

Math 207, Probability and Statistics
Fall Semester, 2014
Dr. Evelyn Bailey

Office hours: Posted weekly on the class conference on Blackboard

Reader: Super Crunchers by Ian Ayres

Materials: Typed formal notes with homework problems, class notes, and articles are provided on the 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.

Grading: Grades will be determined by student performance on four different problem sets, one 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
1 small group experiments @ 50	50
1 Class Project	150
3 Reflective Papers @50	150
1 final exam	<u>250</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 posted 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 the group experiment will be explained in class, on the day the experiment is assigned.

The class project will be in an interview form or survey form which will be determined by the class. We will elicit opinions related students' opinions about an ideal Information Technology (IT) Center including atmosphere, help, services, hours. Students will design and pilot the instrument. The class will collect data and analyze the data. The end result will be a presentation in power point, along with possibly a 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 or co-chairs and secretary or co-secretaries 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 secretary will be the one (or ones) who write up the procedure part of the report in consultation with the chair or co-chairs. 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 7**; power point is due **November 14**. Individual student logs are due **December 1**. The date for the presentation can be determined after consulting with those who will be invited but should be done sometime **between November 17 and November 24**, 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 project 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 Reflection 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 until some studying is done. 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 24	Problem Set I due
September 29	Readings II due
October 6	Problem Set II due
October 11, 14	Fall Break
October 31	Readings III due
November 12	Problem Set III due
November 7	Class Project due (hardcopy, electronic copy final report)
November 14	Power Point due (or before)
November 17 – 24	Presentation on one day (power point, student presenters)
TBD	Group Experiment
TBD	Problem Set IV
December 1	Logs due
December 8	Last class day
December 10	9:00 am deadline for take-home portion of the final exam
December 12	2:00 pm in-class final exam

OUTLINE

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

INTRODUCTION

Wednesday, August 27	Introduction, Orientation, Cardan, Model Building
Friday, August 29	Class Project - IT

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

Problems in typed notes. Reflect on the class project and post what you think is important to ask the students.

PROBABILITY

Wednesday, September 3	Definitions, Addition Rule, Multiplication Rule,
Friday, September 5	Bayes Theorem, Birthday Problem, Craps,
Monday, September 8	Discuss Class Experiment (and any time during
Wednesday, September 10	class as needed from now on. . .)

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

Reader Assignment I assigned 9/3, due on 9/10

Finish problems on probability in the typed notes.

COUNTING

Friday, September 12	Fundamental Theorem of Counting, permutations,
Monday, September 15	combinations; Probability and Counting

Finish problems on Counting in the typed notes.

FUNCTIONS (THEORETICAL)

Wednesday, September 17	Random Variable, Density Functions
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Be able to explain the difference between a pdf and a cdf for continuous and discrete functions.

Receive Problem Set I on Wednesday, due 9/24

Friday, September 19	Joint Density Functions, Marginal Distributions
Monday, September 22	

Problems in typed notes.

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

Reader Assignment II given on Monday, due 9/29.

DISCRETE FUNCTIONS

Wednesday, September 24

Discrete Functions, Binomial Distribution

Friday, September 26

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 9/29

CONTINUOUS FUNCTIONS

Monday, September 29

Continuous Functions, Chebyshev's Theorem, Normal

Friday, October 3

Distribution, empirical rule, Central Limit Theorem,

Monday, October 6

Normal to approximate the binomial as a model, uniform

Problems in typed notes

Receive Problem Set II, due on Monday, 10/6

DATA AND MEASUREMENTS

Wednesday, October 8

Descriptive Statistics

Friday, October 10

Data measures and classification

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 11 - 14

CONFIDENCE INTERVALS

Wednesday, October 15

Confidence Intervals for means and for proportions

Friday, October 17

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

HYPOTHESIS TESTING

Monday, October 20 Theoretical hypothesis testing
 Wednesday, October 22 Hypothesis testing - outline of steps

Reader Assignment III given, due 10/31

Definitions and problems in the typed notes

Friday, October 24 Hypothesis testing - means [one sample, large and small sample)]

Problems in the typed notes

Monday, October 27 Means continued [two samples (dependent, large
 Wednesday, October 29 sample, small sample, homogeneity of variance)]
 Friday, October 31

Reader Assignment III due on 10/31

Problems in typed notes

Monday, November 3 Hypothesis Testing - proportions, and
 Wednesday, November 5 Review Hypothesis Testing

Problems in the typed notes

Receive Problem Set III on Wednesday, due 11/12

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 7 Correlation and Simple Linear Regression
 Monday, November 10 Work on the Class Project
 Wednesday, November 12

Formal Report for the Project

Problems in the typed notes

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

Friday, November 14 ANOVA

Problem Set III due

Problems in the typed notes

Monday, November 17 - Monday December 8: A detailed dates schedule will be provided as soon as the project has been scheduled but it will include the following:

Project: Final Written Report bound, Power Point, Presentation run-through, and Presentation, individual logs, Evaluation

NONPARAMETRIC STATISTICS

Chi Square Tables, Multinomial Experiments, median test

Problems in the typed notes

Group Experiment

Wilcoxon Rank-Sum, Kruskal-Wallis

Problems in the typed notes

Problem Set IV

Thanksgiving Break, November 26 - 30

Logs due on December 1

Discuss Major Misuses of Statistics

Evaluate the course. . .

Wednesday, December 10 9:00 a.m., absolute deadline for *take home* final exam

Friday, December 12 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

Math 207 is an inquiry course in that it includes not only the concepts, principles, assumptions and terminology of statistics, but the class provides information important to a part of the Oxford College campus (this semester, Information Technology) by actively seeking and analyzing input opinions from a random sample of Oxford College students. This process is a way of practicing the field of statistics and which provides an opportunity to think logically like a statistician, a form of experiential learning.