

Math 207, Probability and Statistics  
Fall Semester, 2012  
Dr. Evelyn Bailey

**Office hours:** Posted weekly on the class conference

**Reader:** Super Crunchers by Ian Ayres

**Materials:** Typed formal notes with homework problems, class notes, and articles are provided on the Learnlink class conference; a calculator (TI-84, or equivalent).

**Content:** Probability, Bayes Theorem, counting, probability functions (in general), Chebyshev's Theorem, discrete distributions (binomial, hypergeometric, Poisson, uniform), continuous distributions (Exponential, Normal, Uniform), Central Limit Theorem, visual displays of data, measures of central tendency and of variability, classification of data, Confidence Intervals, Hypothesis Testing (for means and for proportions, for one and two samples), Chi Square goodness of fit tests and Contingency Tables, one-way ANOVA, simple linear regression and correlation, nonparametric tests (median, Wilcoxon Rank Sum Test, Kruskal-Wallis Test). The first half uses calculus to explore concepts of probability upon which statistics is based.

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

- \* work various probability problems,
- \* understand the role of functions in statistics,
- \* categorize data,
- \* recognize several standard distributions,
- \* analyze interval data involving difference of means, difference of proportions,
- \* check for inherent assumptions for the statistical models in this course,
- \* interpret relationships in bivariate data,
- \* compare distributions of responses,
- \* analyze data using rankings (nonparametric statistics),
- \* understand the role of statistics in analyzing data and in inference.
- \* describe major misuses of statistics,

In addition, each student will be expected to actively participate in a class project that includes gathering and analyzing data, writing a formal report, and presenting this report to the appropriate audience. The class project takes time and needs all students participating. Out of class meetings with other students are necessary.

**Pre-requisite:** It is assumed that students enrolled have completed Calculus II, either Math 112 or AP score of 4 or 5. Concepts from calculus will be briefly reviewed as needed but not taught.

**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.

In addition, 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 and pledge that you have done so.** Points earned on extra credit will be added to your total points that will determine your grade.

The total sum of points for each student determines the student's grade.

Points are determined as follows:

4 problem sets @ 100	400
2 small group experiments @ 50	100
1 Class Project	150
3 Responses to the Readers @50	150
1 final exam	<u>200</u>
Total	1000 points

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 will select a partner with whom to work. (In case of an odd number, a student may elect to work alone or three students may get permission to work together). You and your partner may use your own notes (those you have taken in class), the notes provided for this class, and your calculator. You will turn in ONE problem set with signatures of those to be credited. In addition, summarize the contributions made by each person.**

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 students each). Dates are given on the attached outline.

The **class project** will be in an interview form. We will elicit opinions related students' opinions about an ideal Writing Center including atmosphere, help, size, hours. Students will design, pilot the survey. The class will collect data and analyze the data. The end result will be a presentation along, brochure, and final typed report.

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 the class 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. The chairperson is to keep Dr. Bailey informed of progress and to 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 along with a record of what and when his/her contributions took place. 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

The class project paper is due (typed, polished, complete copy posted on the class conference) no later than **November 19**; power point is due **November 28**. Individual student logs are due **December 3**. The date for the presentation can be determined after consulting with those who will be invited but should be done sometime **between November 30 and December 5**, the sooner it is scheduled, the better we will be able to get those who are interested to attend. The presentation includes an appropriate power point.

It is important to stay on schedule so as to have a complete project of which you may be proud. The syllabus topics will be shifted to accommodate the presentation and needed time to work on the project in class. An example is posted on the class conference.

Periodically, your instructor will post (by number of checks) the evaluation of your contribution to the class project. This evaluation will be based on postings on the conference, contributions related to the project during class time, activities related to the class project, and other visual and auditory information from others in the class. The log is the final verification of individual participation for each participant's grade (number of points) on the class project.

**Homework problems** may be worked with other members of this class. Some solutions to some homework will be posted on the class conference. 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.

Three individual assignments from the **reader**, *Super Crunchers*, are included on the schedule. Each student completes these assignments **individually**.

### 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 IN ACCORDANCE WITH INSTRUCTIONS GIVEN FOR THE ASSIGNMENT.**

Important dates:

September 10	Readings I due
September 17	Group Experiment I due
September 26	Problem Set I due
October 1	Readings II due
October 12	Problem Set II due
October 15, 16	Fall Break
October 31	Readings III due
November 14	Problem Set III due
November 19	Class Project due (hardcopy, electronic copy final report)
November 21-25	Thanksgiving Break
November 28	Power Point due (or before)
November 30	Group Experiment II due
November 28 – December 5	Presentation on one day (power point, student presenters)
December 3	Individual log for class project due
December 7	Problem Set IV due
December 10	Last class day
December 12	Reading Day
December 12	9:00 am deadline for take-home portion of the final exam

Final exam will be given according to the college schedule, December 14, Friday, 2:00

## OUTLINE

Changes may occur to accommodate the class project. We will complete all topics.

### INTRODUCTION

Wednesday, August 29	Introduction, Orientation, Class Project
Friday, August 31	Jerome Cardan, Model Building

Read the Math 207 project posted on the conference. Prepare any questions you may have about the study.

Problems in typed notes.

### PROBABILITY

Wednesday, September 5	Definitions, Addition Rule, Multiplication Rule,
Friday, September 7	Bayes Theorem, Birthday Problem, Craps
Monday, September 10	
Wednesday, September 12	

Know definitions: experiment, sample space, certain event, impossible event, mutually exclusive, independent

**Reader Assignment I assigned 9/5, due on 9/10**

**Group Experiment I assigned 9/12, due 9/17**

Friday, September 14	Discuss Class Experiment (and any time during class as needed from now on...)
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Finish problems on probability in the typed notes.

### COUNTING

Monday, September 17	Fundamental Theorem of Counting, permutations, combinations
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**Group Experiment I due**

Wednesday, September 19	Probability and Counting
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Finish problems on Counting in the typed notes.

**Receive Problem Set I on Wednesday, due 9/26**

## FUNCTIONS (THEORETICAL)

Friday, September 21                      Random Variable, Density Functions

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

Monday, September 24                      Joint Density Functions, Marginal Distributions  
Wednesday, September 26

### **Problem Set I due 9/26**

Problems in typed notes.

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

**Reader Assignment II given on Wednesday, due 10/1.**

## DISCRETE FUNCTIONS

Friday, September 28                      Discrete Functions, Binomial Distribution

Monday, October 1                      Poisson, Hypergeometric, and Uniform Distributions

Problems in typed notes.

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

**Reader Assignment II due on 10/1**

## CONTINUOUS FUNCTIONS

Wednesday, October 3                      Continuous Functions, Chebyshev's Theorem, Normal  
Friday, October 5                      Distribution, empirical rule, Central Limit Theorem,  
Monday, October 8                      Normal to approximate the binomial as a model, uniform

Problems in typed notes

**Receive Problem Set II on Friday, 10/12**

## DATA AND MEASUREMENTS

Wednesday, October 10

Descriptive Statistics

Friday, October 12

Data measures and classification

### **Problem Set II due on 10/12**

Problems in typed notes.

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.

***FALL BREAK, October 13 - 16***

## CONFIDENCE INTERVALS

Wednesday, October 17

Confidence Intervals for means and for proportions

Friday, October 19

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

## HYPOTHESIS TESTING

Monday, October 22

Review Progress on the Class Project

Wednesday, October 24

Theoretical hypothesis testing

### **Reader Assignment III given, due 10/31**

Definitions and problems in the typed notes

Friday, October 26

Hypothesis testing - means [one sample, large and small sample]

Monday, October 29

Problems in the typed notes

Wednesday, October 31

Means continued [two samples (dependent, large

Friday, November 2

sample, small sample, homogeneity of variance)]

### **Reader Assignment III due on 10/31**

Problems in typed notes

Monday, November 5

Hypothesis Testing - proportions, and

Wednesday, November 7

Review Hypothesis Testing

Problems in the typed notes

**Receive Problem Set III on Wednesday, due 11/14**

NOTE: Course topics on the schedule below may be altered based on timing needs for the class project and presentation schedule . . . changes will be posted on the class conference.

## REGRESSION

Friday, November 9

# Correlation and Simple Linear Regression

## Problems in the typed notes

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

Monday, November 12

ANOVA/Status of Class Experiment Evaluated

## Problems in the typed notes

## NONPARAMETRIC STATISTICS

Wednesday, November 14    Chi Square Tables, Multinomial Experiments, median test  
Friday, November 16

## Problems in the typed notes

## Problem Set III due, 11/14

**Group Experiment II assigned, due 11/30**

**Finish the formal Class Project Report, due 11/19**

Monday, November 19

## Review the Final Version of the Class Project

Begin putting together the power point and discuss the presentation to be given one day **between November 18 – December 5.**

***Thanksgiving Break, November 21 - 25***

Monday, November 26

## Wilcoxon Rank-Sum, Kruskal-Wallis

Wednesday, November 28

## Discuss presentation

## Problems in the typed notes

**Receive Problem Set IV on Wednesday, due 12/7**



PULL IT ALL TOGETHER

Friday, November 30                      Discuss Major Misuses of Statistics, Catch Up  
 Monday, December 3  
 Wednesday, December 5                      Review, Evaluate  
 Friday, December 7  
 Monday, December 10

Finish problems in typed notes

**Group Experiment due 11/30**

**Individual logs due 12/3**

**Problem Set IV due Friday, 12/7**

**Receive Take Home part of final exam on Friday, 12/7**

Wednesday, December 12      9:00 a.m., absolute deadline for *take home* final exam

Friday, December 14                      2:00 pm, *in class* final exam

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

H. G. Wells

As requested by Dr. Ken Anderson, Dean of Academic Affairs, be advised:

**“Student work submitted as part of this course may be reviewed by Oxford College and Emory College faculty and staff for the purposes of improving instruction and enhancing Emory education.”**