

Math 207, Probability and Statistics
Spring Semester, 2011
Dr. Evelyn Bailey

Office hours: Posted weekly on the class conference

Readers: How to Lie With Statistics by Darrell Huff
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 participate in a class project that includes gathering and analyzing data, writing a formal report, and presenting this report to the appropriate audience.

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

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	140
4 Responses to the Readers @40	160
1 final exam	<u>200</u>
Total	1000 points

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.

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 may use your own notes (those you have taken in class), the notes provided for this class, and your calculator; however, you may not receive help from another person or talk to anyone about the problems on the problem sets or check the web (unless instructed to do so, then provide references) or get any hints from former or present students. NO DISCUSSION!

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). Dates are given on the attached outline.

The **class project** will be in the form of a survey, a replication of a study done in 2005. We will elicit opinions related students' opinions about the Honor Code. We will determine if there are any significant differences between the opinions in 2005 and in 2011. We also have the opportunity to add additional questions that we feel are important to ask.

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 8**. Individual student logs are due **April 22**. The date for the presentation can be determined after consulting with those who will be invited but

should be done sometime **between April 13 and April 20**. 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. The project from the 2005 class 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.

Four individual assignments from the **readers**, *How to Lie With Statistics* and *Super Crunchers*, are included on the schedule. Each student completes these assignments individually unless otherwise indicated.

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 YOUR WORK IN ACCORDANCE WITH INSTRUCTIONS GIVEN FOR THE ASSIGNMENT.

NO DISCUSSION ON PROBLEM SETS ALLOWED!

Important dates:

January 21	Readings I due
February 2	Group Experiment I due
February 9	Problem Set I due
February 14	Readings II due
February 25	Problem Set II due
March 4	Readings III due
March 7 - 11	Spring Break
March 23	Readings IV due
April 4	Problem Set III due
April 8	Class Project due (hardcopy, electronic copy final report)
April 13	Group Experiment II due
April 13 – 20	Presentation on one day (power point, student presenters)
April 22	Individual log for class project due
April 22	Problem Set IV due
April 25	Last class day
April 29	(Friday), 2:00 – 5:00, <i>in class</i> final exam
May 2	(Monday), 9:00, absolute deadline for <i>take home</i> 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

Note: Homework will be assigned in class and posted on the class conference.

INTRODUCTION

Wednesday, January 12	Introduction, Orientation, Class Project
Friday, January 14	Jerome Cardan, Model Building

First Reader Assignment over Introduction and Chapter 1 - 6 in *How to Lie with Statistics*, due 1/21.

Read the Math 207 project from 2005. Prepare any questions you may have about the study.

Problems in typed notes.

PROBABILITY

Wednesday, January 19	Definitions, Addition Rule, Multiplication Rule
Friday, January 21	(conditional), Bayes Theorem,
Monday, January 24	

Know definitions: experiment, sample space, certain event, impossible event, mutually exclusive, independent

Reader Assignment I due on 1/21

Group Experiment I assigned Monday, due 2/2

Wednesday, January 27	Birthday Problem, Craps,
Friday, January 29	Discuss Class Experiment (and any time during class as needed from now on...)

Finish problems on probability in the typed notes.

COUNTING

Monday, January 31 Fundamental Theorem of Counting, permutations, combinations

Wednesday, February 2 Probability and Counting

Finish problems on Counting in the typed notes.

Group Experiment I due on 2/2

Receive Problem Set I on Wednesday, due 2/9

FUNCTIONS (THEORETICAL)

Friday, February 4 Random Variable, Density Functions

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

Monday, February 7 Joint Density Functions, Marginal Distributions

Wednesday, February 9

Problem Set I due 2/9

Problems in typed notes.

Know the following definitions: random variable, joint probability distribution, marginal distribution, conditional distribution, independence.

Reader Assignment II given on Wednesday, over Introduction and Chapters 1 – 3 in *Super Crunchers*, due 2/14.

DISCRETE FUNCTIONS

Friday, February 11 Discrete Functions, Binomial Distribution

Monday, February 14 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 2/14

Happy Valentines Day!

CONTINUOUS FUNCTIONS

Wednesday, February 16 Continuous Functions, Chebyshev's Theorem, Normal

Friday, February 18 Distribution, empirical rule, Central Limit Theorem

Monday, February 21 Normal to approximate the binomial as a model, uniform

Problems in typed notes

Receive Problem Set II on Friday, due 2/25

DATA AND MEASUREMENTS

Wednesday, February 23 Descriptive Statistics

Friday, February 25 Data measures and classification

Monday, February 28

Problem Set II due on 2/25
Reader Assignment III given on Friday, over Chapters 7 – 10 in *How To Lie With Statistics*, due 3/4

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 2 Confidence Intervals for means and for proportions

Friday, March 4 Discuss Class Project

Reader Assignment III due
 Know the following terms: inferential statistics, point estimate, maximum error of estimate

March 7 – 11 is Spring Break

HYPOTHESIS TESTING

Monday, March 14 Review Progress on the Class Project

Wednesday, March 16 Theoretical hypothesis testing

Reader Assignment IV given, Chapters 6 – 8 in *Super Crunchers*, due 3/23
 Definitions and problems in the typed notes
March 17 is St. Patrick's Day. . .

Friday, March 18 Hypothesis testing - means [one sample, large and small sample)]

Monday, March 21

Problems in the typed notes

Wednesday, March 23
Friday, March 25

Means continued [two samples (dependent, large sample, small sample, homogeneity of variance)]

Problems in typed notes

Reader Assignment IV due on 3/23

Monday, March 28
Wednesday, March 30

Hypothesis Testing - proportions, and
Review Hypothesis Testing

Problems in the typed notes

Receive Problem Set III on Monday, due 4/4

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 4 will not change.

REGRESSION

Friday, April 2

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 4

ANOVA/Status of Class Experiment Evaluated

Problems in the typed notes

Problem Set III due

NONPARAMETRIC STATISTICS

Wednesday, April 6

Chi Square Tables, Multinomial Experiments, median test

Problems in the typed notes

Group Experiment II assigned, due 4/13

Finish the formal Class Project Report, due 4/8

Friday, April 8

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 13 and April 20.

Monday, April 11 Wilcoxon Rank-Sum, Kruskal-Wallis
 Wednesday, April 13 Discuss presentation

Problems in the typed notes

Group Experiment II due Wednesday, 4/13

Receive Problem Set IV on Wednesday, due 4/22

Presentation scheduled for a day between April 13 and April 20

PULL IT ALL TOGETHER

Friday, April 15 Discuss Major Misuses of Statistics, Catch Up
 Monday, April 18
 Wednesday, April 20 Review, Evaluate
 Friday, April 22
 Monday, April 25

Finish problems in typed notes

Individual logs due 4/22

Problem Set IV due Friday, 4/22

Receive Take Home part of final exam on Monday, 4/25

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

April 29, Friday 2:00 – 5:00 *in class* final exam
 May 2, Monday 9:00 a.m., absolute deadline for *take home* final exam

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

H. G. Wells