

Math 207, Probability and Statistics
Spring Semester, 2010
Dr. Evelyn Bailey

Office hours: Posted weekly on the class conference

Reader: How to Lie With Statistics by Darrell Huff

Materials: Math 207 Notes (provided in a notebook for this class), a calculator (TI-83, TI-83 PLUS, TI-84, or equivalent type), e-Reserves in the library, articles/materials attached to the class conference.

Content: Visual displays of data, measures of central tendency and of variability, classification of data, counting, probability, Bayes Theorem, probability functions, Chebyshev's Theorem, discrete distributions (binomial, hypergeometric, Poisson, uniform), continuous distributions (Exponential, Normal, Uniform), Central Limit Theorem, Confidence Intervals, Hypothesis Testing (for means and for proportions, for one and two samples), goodness of fit, Chi Square Contingency Tables, one-way ANOVA, simple linear regression and correlation, nonparametric tests (median, Wilcoxon Rank Sum Test, Kruskal-Wallis Test).

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

- * categorize data,
- * work various probability problems,
- * understand the role of functions in statistics,
- * describe major misuses of statistics,
- * recognize several standard distributions,
- * analyze interval data for which statistical tests involving difference of means and difference of proportions is needed,
- * check for inherent assumptions of the statistical models that are included in this course,
- * interpret relationships in bivariate data,
- * compare distributions of responses,
- * understand the role of statistics in analyzing data and in inference.

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 reader, 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 @ 125	500
2 small group experiments @ 50	100
1 Class Project	120
10 Responses to the Reader @ 10	100
1 final exam	<u>200</u>
Total	1020 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.** 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 notebook 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).

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 or an interview, will be designed by the class, and will be related to student needs in the new science facility. We will elicit opinions related to how students study, what students want/need in the study area and other information. There will be contact with the architects coordinated through Dr. Eloise Carter, so there will be times when some of you will need to meet with the architects. We will have two groups working separately but both groups are to gather information for this same project. One group will survey/interview a random sample of all students; the second group will survey/interview a selected sample of math/science students.

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 each of the two groups for this 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. Each chairperson is to keep Dr. Bailey informed of the progress and 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. 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. In this log, each student will record what and when his/her contributions took place.

The class project is due (typed, polished, complete copy posted on the class conference) no later than **April 16**, Friday. Individual student logs are due **April 21**, Monday. The date for the presentation can be determined after consulting with those who will be invited but should be done sometime with week of April 5, April 12 or April 19. It is important to stay on schedule so as to have a complete project for which you may be proud. At least one example of a previous project will be posted on the class conference.

Homework problems (assignments attached) may be worked with other members of this class. Some solutions to some homework problems are on e-Reserve at the library or in the notebook for this class. 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.

Class attendance is important. You are responsible for work done in class. You also are responsible for participating in class project. There are no tutors for this course.

Chapters in the **reader**, *How to Lie With Statistics* are assigned throughout the semester. For each chapter, you need to carefully read and give two quotes. Explain why the quotes were selected and how these observations will help you become a better consumer of information in the world. Grades are based on thought given, the choice of quotes, and the logic behind the quote selection. Each chapter is turned in separately according to the attached schedule.

In addition, there is a Math 207 **class conference**, Math 207 spring 2010. Please use the conference to check announcements, to communicate concerns, to pose questions appropriate for the class, and to attach work related to the class experiment.

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.

Important dates:

February 5	Group Experiment I due
February 12	Problem Set I due
March 3	Problem Set II due
March 8 - 12	Spring Break
April 7	Problem Set III due
April 16	Class Project due, presentation (or can be earlier)
April 19	Group Experiment II due
April 21	LOG for class project due
April 23	Problem Set IV due
April 26	Last class day

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: Additional homework will be assigned in class and posted on the class conference.

INTRODUCTION

Wednesday, January 13	Introduction, Orientation, Class Project
Friday, January 15	Jerome Cardan

Read the Introduction and Chapter 1 in *How to Lie with Statistics*. Individual write-ups are due on 1/20.

Read the previous 207 projects posted on the class conference.

PROBABILITY

Wednesday, January 20	Definitions, Addition Rule, Multiplication Rule
Friday, January 22	(conditional), Bayes Theorem,
Monday, January 26	

Definitions: experiment, sample space, certain event, impossible event, mutually exclusive, independent

Chapter 2 in *How to Lie with Statistics*: Individual write-ups are due on 1/27

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

Group Experiment I assigned Friday, due 2/8

Finish problems on probability in the notebook.

COUNTING

Monday, February 1 Fundamental Theorem of Counting, permutations, combinations

Wednesday, February 3 Probability and Counting

Problems on Counting in the notebook

Chapter 3 in *How to Lie with Statistics*: Write ups due 2/5

Receive Problem Set I, due 2/13

FUNCTIONS (THEORETICAL)

Friday, February 5 Random Variable, Density Functions

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

Monday, February 8 Joint Density Functions, Marginal Distributions
Wednesday, February 10

Group Experiment I due

Notebook problems

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

DISCRETE FUNCTIONS

Friday, February 13 Discrete Functions, Binomial Distribution

Problem Set I due

Read Chapter 4 in *How to Lie with Statistics*: Write-ups due 2/15

Monday, February 15 Poisson, Hypergeometric, and Uniform Distributions

problems in notebook

Know the following definitions: expectation, moments (about the origin and about the mean), mean, variance, skewness, kurtosis.

CONTINUOUS FUNCTIONS

Wednesday, February 17 Continuous Functions, Chebyshev's Theorem, Normal
Friday, February 19 Distribution, empirical rule, Central Limit Theorem

Read Chapter 5 in *How to Lie with Statistics*: Write-ups due 2/22

Monday, February 2 Normal to approximate the binomial as a model, uniform

notebook problems

Receive Problem Set II, due 3/3

DATA AND MEASUREMENTS

Wednesday, February 24 Descriptive Statistics

Friday, February 26 Data measures and classification

Monday, March 1

Wednesday, March 3

problems in notebook

Read Chapter 6 in *How to Lie with Statistics*: Write-ups due 3/5

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.

Problem Set II due on 3/3

Friday, March 6 Discuss Class Project

Spring Break, March 9-13

CONFIDENCE INTERVALS

Monday, March 15 Confidence Intervals for means and for proportions

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

HYPOTHESIS TESTING

Wednesday, March 17 Theoretical hypothesis testing

Definitions in the notebook

Friday, March 20 Hypothesis testing - means [one sample, large and small sample)]

Monday, March 23

problems in the notebook

Read Chapter 7 in *How to Lie with Statistics*: Write-ups are due 3/24

Wednesday, March 24 Means continued [two samples (dependent, large

Friday, March 26 sample, small sample, homogeneity of variance)]

problems in the notebook

Read Chapter 8 in *How to Lie with Statistics*: Write-ups are due 3/29

Monday, March 29 Hypothesis Testing - proportions, and
 Wednesday, March 31 Review Hypothesis Testing

problems in the notebook

Receive Problem Set III, due 4/7

REGRESSION

Friday, April 2 Correlation and Simple Linear Regression

problems in the notebook

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

Monday, April 5 ANOVA/Status of Class Experiment Evaluated

Work problems in the notebook

NONPARAMETRIC STATISTICS

Wednesday, April 7 Chi Square Tables, Multinomial Experiments, median test

problems in the notebook

Problem Set III due

Group Experiment II assigned, due 4/19

Read Chapter 9 in *How to Lie with Statistics*: Write-ups due 4/9

Friday, April 9 Work on the Class Project

Read Chapter 10 in *How to Lie with Statistics*: Write-ups due 4/12

Monday, April 12 Wilcoxon Rank-Sum, Kruskal-Wallis

Wednesday, April 14

problems in notebook

Receive Problem Set IV on Wednesday, due 4/23

Friday, April 16

Discuss Major Misuses of Statistics, Catch Up

Monday, April 19

Class Experiment due on Friday, or earlier

Group Experiment II due on Monday

finish notebook problems. . .

Wednesday, April 21	Review, Evaluate, Catch Up,
Friday, April 23	Discussion of Class Project (evaluation of process)
Monday, April 26	

Individual logs due 4/21

Problem Set IV due Friday, 4/23

Receive Take Home part of final exam on Monday, 4/26

Course Evaluations due on Monday, 4/27

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

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

H. G. Wells