AMS 5 – Statistics

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Course contents and objectives

Our main goal is to help a student develop a feeling for experimental variability, a feeling for the inherent uncertainty when measuring quantities in the real world and how to use logic and basic scientific reasoning to extract useful information from the experiments. We intend to do this with the use of real world case studies and examples.

We take the students through the main aspects of a statistical experiment. We begin with a description of what makes a good experiment (designed experiments), a bad experiment and also observational studies – which are less than perfect, but often are the only study one can perform. We also look at the correct ways to choose individuals for an experiment (sampling techniques) and possible maladies in the way these choices are put in practice (bias). We will then move to data analysis techniques, how to summarize characteristics of a data set (average, standard deviation and percentiles) and how to represent it graphically (histograms and plots). We introduce the normal curve and show how useful it is in our statistical endeavors. The concepts of association between two variables (correlation) and predicting one variable value when given a value of another variable (linear regression) are also covered. We study the basics of probability and show how we can use the normal distribution to calculate probabilities. We close the course with ideas in statistical inference; these are mathematical techniques that allow someone to make a generalization based on a sample of individuals. We cover confidence intervals for population averages and percentages and confidence intervals for difference between two population's parameters too. If there is time we will cover the hypothesis testing procedure.

Required Text

Freedman, D., Pisani, R., and Purves, R., (2007), Statistics, Fourth Edition. New York, Norton.

There will be 2 books on reserve at the Science Library.

Self-diagnostic test

Our experience teaching Statistics shows a significant percentage of the students were not "trained" at doing the kind of reasonings and answer's justifications required in this class; it is not uncommon that 'A'-level students (even in other mathematics courses) find out in the midterm that they need to think about these class's problems in a different way than they have ever done before. We want to help you find out if you need extra work to prepare for Statistics well before the midterm. So we found out a way to give students a foretaste of what kind of thinking they are going to be asked to do, by producing a self-diagnostic test. This test will not count for your final grade in fact, if we don't have the graders, most likely you will be the only ones to look at your own answers.

In your first section, the TA will give you a few minutes to start working on it, and will also show what kind of answers we want.

These are the main things the student should extract from the test:

- Am I able to find the logic of the questions clearly? or do I have difficulties seeing the point of the question?
- Am I able to express my reasoning clearly and succinctly? or do I have to resort to lengthly answers and although I intuitively see the point, I can't put it down in writing?
- Is this the first time I am seeing these kinds of questions?

If the self-diagnostic test helps you find out some difficulties in your mathematical reasoning, there is help:

- AMS2 - Pre-Statistics is a course especially designed to help a student transition into Statistics. Check the catalogue for when it's offered and maybe it's a good idea to attend it before attempting to take Statistics
- There are wonderful workshops offered by the Academic Resource Center, given by experienced staff. Check below in the Tutoring section for further information.
- There are great books out there that help you make your first steps in logical/sound reasoning. I recommend Beardsley's "Thinking straight". They are very easy to read, and have great exercises to help you practice a new way to organize your thoughts and help your self-confidence.

It is your decision which of the proposed remedies you will take.

Lectures

Media Theater M110 (check a campus map at `http://maps.ucsc.edu/`). Tuesdays and Thursdays from 2:00pm to 3:45pm.

Discussion sections

These are times set up for you to get help solving the weekly practice problems. These problems are fundamental to help you do the graded problems well.

Double check times and locations at `https://pisa.ucsc.edu/prd/sr0060/`. Check a campus map at `http://maps.ucsc.edu/` for locations.

Discussion section 01A to be held at Engineering 2 194 on Mondays, from 12:30-1:40pm.

Discussion section 01B to be held at Earth & Marine B214 on Mondays, from 3:30-4:40pm.

Discussion section 01C to be held at Physical Sciences 136 on Tuesdays, from 6:00-7:10pm.

Discussion section 01D to be held at Physical Sciences 136 on Tuesdays, from 7:30-8:40pm.

Discussion section 01E to be held at Engineer 2 194 on Wednesdays, from 11:00-12:10pm.

Discussion section 01F to be held at Oakes Academy 106 on Wednesdays, from 3:30-4:40pm.

Discussion section 01G to be held at Earth & Marine B214 on Thursdays, from 8:30-9:40am.

Discussion section 01H to be held at Engineering 2 194 on Fridays, from 8:00-9:10am.

Discussion section 01I to be held at Engineering 2 194 on Fridays, from 9:30-10:40am.

Sections are **not** optional. They are part of the requirements to pass this course and attending them is paramount to getting a satisfactory result.

There will be a quiz during all sections. This is a way to reward the students who take the time to come to sections and, at the same time, to allow them to see how they are doing in class with very easy quick tests.

Office hours

These times will be very important for your work, because these are the only places where students can discuss the homework problems that are to be graded later in the week. These are also a wonderful opportunity to discuss previous homework problems and find out why you missed some of the points in the grading.

Tentative schedule. Please get in touch with us in case you cannot make any of the times below. Office hours are an important part of the learning process, and we want to make sure that everyone has access to at least one of the office hours sessions per week.

Bruno: Tuesdays and Thursdays from 4 to 5pm at Jack Baskin building, room #141 or Jack's Lounge (I'm usually in one or the other).

Teaching Assistants: Jing at room BE146 (Wednesdays, 10-11am and 2-3pm), Vaneet at room BE314 –this is in the old Baskin building– (Fridays from 3-4pm), Jacob at room BE144 (Fridays, 11 to noon). We are committed to give all the support we possibly can, so let us know if you need additional office hours.

Tutoring

This class several forms of support from the Academic Resource Center (ARC), check their website at `http://www2.ucsc.edu/arc/`.

Modified Supplemental Instruction (MSI) is our main tutoring support from the AR-Center. More news during lectures. Their web site is at: `http://www2.ucsc.edu/lss/msi.shtml`.

More free tutoring services can be found at
`www.cse.ucsc.edu/advising/undergraduate/current/tutor.html`

It is our experience that students do not use tutoring sessions (for one reason or another, most quite un-rational) although they need it badly. In order to motivate you a little further to make use of them, I am allowing students who attend at least 5 sessions to drop an additional worst score in quizzes and homework (ie. instead of just dropping one worst score in each, the student will be allowed to drop the two worst scores).

Quizzes

There will be one quiz per section, they will be very easy and short; the intention is to both reward the students for attending section and also to give everyone an idea on how well they are doing on a very basic level.

Quizzes will account for 10% of the final grade. Everyone will be allowed to drop the lowest score. This is to account for possible incidents that might keep you from attending a particular section; **therefore there is no need to ask to re-take quizzes**. You will also be allowed to drop an additional worst quiz score in case you complete more than 5 tutoring sessions with MSI.

Any questions regarding quizzes's scores or their grading should be addressed to your own TA.

Homework

There will be one set of homework problems per week, these will work very much like small weekly tests, although you are allowed to discuss some questions during office hours. It's very important you find out the reason why you missed points in the homework problems because, most likely, the same low grade will happen in the exams if you try to answer the same way. Homework is fundamental to help you prepare for the tests.

The homework will always be due on Friday by 5:00pm. There is a drop box with the name of your TA at one of the entrances to Jack's Lounge (check map on class's website).

Whenever possible, homework solutions will be posted in the glass showcase at Jack's Lounge (just above the drop-off boxes) shortly after the deadline. The scores will be posted on the course's web site.

Graded homework will be given back in section.

We have a precise system for grading all your homework and it does not work with late homework. **We have never accepted late homework in the past**.

The average of homework scores will account for 10% of the final grade. Everyone will be allowed to drop the lowest score (you will also be allowed to drop an additional worst homework score in case you complete more than 5 tutoring sessions with MSI).

Any questions regarding homework's scores or grading should be addressed to your TA.

List of priorities when working on homework:

1. Understanding each problem. This includes checking the corrections and solutions when you get your homework back. If there's anything you don't understand, talk to us about it.

2. Try to complete as much of the homework list as early as possible. If you can't do it before the deadline to hand the problems for grading, just give us whatever you did. Make sure, though, that you finish all the problems, even if after the deadline.

3. If you have difficulties in a particular set of problems, choose extra problems and work on them together with Bruno, a TA or your favorite tutor.

4. **By the time you get to the exam, make sure you understand all the problems in the homework list – "graded" and "practice" problems alike**.

Midterm

This test is mostly a midterm "reality-check", to confirm whether you are understanding the concepts correctly; it will contain questions similar in complexity to what you will find later on in the final exam.

The midterm will take place on Tuesday, May 6th, in class (although we might set up an additional room to accommodate everyone comfortably - there will be news about this in class and on the class's website), this exam will cover all that was taught up until the last class before the date of the exam.

The exam's score will contribute 30% to the final grade.

You are allowed only the following in the test: **a 4-function calculator, a pencil and an eraser**.

Official solutions will be posted in the glass case at Jack's lounge at Jack Baskin's building just after the exam.

The final will include problems of the same type as the ones in the midterm (ie. the final will include all what was taught in the quarter), so make sure you understand all the mistakes you (eventually) made in the midterm, so that you don't repeat them in the final.

Important note. Unfortunately we cannot set up midterm re-takes; If you can't make it to the midterm we will calculate your final grade with 10% of your average homework score, 10% of your average quiz score and 80% of your final exam.

Any questions about the scores on the midterm should be addressed to Bruno.

Final exam

This is the most important item in your final letter grade, it will cover everything that was taught during the quarter, there is a minimum grade requirement, and contrary to all the other scores in this class, the final scores will not be curved. This is the chance for students to show how much they know about Statistics, in particular, what was taught during the quarter.

The test will take place on Tuesday, June 10 from noon to 3:00 pm at Media Theater M110 (double-check at `http://reg.ucsc.edu/soc/2082/sched.html#Spring2008`).

You are allowed only the following in the test: **a 4-function calculator, a pencil and an eraser**.

The exam will cover **all** that was taught during the quarter [1].

The exam's score will account for 50% of the final grade. Since the final exam is the only chance we have of testing you (individually) on your knowledge of the full content of the

[1] Once more, having looked carefully at your answers in the homework and midterm will be a good guide to preparing yourselves for the final exam.

course, we require a minimum of 60% in the final exam in order to pass the class (regardless of your total final average). You will see that once this score has been overcome, you will have a nice final grade.

Official solutions will be posted in the glass case at Jack's lounge at Jack Baskin's building.

Important note: Before you enroll in this class, make sure you check the date of the final exam and that you can make it. We will only allow final exam re-takes in case a truly disastrous event keeps you from taking it. I mean disastrous events only, not the fact that you want to take an earlier flight home, or that it is just not convenient.

Any questions about the scores on the final should be addressed to Bruno.

Passing this class

The final grade is calculated with the following formula:

0.1*(average homework scores) + 0.1*(average quiz scores) + 0.3*(midterm score) + 0.5*(final exam score)

You will have a C (or a 'Pass') if you have at least 60% as your final score **and** 60% in the final exam.

Course's web page

Address: `http://www.soe.ucsc.edu/classes/ams005/Spring08/`

The web page will contain the list of homework due, score list (updated weekly) and most likely some notes from the lectures. It will also contain any announcements related to the course and all the information related to it.

Protected material can be accessed by using the following information,

username: ams005

password: ariel71

Class Rules

No type of collaboration between students is allowed in quizzes, the midterm or the final exam. Not complying with this rule will initiate a very unpleasant procedure for both the students and us, so please don't let yourself get to the point where illegal collaboration becomes an option; start working from the first day of class and stay engaged with us in sections, office hours and tutoring sessions.

You can work together on homework, but 'carbon copies' are not acceptable.

Not complying with these rules will result in a score of zero and a serious conversation with Bruno.

Always substantiate any answer you give to any question in this class, even if you are not explicitly asked to justify your answer. "True" or "false", "yes" or "no" answers have to be justified, either with words or calculations. This also means you have to work on giving clear, succinct answers.

Late homework is never accepted. We have a system set up for grading homework: graders pick them up on Fridays at 5pm sharp and we publish the solutions also at that time, so accepting late homework will affect negatively the way the system works. Don't

forget that the main goal of homework is to get it done, not getting it graded (even though we can all agree getting both is the ideal!).

How to improve your chances to get a good result in this course

Take as much advantage as possible of the **office hours**. They are a wonderful opportunity to get an almost one-to-one tutoring. I will be able to pay closer attention to you individually and therefore help you more efficiently.

Unfortunately our education system still expects the students to arrive at this school with good strategies for working/studying, and the sad reality is that many times they don't. In fact, there is a resource that I strongly advise all students to take, it's a set of workshops that (in my opinion) should be compulsory to all students since they are so useful; more information at `http://www2.ucsc.edu/csas/#workshops`.

Although we are very well aware that each person is an individual and running the serious risk of sounding paternalistic, allow us to give you a few ideas on how to improve your studying of mathematics.

- Read the book. Many people give up after a first read of the book, giving in to frustration. Please keep in mind that no one expects you to understand everything on a first read. No one can do that. Most typically a student needs to read the material two to four times until he/she starts feeling comfortable with the new concepts.

- Study the examples. These are the "doors" that lead to the solution of most of the exercises. It is almost pointless to tackle homeworks and quizzes if one doesn't understand the examples. The usual procedure should be to re-read the theory in case you have difficulties with a specific example.

- Work out the problems given in the book. Feel free to do as many as you feel like. Start with the easy ones first. If you have problems, go back to the examples, maybe you just skipped something important.

- Organized work. Be organized and write down your calculations in a clean and ordered way, problem solving is much simpler if one has organized, clear calculations. Usually "messy writing" $\Longrightarrow$ "messy thinking".

- Make full use of lectures, sections, office hours and labs. Don't be afraid to make questions. The more you interact with the teachers the more likely you will be able to absorb more knowledge. Come to us as many times as are necessary!

You can and you **should** come to me for help during any of the stages described above, but you'll be able to take more from our meetings if you have gone through the first items in this list on your own at least once.

I look at this course as a team work and the main goal of all of us is to help you learn mathematics and help you have a good final grade.

I welcome you to this course and we hope that by the end of it you feel that you have learned something useful and at the same time had some fun doing it!