Math 207, Probability and Statistics
Spring Semester, 2008
Dr. Evelyn Bailey

Office hours: Room 303 Seney Hall, 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.

Grading: Grades will be determined by student performance on four different problem sets, three group experiments, a class experiment, 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
3 small group experiments @ 50	150
1 Class Experiment	110
1 Responses to the Reader	100
1 final exam	200

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 experiment will be in the form of a survey or an interview, will be designed by the class, and will be related to Oxford's new Natural Science and Mathematics facility. We will work with Dr. Eloise Carter to elicit information from students related to space in the new building (group meeting sizes, wall space, physical requirements such as whiteboards, wireless, plugs, tables and chairs [movable or not], noise levels, art), connections to the rest of campus (to the forest, outdoors, walkways to other buildings, wireless, surfaces outdoors for writing), how space and learning is connected, sustainability, colors and gathering spaces for study.

The class experiment 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, presenting findings to the appropriate audience, and making conclusions, concrete recommendations. 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 this experiment. The chairperson conducts class during those times we work on the class experiment. Each person in the class is expected to contribute substantially in many and various ways. The class experiment/project is due on April 21. Examples of previous experiments 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 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 three 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 on the last class day.

There is a Math 207 class conference, Math 207 spring 2008. 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, eReserves)
    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!

* 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.

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 8	Group Experiment I due
February 15	Problem Set I due
March 3	Problem Set II due
March 10 - 14	Spring Break
March 19	Group Experiment II due
April 11	Problem Set III due
April 18	Group Experiment III due
April 21	Class Experiment due, presentation (can be earlier)
April 25	Problem Set IV due
April 28	Responses to *How to Lie with Statistics* due; Last class day
	Final exam according to the college schedule

Homework Assignments

INTRODUCTION

Wednesday, January 16 — Introduction, Orientation
Friday, January 18

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*

PROBABILITY

Wednesday, January 23 — Definitions, Addition Rule, Multiplication Rule
Friday, January 25 — (conditional), Bayes Theorem, Jerome Cardan,
Monday, January 28 — 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 30 — Birthday Problem, Craps,
Friday, February 1 — Discuss Class Experiment

Group Experiment I assigned Friday, due 2/8
Problems on probability in the notebook, pgs. 4,5

COUNTING

Monday, February 4 Fundamental Theorem of Counting, permutations, combinations

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

Wednesday, February 6 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*

FUNCTIONS (THEORETICAL)

Friday, February 8 Random Variable, Density Functions

Group Experiment I due
Receive Problem Set I, due 2/15
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 11 Joint Density Functions, Marginal Distributions
Wednesday, February 13

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 15 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 18 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 20 — Continuous Functions, Chebyshev's Theorem, Normal
Friday, February 22 — 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 25 — 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 3/3

DATA AND MEASUREMENTS

Wednesday, February 27 — Descriptive Statistics

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

Friday, February 29 — Data measures and classification
Monday, March 3
Wednesday, March 5

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 3/3
Group Experiment II assigned 3/5, due 3/19

Friday, March 7 — Discuss Class Project

Spring Break, March 10-14

CONFIDENCE INTERVALS

Monday, March 17 — 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 19 Theoretical hypothesis testing

p. 118: 13, 14, 16, 18, 19, 27, 28, 30
definitions in the notebook
Group Experiment II due

Friday, March 21 No Formal Class, Meet to work on the class experiment

Read Chapter 7 in *How to Lie with Statistics*

Monday, March 24 Hypothesis testing - means [one sample, large and small sample)]
Wednesday, March 26

problems in the notebook

Friday, March 28 Means continued [two samples (dependent, large
Monday, March 31 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*

Wednesday, April 2 Hypothesis Testing - proportions

p. 163: 28, 29, 30, 32, 33; problems in the notebook

Friday, April 4 Review hypothesis testing

Receive Problem Set III, due 4/11

REGRESSION

Monday, April 7 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

Wednesday, April 9 ANOVA/Status of Class Experiment Evaluated

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

NONPARAMETRIC STATISTICS

Friday, April 11 — 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 4/18

Monday, April 14 — Work on the Class Experiment

Read Chapter 10 in *How to Lie with Statistics*

Wednesday, April 16 — Wilcoxon Rank-Sum, Kruskal-Wallis
Friday, April 18

Work problems in notebook
Group Experiment III due on Friday
Receive Problem Set IV on Wednesday, due 4/25

Monday, April 21 — Discuss Major Misuses of Statistics, Catch Up
Wednesday, April 23

finish notebook. . .
Class Experiment due on Monday, or earlier
Receive Class/course Evaluation Forms on Wednesday, due Monday, 4/28

Friday, April 25 — Review, Evaluate, Catch Up
Monday, April 28

Problem Set IV due Friday
Receive Take Home part of final exam on Monday, due with the final exam
Typed responses to *How to Lie With Statistics* due Monday
Course Evaluations due on Monday
Final Exam according to college schedule

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

تمارين المراجعة

تمرين ١٦ مفردات *Vocabulary*

CROSS OUT THE WORD THAT DOES NOT FIT:

١-	الاحد	الاثنين	الخريف	
٢-	مترجم	ضابط	معيد	
٣-	زميل	ابن	زوج	
٤-	جو	ازدحام	رطوبة	
٥-	كلية	جامعة	مدرسة	
٦-	لأنّ	لذلك	بالنسبة لـِ	
٧-	فعلاً	نهارًا	صباحاً	
٨-	أتذكر	أحفظ	أعرف	
٩-	كلية	منطقة	مدينة	
١٠-	مشمس	مشغول	ممطر	

تمرين ١٧ هذا/هذه

TENCES WITH THE ARABIC EQUIVALENT OF THE PHRASES IN PARENTHESES.

١- لا أحبّ السكن في _____ *(This old house)* .

٢- _____ الأسبوع الرابع. *(This is)*

٣- _____ قهوة عربية؟ *(Is this?)*

٤- _____ تدرّس التاريخ الأوروبي. *(new professor)*

٥- هل تدرسون في _____ ؟ *(this college)*

٦- _____ عندي صفوف صعبة جداً! *(this semester)*

٧- في _____ ٧ طلاب فقط. *(this small class)*

٨- _____ المكتبة؟ *(Is this)*

٩- أحبّ الأكل في _____ . *(excellent restaurant)*

١٠- زملائي يسكنون في _____ . *(This area)*