Math 207, Probability and Statistics
Spring Semester, 2012
Dr. Evelyn Bailey

Office hours: Posted weekly on the class conference

Reader: Super Crunchers by Ian Ayres

Materials: Typed formal notes with homework problems, class notes, and articles are provided on the Learnlink class conference; a calculator (TI-84, or equivalent).

Content: Probability, Bayes Theorem, counting, probability functions (in general), Chebyshev's Theorem, discrete distributions (binomial, hypergeometric, Poisson, uniform), continuous distributions (Exponential, Normal, Uniform), Central Limit Theorem, visual displays of data, measures of central tendency and of variability, classification of data, Confidence Intervals, Hypothesis Testing (for means and for proportions, for one and two samples), Chi Square goodness of fit tests and Contingency Tables, one-way ANOVA, simple linear regression and correlation, nonparametric tests (median, Wilcoxon Rank Sum Test, Kruskal-Wallis Test). The first half uses calculus to explore concepts of probability upon which statistics is based.

Goals: At the end of this course students should be able to:

* work various probability problems,
* understand the role of functions in statistics,
* categorize data,
* recognize several standard distributions,
* analyze interval data involving difference of means, difference of proportions,
* check for inherent assumptions for the statistical models in this course,
* interpret relationships in bivariate data,
* compare distributions of responses,
* analyze data using rankings (nonparametric statistics),
* understand the role of statistics in analyzing data and in inference.
* describe major misuses of statistics,

In addition, each student will be expected to actively participate in a class project that includes gathering and analyzing data, writing a formal report, and presenting this report to the appropriate audience. The class project takes time and needs all students participating. Out of class meetings with other students are necessary.

Grading: It is assumed that students enrolled have completed Calculus II, either Math 112 or AP score of 4 or 5. Concepts from calculus will be briefly reviewed as needed but not taught.

Grades will be determined by student performance on four different problem sets, two group experiments, a class project, responses to the reader, and a final exam.

In addition, there will be opportunities for **extra credit work**. Extra credit problems are usually not the standard type problems but those that require more thought and some original work. **You must do work independently for credit on bonus work unless otherwise indicated and pledge that you have done so.** Points earned on extra credit will be added to your total points that will determine your grade.

The total sum of points for each student determines the student's grade. Points are determined as follows:

4 problem sets @ 100	400
2 small group experiments @ 50	100
1 Class Project	150
3 Responses to the Readers @50	150
1 final exam	200
Total	1000 points

In general,

900 points and up	A, A-
750 to 899 points	B+, B, B-
600 to 749 points	C+, C, C-
below 600 points	F

Some Policies:

All **problem sets** will be given out at least one week before the due date. All problem sets are due at class time on the dates indicated. Fifty points will be deducted per day for late problem sets. Emergencies will be handled on an individual basis.

For work on problem sets, you will select a partner with whom to work. (In case of an odd number, a student may elect to work alone or three students may get permission to work together). You and your partner may use your own notes (those you have taken in class), the notes provided for this class, and your calculator. You will turn in ONE problem set with signatures of those to be credited. In addition, summarize the contributions made by each person.

Instructions regarding **group experiments** will be explained in class, on the day the experiment is assigned. There will be two experiments, worked in small groups (two or three students each). Dates are given on the attached outline.

The **class project** will be in the form of a survey. We will elicit opinions related students' opinions about an ideal Math Center including atmosphere, help, size, hours. Students will design, pilot the survey. The class will collect data and analyze the data. The end result will be a presentation along, brochure, and final typed report.

The class project includes components of a good experimental design: determining well-defined question(s) and researching information related to what is to be accomplished, designing and piloting a survey or an interview format of questions, finalizing a survey or interview outline, gathering data (random sampling), analyzing data, making conclusions, determining concrete recommendations, and presenting findings to the appropriate audience.

The class elects a chairperson and secretary for the class project. The secretary keeps up with what is accomplished in class meetings and posts information from other class members so that there is a complete record of the procedure. The chairperson conducts class during those times we work on the class project. The chairperson is to keep Dr. Bailey informed of progress and to discuss any problems.

Each person in the class is expected to contribute substantially in many and various ways. To this end, each student will keep a **log** that includes the individual's ideas, thoughts, and contributions to the project along with a record of what and when his/her contributions took place. This log may be kept on the student's computer and printed out at the end of the semester OR the log may be recorded in a notebook

The class project is due (typed, polished, complete copy posted on the class conference) no later than **April 13**. Individual student logs are due **April 25**. The date for the presentation can be determined after consulting with those who will be invited but should be done sometime **between April 16 and April 27**. The presentation includes an appropriate power point.

It is important to stay on schedule so as to have a complete project of which you may be proud. The syllabus topics will be shifted to accommodate the presentation and needed time to work on the project in class. An example is posted on the class conference.

Periodically, your instructor will post (by number of checks) the evaluation of your contribution to the class project This evaluation will be based on postings on the conference, contributions related to the project during class time, activities related to the class project, and other visual and auditory information from others in the class. The log is the final verification of individual participation for each participant's grade (number of points) on the class project.

Homework problems may be worked with other members of this class. Some solutions to some homework will be posted on the class conference. You will need to keep your class notes and homework problems well organized and complete so that they will be useful to you on your problem sets and the final exam.

Three individual assignments from the **reader**, *Super Crunchers,* are included on the schedule. Each student completes these assignments **individually**.

Responsibilities**:**

* Each **student** has the following responsibilities:

1. Come prepared and on time to every class.
2. Complete all work on time with proper thought.
3. Consider that it is not always the fault of the instructor if the student doesn't understand the material. Use your outside help (office hours, SI sessions, e-Reserves)
4. Treat the instructor and peers with respect.
5. Ask questions. Asking questions is a sign of maturity, not ignorance, as long as the student thinks clearly before asking.
6. Understand that the instructor is not trying to "nit pick" when grading and remember that grading is the responsibility of the instructor. Accuracy is important in this class!
7. Actively participate in the class project by contributing as needed to the outcome.

***** The **instructor** has the following responsibilities:

1. Come prepared to every class.
2. Design each class so students can accomplish the cognitive objectives listed in the syllabus.
3. Provide appropriate tips for studying and study materials as seem appropriate.
4. Create a mutually respectful classroom environment.
5. Return tests and quizzes in a timely manner so that students will know their grade.
6. Grading, as far as possible, to be consistent and impersonal even though students might not agree with the decisions concerning partial credit.
7. Providing class time for students to organize, to work together, and to discuss the class project.

THE HONOR CODE OF OXFORD COLLEGE APPLIES TO ALL WORK IN THIS CLASS! YOUR PROBLEM SETS AND ANY OTHER WORK ARE PLEDGED TO BE IN ACCORDANCE WITH INSTRUCTIONS GIVEN FOR THE ASSIGNMENT.

Important dates:

January 27	Readings I due
February 6	Group Experiment I due
February 15	Problem Set I due
February 20	Readings II due
March 7	Problem Set II due
March 12 - 16	Spring Break
March 28	Readings III due
April 11	Problem Set III due
April 13	Class Project due (hardcopy, electronic copy final report)
April 20	Group Experiment II due
April 16 – 27	Presentation on one day (power point, student presenters)
April 25	Individual log for class project due
April 27	Problem Set IV due
April 30	Last class day
May 2	Reading Day
May 7	9:00 am deadline for take-home portion of the final exam

Final exam will be given according to the college schedule. There will be a take-home portion and an in class portion of the final exam.

OUTLINE

INTRODUCTION

Wednesday, January 18 — Introduction, Orientation, Class Project
Friday, January 20 — Jerome Cardan, Model Building

Reader Assignment I, due 1/27
Read the Math 207 project posted on the conference. Prepare any questions you may have about the study.
Problems in typed notes.

PROBABILITY

Monday, January 23 — Definitions, Addition Rule, Multiplication Rule,
Wednesday, January 25 — Bayes Theorem, Birthday Problem, Craps
Friday, January 27
Monday, January 30

Know definitions: experiment, sample space, certain event, impossible event, mutually exclusive, independent
Reader Assignment I due on 1/27
Group Experiment I assigned Monday, due 2/6

Wednesday, February 1 — Discuss Class Experiment (and any time during class as
Friday, February 3 — needed from now on…) and catch up

Finish problems on probability in the typed notes.

COUNTING

Monday, February 6 Fundamental Theorem of Counting, permutations, combinations

Group Experiment I due

Wednesday, February 8 Probability and Counting

Finish problems on Counting in the typed notes.
Receive Problem Set I on Wednesday, due 2/15

FUNCTIONS (THEORETICAL)

Friday, February 10 Random Variable, Density Functions

Be able to explain the difference between a pdf and a cdf for continuous and discrete functions.

Monday, February 13 Joint Density Functions, Marginal Distributions
Wednesday, February 15

Problem Set I due 2/15
Problems in typed notes.
Know the following definitions: random variable, joint probability distribution, marginal distribution, conditional distribution, independence.
Reader Assignment II given on Wednesday, due 2/20.

DISCRETE FUNCTIONS

Friday, February 17 Discrete Functions, Binomial Distribution

Monday, February 20 Poisson, Hypergeometric, and Uniform Distributions

Problems in typed notes.
Know the following definitions: expectation, moments (about the origin and about the mean), mean, variance, skewness, kurtosis.
Reader Assignment II due on 2/20

CONTINUOUS FUNCTIONS

Wednesday, February 22 Continuous Functions, Chebyshev's Theorem, Normal
Friday, February 24 Distribution, empirical rule, Central Limit Theorem

Monday, February 27 Normal to approximate the binomial as a model, uniform

Problems in typed notes
Receive Problem Set II on Monday, due 3/7

DATA AND MEASUREMENTS

Wednesday, March 2 — Descriptive Statistics

Friday, March 5 — Data measures and classification
Monday, March 7

Problem Set II due on 3/7
Problems in typed notes.
Know the following definitions: random sample, stem-and-leaf, outlier, statistical inference, histogram, quartiles, parametric vs nonparametric statistics, types of data (nominal, interval, ordinal, ratio), measures of central tendency and of variability.

CONFIDENCE INTERVALS

Wednesday, March 7 — Confidence Intervals for means and for proportions

Friday, March 9 — Discuss Class Project

Know the following terms: inferential statistics, point estimate, maximum error of estimate

March 12 - 16 is Spring Break

HYPOTHESIS TESTING

Monday, March 19 — Review Progress on the Class Project
Wednesday, March 21 — Theoretical hypothesis testing

Reader Assignment III given, due 3/28
Definitions and problems in the typed notes

Friday, March 23 — Hypothesis testing - means [one sample, large and small sample)]
Monday, March 26

Problems in the typed notes

Wednesday, March 28 — Means continued [two samples (dependent, large
Friday, March 30 — sample, small sample, homogeneity of variance)]

Reader Assignment III due on 3/28
Problems in typed notes

Monday, April 2 Hypothesis Testing - proportions, and
Wednesday, April 4 Review Hypothesis Testing

Problems in the typed notes
Receive Problem Set III on Wednesday, due 4/11

NOTE: Course topics on the schedule below may be altered based on timing needs for the class project and presentation schedule . . . changes will be posted on the class conference. Problem Set III due on April 11 will not change.

REGRESSION

Friday, April 6 Correlation and Simple Linear Regression

Problems in the typed notes
Know the following definitions: bivariate data, coefficient of determination, covariance, method of least squares, spuriously correlated

Monday, April 9 ANOVA/Status of Class Experiment Evaluated

Problems in the typed notes

NONPARAMETRIC STATISTICS

Wednesday, April 11 Chi Square Tables, Multinomial Experiments, median test

Problems in the typed notes
Problem Set III due
Group Experiment II assigned, due 4/20
Finish the formal Class Project Report, due 4/13

Friday, April 13 **Review the Final Version of the Class Project**

Begin putting together the power point and discuss the presentation to be given one day **between April 16 and April 27**.

Monday, April 16 Wilcoxon Rank-Sum, Kruskal-Wallis
Wednesday, April 18 Discuss presentation

Problems in the typed notes
Receive Problem Set IV on Wednesday, due 4/27

PULL IT ALL TOGETHER

Friday, April 20	Discuss Major Misuses of Statistics, Catch Up
Monday, April 23	
Wednesday, April 25	Review, Evaluate
Friday, April 27	
Monday, April 30	

Finish problems in typed notes
Group Experiment due 4/20
Individual logs due 4/25
Problem Set IV due Friday, 4/27
Receive Take Home part of final exam on Monday, 4/30

The in class final exam will be given in accordance with the college rules and schedule.

May 7, Monday	9:00 a.m., absolute deadline for *take home* final exam

As requested by Dr. Ken Anderson, Associate Dean of Academic Affairs, be advised:

"Student work submitted as part of this course may be reviewed by Oxford College and Emory College faculty and staff for the purposes of improving instruction and enhancing Emory education."

Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.
H. G. Wells