USF Math 371 (Statistics with Applications), Spring 2015

Syllabus
January 26, 2015

Instructor: Dr. Mario MICHELI, mmicheli@usfca.edu, Harney (HR) 222A.
Class time and place: Tuesdays and Thursdays (TR) 12:45-2:30pm, in Lo Schiavo 209.
Office hours: on Mon. 3:00–4:00 p.m. & on Wed. 1:00–3:15 p.m., or by appointment, in Harney 222A.
Prerequisite: Math 370 (Probability with Applications), or permission of instructor.
Home page for the course: http://www.cs.usfca.edu/~mmicheli/MATH371/index.html/
Canvas: I will use Canvas to post grades for homework assignments and exams.

On Statistics: Statistics is widely considered an exciting, dynamic, and intrinsically interdisciplinary science. The work of statisticians powers search engines like Google, has proven critical to the exploration of the human genome, and is used by hedge fund managers to detect arbitrage opportunities (risk-free trading strategies that yield profit with positive probability) that are profitable only on average (called statistical arbitrage). The New York Times recently declared that statisticians will enjoy one of the highest-paying, highly-coveted careers over the next decade.

Topics of this course: Time permitting we will cover all of the topics and develop all the skills below.
- Model and simulate the occurrence of events using probability distributions that are particularly important to statisticians, including the beta, Student’s t, chi-square, and F distributions.
- Understand the conceptual underpinnings of point estimation and both elementary and compound tests of hypothesis.
- Understand, and be able to implement, randomization-based alternatives to traditional hypothesis tests and traditional confidence interval construction techniques.
- Be able to describe some of the various attributes that make an estimator attractive, like unbiasedness, sufficiency, consistency, completeness, uniqueness, and minimal sufficiency.
- Understand what it means for a statistical test to be a uniformly most powerful test.
- Develop a sensitivity to, and a working knowledge of, the importance of nonparametric alternatives to the usual parametric hypothesis tests.
- Develop and understand how to appropriately implement regression and Principal Component Analysis.
- Understand the Bayesian approach to statistics.
- Cover important applications of statistics to genomics, econometrics, population dynamics, big data problems and many more.

In general, this course will prepare successful students for undergraduate- and graduate- level research projects in the social and natural sciences, as well as for further study of statistics, probability theory, and stochastic analysis at the graduate level.

Student learning outcomes: By the end of the course a student will have learned to:
- Determine whether a problem lends itself to a mathematical solution.
- Design a mathematical solution when appropriate.
- Implement a designed solution, or identify and correct problems with the design.
- Evaluate the validity of a solution and its relevance to the original problem.
- Practice, appreciate, and apply the skill of rigorous thinking.
- Approach problems in a more proficient and creative way.

Homework: There will be 9 homework assignments, due on Thursdays at the beginning of class (they are approximately bi-weekly; see the attached lecture-by-lecture syllabus to see the due dates). Each homework assignment will have a maximum score of 20 points. To receive full credit for your work, you will have to (1) show your reasoning and (2) write clearly. No late homework will be accepted, but the (one) lowest homework score (out of 9) will be dropped. Some assignments will require programming in Python, Matlab, or R. If you are not familiar with the languages, you will learn the necessary amount in this course.
Quizzes: None. Yay!

Midterm and final exams: We shall have two in-class midterm exams, and a final exam. During the exams you will not be allowed to use books, printed material, notes, calculators, cell phones, or other electronic devices. Besides pencil and paper, you will be allowed to use the following “cheat sheets”:

- **First midterm:** one side of a letter-sized page (8.5” × 11”) of your own hand-written notes;
- **Second midterm:** two sides of a letter-sized page (8.5” × 11”) of your own hand-written notes;
- **Final exam:** three sides of a letter-sized page (8.5” × 11”) of your own hand-written notes.

For example, during the second midterm you can use the one-sided sheet that you prepared for the first midterm, plus an additional side. As far as the material that you will be expected to know for the exams:

- **the first midterm** will be on what we cover until Thursday, February 26 (included);
- **the second midterm** will be on what we cover until Thursday, April 16 (included);
- **the final exam** will be cumulative, but with more emphasis on the the last few weeks of class.

Mark your calendars for the midterm and final exam dates, as no make-up exams are given. In the case that you miss a midterm exam with a valid excuse (i.e. a documented sudden medical or family emergency), your final exam grade will replace the missing midterm grade. It is your responsibility to arrange your travel schedule so that you are present for the final exam.

**Final grade breakdown:** Your grade will be will be computed as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm #1</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm #2</td>
<td>20%</td>
</tr>
<tr>
<td>Final exam</td>
<td>40%</td>
</tr>
</tbody>
</table>

I will be grading the class on a curve. The course average (typically a B−) will depend on how satisfied I will be about the general outcome of the class.

**In the Classroom:** Students are expected to arrive to class on time and pay attention in class. While in class, you are expected to refrain from listening to a portable device, talking on a cell phone, allowing cell phones to ring, using a computer, texting, sleeping, doing homework, or reading newspapers and magazines. My lectures are often very interactive and call for student participation, it is paramount that each student feels comfortable speaking up in class. As such any student behavior that is detrimental to an open and respectful environment is not acceptable and maybe subject to a lower grade and or removal from the class.

**Withdrawals and Incompletes:** The last day to withdraw from the course is Monday, April 13. If you plan to withdraw from the course, it is your responsibility to complete the necessary paperwork by this date. You will not be allowed to withdraw after this date. An incomplete grade will be given only if you have a serious emergency, such as a medical condition, that prevents you from completing the course. You must produce proper documentation and must be passing the course with most of it complete. An incomplete grade will not be granted to avoid failing the course.

**Academic honesty:** As a Jesuit institution committed to *cura personalis* – the care and education of the whole person – USF has an obligation to embody and foster the values of honesty and integrity. USF upholds the standards of honesty and integrity from all members of the academic community. All students are expected to know and adhere to the University’s Honor Code. You can find the full text of the code online at [www.usfca.edu/fogcutter](http://www.usfca.edu/fogcutter). You are encouraged to discuss the homework problems and course material with other students and with he instructor during office hours. However, the homework that you hand in should reflect your own understanding of the material. You are NOT allowed to simply copy solutions from other students or other sources. Complete academic honesty is expected during exams. Cheating on an exam will result in an automatic failing grade (F) for the course.