regression

- Response surface methodology

- Modern topics such as active learning, Bayesian adaptive design and reinforcement learning (If time permits)

Other logistics

- **Lab:** Lab time will be mainly spent working on practice problems, how to conduct data analyses in R, and also running experiments. In the week when an assignment is posted, some of the lab time will be devoted to review the homework questions. We assume familiarity with R. If you do not have experience with R, in the first week you should go through online introductions to the programming language.

- **Class Activities and Attendance:**
  - Attending lectures will be critical for doing well in the class. I encourage active engagement in the class, and will pose questions and call on people during class.
  - Handouts given in class deal with in-class activities and discussions and will generally not be posted online.

- Several experiments will be run in class or section and attendance is required. Results from the experiments may be needed to do homework problems. More information will be given later in the semester.

- **Email:**

  - If you wish for your email to make it into my or your GSI's inbox, the subject of your email must contain the text "158".
  - Neither I nor the GSI explain course material over email and will not respond to emails with such requests. Please come to my office hours, discussion section, or GSI's office hours (or schedule another time to meet if you have irreconcilable conflicts with the office hours).
  - I respond to email regarding the class roughly once a day, and almost never in the evening nor weekend.

- **Academic Honesty Policy:**

  - Homework must be done independently. If a homework problem is based on an experiment run in class or section, only the experimental results can be done jointly; answering HW questions about the experiment must be done independently. Obtaining and/or using solutions from previous years or from the internet, if such happen to be available, is considered cheating. With other classmates, you may discuss issues about the homework, but you must not sit down and do the assignment jointly.
  - Please note that while the homework is time-consuming, they are en masse 30% of your grade; the cumulative weight is large, but becoming desperate over single questions is not worth the risk of cheating!
  - For projects students naturally will work with the students in their group, but no other students.

- For exams cheating includes, but is not limited to, bringing written or electronic materials into an exam or quiz, using written or electronic materials during an exam or quiz, copying off another person's exam or quiz, allowing someone to copy off of your exam or quiz, and having someone take an exam or quiz for you.
- In fairness to students who put in an honest effort, cheaters will be harshly treated. Any evidence of cheating will result in a score of zero (0) on the entire assignment or examination. I will always report incidences of cheating to Student Judicial Affairs, which may administer additional punishment.

- **Disability:** If you need accommodations for any physical, psychological, or learning disability, please speak to me after class or during office hours. Please note that if you must make arrangements in a timely manner (through DSP) so that I can make the appropriate accommodations.