Math 207, Probability and Statistics
Spring Semester, 1997
Dr. Evelyn C. Bailey

Office hours: Room 115D Seney Hall,
11:00-12:30 MWF, 1:15-2:30 TTh, others by appointment

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

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), Linear Regression (simple and multiple), ANOVA, Chi Square Contingency Tables

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

Grading: Grades will be determined by student performance on four different problem sets, a final exam, and a few extra credit (optional) problems.

Problem Set I Probability, Counting
due Wednesday, February 5

Problem Set II Functions, Summary Statistics
due Friday, March 7

Problem Set III Confidence Intervals, Hypothesis Testing
due Monday, April 7

Problem Set IV Regression, ANOVA, Contingency Tables
due Thursday, May 1

Final Exam at 2:00
on Thursday, May 1

Each problem set will have at least 200 possible points, the final exam will have a possible 200 points for a total of 1000 points.

There will be opportunities for extra credit work, announced in class. 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
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), your text book, 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. Specific instructions will be given for each extra credit problem or project.

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. Homework assignments are given in class along with summary notes over the course material. Homework problems may be worked with other members of this class. Often solutions to homework problems are posted outside office 115D in Seney Hall. There are no tutors for this course.

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.

Math 207
Homework Assignments

Wednesday, January 15 Introduction

Read Chapter 1 and in 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?

PROBABILITY

Friday, January 17 Definitions, Addition Rule

p. 45: 1, 2, 3

Monday, January 20 is MLK holiday

Wednesday, January 22 Multiplication Rule (conditional), Bayes Theorem

p. 46: 5-27

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

Friday, January 24 Jerome Cardan, Birthday Problem, Craps

Problems on probability handout

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

Monday, January 27 Review

Finish previous homework

Receive Problem Set I, due on Wednesday, February 5.

Optional Bonus 40 points, due with Problem Set I: Design a game similar to craps where $.495 \leq P(\text{win}) \leq .504$ that uses two different Platonic solids (but not cubes or tetrahedrons). Name the Platonic solids and describe them. (1) Name your game. (2) Why are they called the Platonic solids? (3) Describe all 5 Platonic solids. (4) Clearly show the number assignment to the sides of the solids you select, the sample space for your choice, your calculations demonstrating the probability of winning your game. You may not discuss this assignment with anyone. If you decide to work this optional problem, sign a statement that you have done this work by yourself, using only your notes, text, and calculator.

COUNTING

Wednesday, January 29 — Fundamental Theorem of Counting, permutations, combinations

P. 48: 28-37, 40 (Get common denominator)
How big is "30!"? Compare to what?
How many zeros are at the end of "200!"?

Friday, January 31 — Probability and Counting

Problems on Counting handout
P. 50: 71-80, 82

Monday, February 3 — Review and "Catch up" day

Finish Problem Set I - due Wednesday, February 5

FUNCTIONS (THEORETICAL)

Wednesday, February 5 — Random Variable, Density Functions

PROBLEM SET 1 DUE
Read in Chapter 2 pages 27 to 45
page 48: 41-45

Friday, February 7 — Joint Density Functions

page 49: 47-50
problems 1, 2 in handout

Optional Bonus 30 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.

Optional Bonus 20 points, due with Problem Set 2: How many rectangles are there on an "m x m checkerboard"? Clearly describe your reasoning and show how it works by giving the number of rectangles on a 8 x 8 board and on a 15 x 15 board. State your results in terms of sigma notation.

Monday, February 10 — Marginal Distributions

Page 49: 51, 52, 58, 60, 62, 64, 68
Page 52: 91, 92, 93, 97
Finish problems on handout

Wednesday, February 12 — Review

Finish previous homework. . .

Know the following definitions: random variable, pdf, cdf, discrete vs continuous function, joint probability distribution, marginal distribution, conditional distribution, independence.

DISCRETE FUNCTIONS

Friday, February 14 Discrete Functions, Binomial Distribution

Read pages 53-72
page 92: 1, 2, 5, 6, 7, 9, 12, 13, 15, 16, 17, 18, 20

Monday, February 17 Poisson, Hypergeometric, and Uniform Distributions

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

CONTINUOUS FUNCTIONS

Wednesday, February 19 Continuous Functions, Chebyshev's Theorem
page 95: 37, 42, 44
finish previous homework
Three people problem

Friday, February 21 Normal Distribution, empirical rule
page 96: 46-50, 54, 55, 57, 58, 59, 62, 64
page 100: 101, 103, 104, 105, 106, 108

Monday, February 24 Exponential Distribution
page 97: 66, 67, 68
page 99: 83, 85, 87, 94, 95
Gather data for CLT (due Wednesday for class)

Wednesday, February 26 Central Limit Theorem
Finish previous homework. . .
Receive Problem Set 2, due Friday, March 7

DATA AND MEASUREMENTS

Friday, February 28 and
Monday, March 3 Descriptive Statistics
Read pages 102-109
page 117: 1-5
problems on handout

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.

Wednesday, March 5 }
Friday, March 7 } Data measures and classification
Read pages 129 to 134; p. 162: 10, 11
Problem Set 2 due
Optional Bonus 30 points: due with Problem Set 3: Gypsy problem. . .

Spring Break: March 8-16

CONFIDENCE INTERVALS

Monday, March 17 } Confidence Intervals for means and for proportions
Wednesday, March 19 }
p. 154: 35, 36; p. 168: 72; problems on handout
Know the following terms: inferential statistics, point estimate, maximum error of estimate

HYPOTHESIS TESTING

Friday, March 21 Theoretical hypothesis testing
p. 118: 13, 14, 16, 18, 19, 27, 28, 30

Monday, March 24 }
Wednesday, March 26 } Hypothesis testing - means
Read pages 138 to 159; p. 162: 12, 15, 16, 25, 26, 27
problems on handout

Friday, March 28 Good Friday, no class

Monday, March 31 Hypothesis Testing - proportions
p. 163: 28, 29, 30, 32, 33; problems on handout
Receive Problem Set 3 due Monday, April 7

Wednesday, April 2 }
Friday, April 4 } More hypothesis Testing
p. 164: 35, 36, 41, 42, 43, 45, 46, 47, 48, 49, 53, 55, 56
p. 169: 80, 81, 83
Know the following terms: null hypothesis, alternate hypothesis, test statistic

REGRESSION

Monday, April 7 } Correlation and Simple Linear Regression
Wednesday, April 9 }

Read chapter 7

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

Problem Set 3 due on April 7

OPTIONAL BONUS 40 points, due with Problem Set 4: An experiment to be described in class. . .

Friday, April 11 Special Class

Monday, April 14 Multiple Linear Regression

page 214: 21, 22, 23

page 216: 37, 39

Work problems on handout

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

Wednesday, April 16 ANOVA

Work problems on information

CONTINGENCY TABLES

Friday, April 18 } Chi Square Tables
Monday, April 21 } and Multinomial Experiments
Wednesday, April 23 }

Read chapter 9

page 266: 1, 2, 3, 4, 5, 15, 18

Work problems on handout

Receive Problem Set 4 (Monday), due on Thursday, May 1 at 2:00.

Friday, April 25 Review for final exam

Monday, April 28 Three People Problem (revisited if needed). . .

Problem Set 4 due 2:00 on Thursday, May 1
(when you come to take your final exam)