Math 207, Probability and Statistics
Spring Semester, 2002
Dr. Evelyn Bailey

Office hours: Room 115A Seney Hall,
In general, 10 - 11:30 TTh; 2:00 – 3:00 MWF, and others by appointment

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

Reader: Statistics You Can't Trust, Steve Campbell

Materials: Math 207 Notes (provided in notebook), calculator (TI-83, TI-82, or equivalent type)

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, one-way ANOVA, simple Linear regression and correlation, nonparametric tests (median, multinomial, 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 experiments, and a final exam. Each problem set will have 150 possible points; each experiment will have 60 points; the final exam will have 220 points, for a total of 1000 possible points:

4 problem sets @ 150	600
3 experiments @ 60	180
1 final exam	220

Total	1000 points

There will be opportunities for extra credit work, announced in class or listed on the attached assignments. These 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.

Policies regarding experiments will be explained in class, on the day the experiment is assigned. Experiments may require group work or individual work.

Homework problems (assignments attached) may be worked with other members of this class. Solutions to some homework problems are on reserve at the library.

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 final exam.

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

There is a Math 207 class conference on LearnLink. Please use the conference to check announcements and to communicate concerns and questions appropriate for the class.

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:

Friday, February 8	Experiment 1 due
Wednesday, February 13	Problem Set I due
Monday, March 4	Problem Set II due
March 11-15	SPRING BREAK
Friday, March 29	No Class
Monday, April 1	Experiment 2 due
Friday, April 2	Problem Set III due
Wednesday, April 24	Experiment 3 due
Friday, April 26	Problem Set IV due
Monday, April 29	Last class day
	Final exam

Math 207
Homework Assignments

Wednesday, January 16 Introduction
Friday, January 18

Read Chapter 1 and part of Chapter 2 (pages 4-26)

Explain how our present model of the solar system and our present model of the atom are examples of the evolutionary nature of model building. Are there other examples? Why are models important?

Read Introduction and Chapter 1 in *Statistics You Can't Trust*. See attached questions.

PROBABILITY

Wednesday, January 23 Definitions, Addition Rule, Multiplication Rule
Friday, January 25 (conditional), Bayes Theorem

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

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

Monday, January 28 Jerome Cardan, Birthday Problem, Craps
Wednesday, January 30

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

How many people are needed so that the probability of at least two people having the same birthday is 1/2?

What is the minimum number of red and black socks in a drawer such that the probability of picking two red socks is 1/2? is 2/3? is 3/4? Is there a solution for all three?

Optional Bonus 20 points, due with Problem Set I explained in class.

Experiment 1: Design a game similar to craps where .501 = P(win) = .502 that uses two different Platonic solids. (1) Name your game. (2) Clearly show the number assignment to the sides of the solids you select, and the sample space for your choice. (3) Clearly provide your calculations demonstrating the probability of winning your game. Work in groups of 2, 3, or 4.

Read Chapter 9 in Statistics You Can't Trust. Answer the attached questions.

COUNTING

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

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

How big is "30!"? How big is Avogadro's number? How many drops of water are there in all the oceans of the world? How many grains of sand are there on all the

beaches of the world? Which one (30! Avogadro's number, number of drops of water in the oceans, number of grains of sand) is the largest? How do you answer these questions?

Receive Problem Set I

Monday, February 4 Probability and Counting
Wednesday, February 6

Problems on Counting in the notebook, pgs. 8, 9, 10
P. 50: 71-80, 82
Optional Bonus 30 points, due with Problem Set 2: Create a children's story book explaining very large numbers in an unusual way. Show all calculations and give the projected age of your reader.

FUNCTIONS (THEORETICAL)

Friday, February 8 Random Variable, Density Functions

Read in Chapter 2 pages 27 to 45
page 48: 41-45
Explain the difference between a pdf and a cdf for both continuous and discrete functions.
Experiment 1 due

Monday, February 11 Joint Density Functions, Marginal Distributions

page 49: 47-52, 58, 60, 62, 64, 68; page 52: 91, 92, 93, 97
Optional Bonus 20 points, due with Problem Set 2: Find an algorithm for determining the number of zeros at the end of N! where N is any whole number. Clearly give the steps in your algorithm. Show how your algorithm works by giving the number of zeros at the end of 200! and at the end of 1000! as examples.
Notebook problems p. 17, 18
Know the following definitions: random variable, joint probability distribution, marginal distribution, conditional distribution, independence.

DISCRETE FUNCTIONS

Wednesday, 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 1 due

Friday, February 15 Poisson, Hypergeometric, and Uniform Distributions

page 94: 22, 24, 25, 29, 33, 34
problems in notebook, pgs. 23, 24
Know the following definitions: expectation, moments (about the origin and about the mean), mean, variance, skewness, kurtosis.

CONTINUOUS FUNCTIONS

Monday, February 18 — Continuous Functions, Chebyshev's Theorem, Normal
Wednesday, February 20 — Distribution, empirical rule

page 95: 37, 42, 44
page 96: 46-50, 54, 55, 57, 58, 59, 62, 64
page 100: 101, 103, 104, 105, 106, 108

Friday, February 22 — Normal to approximate the binomial, Central Limit Theorem

page 97: 66, 67, 68
page 99: 83, 85, 87, 94, 95

Monday, February 25 — Rectangular (Uniform) distribution, Review

Finish previous homework
Problems in notebook, p. 29, 30
Answer questions about the experiment
Receive Problem Set II

DATA AND MEASUREMENTS

Wednesday, February 27 — Descriptive Statistics
Friday, March 1

Read pages 102-109
page 117: 1-5
problems in notebook, p. 35, 36
Read Chapters 2, 3, and 10 in Statistics You Can't Trust. Answer attached questions.

Monday, March 4 — Data measures and classification

Read pages 129 to 134; p. 162: 10, 11
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 measures of variability.
Read Chapters 4 and 5 in Statistics You Can't Trust. Answer the attached questions.
Problem Set II due

CONFIDENCE INTERVALS

Wednesday, March 6 — Confidence Intervals for means and for proportions
Friday, March 8

p. 164: 35, 36; p. 168: 72; problems in notebook, p. 40

Know the following terms: inferential statistics, point estimate, maximum error of estimate
Finish any previous homework, catch up!
Optional Bonus Problem explained Friday, due with Problem Set III

Spring Break March 11-15

HYPOTHESIS TESTING

Monday, March 18 Theoretical hypothesis testing
Wednesday, March 20

p. 118: 13, 14, 16, 18, 19, 27, 28, 30
problems in the notebook, p. 44
Experiment 2 assigned

Friday, March 22 Hypothesis testing - means [to a value (large sample, small sample)]

Read chapters 6, 7, 8 in Statistics You Can't Trust. Answer the attached questions.
Know the following terms: null hypothesis, alternate hypothesis, test statistic

Monday, March 25 Means continued [compare means (dependent, large
Wednesday, 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, p. 46, 47

Friday, March 29 No Class

Monday, April 1 Hypothesis Testing - proportions

p. 163: 28, 29, 30, 32, 33; problems in the notebook, p. 48, 49
Experiment 2 due

Wednesday, April 3 Review hypothesis testing

p. 164: 35, 36, 41, 42, 43, 45, 46, 47, 48, 49, 53, 55, 56
p. 169: 80, 81, 83
Receive Problem Set III

REGRESSION

Friday, April 5 Correlation and Simple Linear Regression
Monday, April 8

Read chapter 7
page 211: 2, 3, 7, 9, 13, 19

Work problems in the notebook, p. 53
Know the following definitions: bivariate data, coefficient of determination, covariance, method of least squares, spuriously correlated
Bring Calculator

Wednesday, April 10 ANOVA
Friday, April 12

Problem Set III due Friday
Work problems in the notebook, p. 55, 56
Read Chapter 11 in Statistics You Can't Trust. Answer the attached questions.

NONPARAMETRIC STATISTICS

Monday, April 15 Chi Square Tables, Multinomial Experiments, median test
Wednesday, April 17
Friday, April 19

Experiment 3 assigned Monday
Read chapter 9
page 266: 1, 2, 3, 4, 5, 15, 18
Read chapter 12 in Statistics You Can't Trust. Answer the attached questions.
Work problems in the notebook, p. 59, 60
Receive Problem Set IV on Wednesday
Optional Bonus to be described in class on Friday and due with Problem Set IV

Monday, April 22 Wilcoxon Rank-Sum, Kruskal-Wallis
Wednesday, April 24

Work problems in notebook, p. 61
Experiment 3 due Wednesday

Friday, April 26 Discuss Major Misuses of Statistics

Read Chapters 13 and 14 in Statistics You Can't Trust. Answer attached questions.
Problem Set IV due

Monday, April 29 Review, Evaluate

notebook p. 62
Read Glossary in Statistics You Can't Trust
Receive Take Home part of final exam

Thursday, May 2

Final Exam at 9:00