

Math 207, Probability and Statistics
Spring Semester, 2009
Dr. Evelyn Bailey

Office hours: Posted weekly on the class conference

Text: Introduction to Mathematical Statistics, 5th ed, by Paul G. Hoel

Reader: How to Lie With Statistics by Darrell Huff

Materials: Math 207 Notes (provided in a notebook for this class), use of a calculator (TI-83, TI-83 PLUS, TI-84, or equivalent type), e-Reserves in the library

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 @ 110 | 440 |
| 2 small group experiments @ 50 | 100 |
| 1 Class Project | 150 |
| 1 Responses to the Reader | 110 |
| 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.** 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, your textbook, the computer facilities, and/or your own computer or calculator; however, you may not receive help from another person or talk to anyone about the problems on the problem sets.

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

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 Oxford's Conduct Code. We will elicit opinions related to the conduct of students, to the Conduct Code, and to the efficiency of the Conduct Board. See the class conference for a direct link to the Conduct Code.

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, concrete recommendations, and presenting findings to the appropriate audience.

The class elects a chairperson and secretary for the project. The secretary keeps up with what was 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 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. In this log, each student will record what and when the contributions took place. The class project is due no later than **April 15**. At least one examples of a previous project will be posted on the class conference.

Homework problems (assignments attached) may be worked with other members of this class. 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. 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. Completing these in a timely manner, as they are assigned, is the best approach to completing this assignment. The chapters are short and interesting, information you should know about statistics. A typed paper with your responses is due **April 22**. Grades are based on thought given, the choice of quotes, and the logic behind the quote selection.

There is a Math 207 class conference, Math 207 spring 2009. 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 6 | Group Experiment I due |
| February 13 | Problem Set I due |
| March 4 | Problem Set II due |
| March 9 - 13 | Spring Break |
| April 8 | Problem Set III due |
| April 15 | Class Project due, presentation (or can be earlier) |
| April 20 | Group Experiment II due |
| April 22 | Responses to <i>How to Lie with Statistics</i> due; Last class day |
| April 24 | Problem Set IV due |
| April 27 | Last class day |
| | Final exam according to the college schedule |

Homework AssignmentsINTRODUCTION

| | |
|-----------------------|---------------------------|
| Wednesday, January 14 | Introduction, Orientation |
| Friday, January 16 | Jerome Cardan |

Read Chapter 1 and part of Chapter 2 (pages 4-26) to get an overview

Read Introduction and Chapter 1 in *How to Lie with Statistics*

Read the Conduct Code and the previous 207 project on the Honor Code.

By Friday evening, each student is to post on the class conference: a) concerns you have regarding the Conduct Code; b) the positive aspects of the Code; c) what effect the Code has on the conduct of students at Oxford College.

PROBABILITY

| | |
|-----------------------|---|
| Wednesday, January 21 | Definitions, Addition Rule, Multiplication Rule |
| Friday, January 23 | (conditional), Bayes Theorem, |
| Monday, January 27 | Discuss Class Experiment - elect chairperson, secretary |

p. 45-46: 1, 2, 3, 5-27

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

Chapter 2 in *How to Lie with Statistics*

| | |
|-----------------------|--------------------------|
| Wednesday, January 28 | Birthday Problem, Craps, |
| Friday, January 30 | Discuss Class Experiment |

Group Experiment I assigned Friday, due 2/6

Problems on probability in the notebook, pgs. 4,5

COUNTING

Monday, February 2 Fundamental Theorem of Counting, permutations, combinations

P. 48: 28-37, 40 (Get common denominator)

Wednesday, February 4 Probability and Counting, Discuss Class Experiment (and any time during class as needed from now on...)

Problems on Counting in the notebook

P. 50: 71-80, 82

Chapter 3 in *How to Lie with Statistics*

Group Experiment I due

Receive Problem Set I, due 2/13

FUNCTIONS (THEORETICAL)

Friday, February 6 Random Variable, Density Functions

Read in Chapter 2 pages 27 to 45; page 48: 41-45

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

Monday, February 9 Joint Density Functions, Marginal Distributions

Wednesday, February 11

page 49: 47-52, 58, 60, 62, 64, 68; page 52: 91, 92, 93, 97

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

Read pages 53-72

page 92: 1, 2, 5, 6, 7, 9, 12, 13, 15, 16, 17, 18, 20

Problem Set I due

Read Chapter 4 in *How to Lie with Statistics*

Monday, February 16 Poisson, Hypergeometric, and Uniform Distributions

page 94: 22, 24, 25, 29, 33, 34

problems in notebook

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

CONTINUOUS FUNCTIONS

Wednesday, February 18 Continuous Functions, Chebyshev's Theorem, Normal
Friday, February 20 Distribution, empirical rule, Central Limit Theorem

page 95: 37, 42, 44
page 96: 46-50, 54, 55, 57, 58, 59, 62, 64
page 100: 101, 103, 104, 105, 106, 108
Read Chapter 5 in *How to Lie with Statistics*

Monday, February 23 Normal to approximate the binomial as a model, uniform

page 97: 66, 67, 68
page 99: 83, 85, 87, 94, 95
notebook problems
Receive Problem Set II, due 3/4

DATA AND MEASUREMENTS

Wednesday, February 25 Descriptive Statistics

Read pages 102-109; page 117: 1-5

Friday, February 27 Data measures and classification

Monday, March 2

Wednesday, March 4

Read pages 129 to 134; p. 162: 10, 11
problems in notebook
Read Chapter 6 in *How to Lie with Statistics*
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 3/4

Friday, March 6 Discuss Class Project

Spring Break, March 9-13

CONFIDENCE INTERVALS

Monday, March 16 Confidence Intervals for means and for proportions

p. 164: 35, 36; p. 168: 72
Know the following terms: inferential statistics, point estimate, maximum error of estimate

HYPOTHESIS TESTING

Wednesday, March 18 Theoretical hypothesis testing

p. 118: 13, 14, 16, 18, 19, 27, 28, 30
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*

Wednesday, March 25 Means continued [two samples (dependent, large
Friday, March 27 sample, small sample, homogeneity of variance)]

Read pages 138 to 159; p. 162: 12, 15, 16, 25, 26, 27
problems in the notebook
Read Chapter 8 in *How to Lie with Statistics*

Monday, March 30 Hypothesis Testing - proportions
Wednesday, April 1 Review Hypothesis Testing

p. 163: 28, 29, 30, 32, 33; problems in the notebook
Receive Problem Set III, due 4/8

REGRESSION

Friday, April 3 Correlation and Simple Linear Regression

Read chapter 7 in text
page 211: 2, 3, 7, 9, 13, 19
problems in the notebook
Know the following definitions: bivariate data, coefficient of determination,
covariance, method of least squares, spuriously correlated

Monday, April 6 ANOVA/Status of Class Experiment Evaluated

Work problems in the notebook
Read Chapter 9 in *How to Lie with Statistics*

NONPARAMETRIC STATISTICS

Wednesday, April 8 Chi Square Tables, Multinomial Experiments, median test

page 266: 1, 2, 3, 4, 5, 15, 18
problems in the notebook

Problem Set III due

Group Experiment III assigned, due 4/20

Friday, April 10 Work on the Class Project

Read Chapter 10 in *How to Lie with Statistics*

Monday, April 13 Wilcoxon Rank-Sum, Kruskal-Wallis

Wednesday, April 15

Work problems in notebook

Receive Problem Set IV on Wednesday, due 4/24

Class Experiment due on Wednesday, or earlier

Friday, April 17

Discuss Major Misuses of Statistics, Catch Up

Monday, April 20

Group Experiment III due on Monday

finish notebook. . .

Receive Class/course Evaluation Forms on Wednesday, due Monday, 4/27

Wednesday, April 22

Review, Evaluate, Catch Up,

Friday, April 24

Discussion of Class Project (evaluation of process)

Monday, April 27

Problem Set IV due Friday, 4/24

**Receive Take Home part of final exam on Monday, due with the final exam,
given according to the college schedule**

Typed responses to *How to Lie With Statistics* due Monday, 4/27

Course Evaluations due on Monday, 4/27

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

H. G. Wells