

Mathematics 107 - Introduction to Probability and Statistics
Spring, 2007

Instructor: Oser **Office:** 122A Pierce Hall

Text and materials: Elementary Statistics, 6th ed., Allan G. Bluman
Statistics: A Guide to the Unknown, 4th ed., Peck, et al.
Math 107 Notebook
Calculator (TI-83, TI-83 PLUS, TI-84 or TI-84 PLUS recommended)

Course Content: Visual displays of data, measures of central tendency and of variability, classification of data, counting, probability, Chebyshev's Theorem, normal distribution, binomial distribution, Central Limit Theorem, hypergeometric distribution, Poisson distribution, Confidence Intervals, Hypothesis testing (means, proportions, variances), Simple linear regression and correlation, Analysis of Variance (one way), Chi Square Tests (Goodness-of-fit, Contingency Tables), Nonparametric methods (Wilcoxon [for independent and dependent samples], Kruskal Wallis, Spearman's). Emphasis is on inference.

Goals:

1. **Cognitive:** At the end of this course students should be able to:
 - (1) Categorize a data set;
 - (2) Correctly work various simple probability problems;
 - (3) Articulate the role of functions in statistics;
 - (4) Describe major misuses of statistics,
 - (5) Recognize several distributions and characterize them;
 - (6) Analyze interval data for which statistical tests involving means, proportions, medians, rankings, and variances are the parameters;
 - (7) Interpret relationships in bivariate data;
 - (8) Discuss the difference between parametric and nonparametric statistics in relation to inherent assumptions of the general statistical model;
 - (9) Recognize and explain the limitations of statistics;
 - (10) Interpret the role of statistics in analyzing data and in inference;
 - (11) Use a computer and/or a calculator for appropriate statistical tests;
 - (12) Interpret statistical findings in relation to the situation from which the data was drawn,
 - (13) Describe the experimental nature of mathematical statistics,
 - (14) Draw inferences using the vocabulary of statistics.
2. **Affective:**
 - (1) Students may choose to use suggested organizational guidelines, study skills and test-taking approaches.
 - (2) Students will perform three experiments, using appropriate statistical techniques.
 - (3) Group work for the experiments will enable students to coordinate with others while completing a project and will enable students to develop problem-solving strategies.

The general goals for students taking this course are: Students should: (a) begin to be good consumers of information through gaining knowledge about statistics, (b) become more focused on learning processes as they learn and apply study skills, and (c) stay active in the learning process thus integrating cognitive and affective goals.

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.
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.

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 experiments in a timely manner so that students will know their grades.
6. Grading, as far as possible, to be consistent and impersonal even though students might not agree with the decisions concerning partial credit.

Organizational Guidelines for students:

- (1) As soon as you get your syllabi from all your courses, put all important dates on a single calendar, clearly labeled.
- (2) Stay current in your subjects by setting aside 8 to 9 hours per week to study each subject. You may need more time in some subjects. Spread this time out over the week. Marathon studying, especially in mathematics, does not work well!
- (3) Plan ahead so that you get enough sleep before a test or you will not be able to think clearly and logically.
- (4) Take advantage of the available outside help for this course. Schedule at least one SI session per week.
- (5) Plan ahead for your experiments (and other projects and papers). Working with others requires scheduling far in advance of the due date.
- (6) Have needed supplies for each course. For Math 107 you will need a notebook for class notes, notes from the text, and homework; a calculator; a text book and a notebook; and, of course, pens and pencils.
- (7) Follow each syllabus carefully. For Math 107, your homework is listed for each class meeting. Reading the chapter before coming to class will help your understanding of the material.

Grading: Grades will be determined by student performance on five tests, three experiments, responses to readings, quizzes, and the final exam.

In general,

5 tests @ 100	500	A, A-:	900 points and above
3 experiments @ 50	150	B+, B, B-:	800-899 points
Readings and quizzes	150	C+, C, C-:	700-799 points
Final Exam	<u>200</u>	D+, D	600-699 points
TOTAL	1000	F	below 600 points

Tests: Tests will be given at **3:00 pm** on **February 9, March 2, March 23, April 6, and April 27**. Each test will cover the topics listed for that test on the attached outline. There are no practice tests or additional problems outside of those in the text and notebook. Formulas will be provided. Each student will need a calculator. Students are expected to take all tests at the scheduled times. Any emergencies will be handled on an individual basis and must be documented. Any student needing special accommodations must communicate these needs and make arrangements at least one class period in advance of any test. The final exam will be given at the time scheduled by the registrar and will include material selected from the entire course.

Experiments: There will be three experiments, with students working in groups of four. The experiments will be due on **February 23, March 30 and April 20**. Example experiments are provided in the notebook for this course. Each student is expected to participate in a somewhat "equal" manner. A signed form of individual contributions must accompany each experiment (See the Notebook). No experiment will be accepted after class time on the due date. An individual's grade is based on the individual's contribution, the group's write-up, the statistical analysis used, the experimental procedure outlined and followed, and creativity including originality and neatness.

Readings and Quizzes: Readings from the book Statistics: A Guide to the Unknown are intended to enhance the student's understanding of the use of statistics in today's world. Readings will be assigned by the instructor.

Quizzes are unannounced and may be given at any time. There is no make-up for missed quizzes.

Homework: Class time will be used to enrich topics in statistics but will not be used to summarize information from the text. It is each student's responsibility to read the textbook and make appropriate notes. Homework problems will not be collected but are to benefit the student. Each student should work most of the problems assigned in the text and in the notebook. Example problems will be worked in class, one for each major concept. Basic problems and concepts for which the student is responsible are included in the notebook for this course. To do well, the average student will need to study about 3 hours outside of class for every class meeting or around 8 to 9 hours per week. Preparing and executing experiments, studying and reviewing for tests will require more time.

Office Hours: Office hours will be announced by the instructor. Students should use this time to come by and ask specific questions related to this course. In addition, students may email, privately or on the Math 107 class conference.

Outside Help: In addition to office hours, students are encouraged to use the following:

There is a class conference, Math 107 spring 2007. Students should have the class conference on their desktops and should consult this conference frequently for announcements about office hours, SI sessions, tutoring, etc. Students may pose individual questions on the class conference.

There will be SI leaders for Math 107. Our SI student leaders will schedule review sessions each week. These sessions are optional, however each student is encouraged to pick one of the times per week and attend regularly. Even though these sessions are optional, students who attend SI sessions generally do better in the courses for which there are SI leaders. Individual Tutoring is available in the Math Tutoring Center (schedule to be posted as soon as it is finalized).

Study groups organized by students are highly recommended. The meetings should be scheduled weekly and should be part of a regular weekly routine.

Attendance Policy: You are expected to attend all classes since you are responsible for work covered in class.

Unannounced quizzes are not made up; therefore, if a student is absent when a quiz is given, the student will not have the opportunity to make it up. Emergencies and verifications are at the discretion of the professor.

HONOR CODE: THE HONOR CODE APPLIES TO ALL WORK SUBMITTED FOR CREDIT POINTS TOWARD YOUR GRADE. ALL SUCH WORK WILL BE PLEDGED TO BE YOURS AND YOURS ALONE. YOU PLEDGE THAT WITH YOUR SIGNATURE

Topics and homework assignments

PART 1 for Test 1:

1/18 (Thu.) Introduction to Statistics

Chapter 1: Make study notes on the types of data (pp 6-9); on the types of sampling (pp 10-12), on an experimental design; begin a list of "misuses" of statistics; record stories from history (class notes); summary on pp 24-25; p. 26: 7, 8, 9, 11, 12, 13, 17, 19, 21-29.

1/23 (Tue.) Introduction to Statistics, Jerome Cardan

Chapter 2: Make study notes on categorical frequency distributions (class tally, frequency, percent), group frequency distributions (class limits, class boundaries [use of ".5"], tally frequency, cumulative frequency), grouped frequency distribution rules (pp 38-39). Be able to create a frequency histogram and a relative frequency histogram. Be

able to create a display using stem and leaf; p. 44: 11, 17 (draw a frequency histogram); p. 58: 7; p. 78: 15, 17; p. 86: 21; p. 91: 26.

1/25 (Thu.) Descriptive Statistics

Chapter 3: see p. 107-108 distributions p. 109, p. 123, p. 125, p. 127; p. 110: 1, 9, 11, 31; p. 129: 5, 15, 33, 35, 43, 46; p. 164: 14.

Find the smallest integer value, x , such that x is an outlier of the following data set: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, x . Use both definitions and compare.

1/30 (Tue.) and 2/1 (Thu.) Laws of Probability and Counting

Chapter 4, p. 219 rules: p. 185: 9, 12, 13, 14, 15, 17, 21, 23, 25; p. 193: 3, 5, 7, 9, 11, 13, 17, 19, 23, 24, 25; p. 209: 3, 7, 12, 15, 23, 25, 29, 31, 33, 35, 39, 41, 43, 47. ; p. 220: 1 – 51 odd; p. 226: 1, 3, 5, 7, 9, 11; summary p. 227-228; p. 229: 3, 5, 7, 9, 11, 13, 15, 19, 21, 23, 25, 27, 31, 35, 37, 39, 41; p. 231: 18 – 47 odd

2/6 (Tue.) Bayes' Theorem, birthday problem, game of craps

Appendix B-2, p. A-9; A-12: 1, 3, 5, 7, 9, 11; p. 233: 3

2/8 (Thu.) Review for Test 1

Notebook notes and problems, p. 2-10.

2/9 (Fri.) **Test 1**

PART 2 for Test 2:

2/13 (Tue.) Probability Distributions, Binomial Distribution

Chapter 5, Sections 5-2, 5-3, 5-4: p. 244: 1, 7, 9, 11, 12-18, 19, 23, 25 (make a probability graph and a probability histogram); p. 253: 1, 5, 7, 11, 15, 17, 20; p. 263: 1, 3, 5, 9, 11, 13, 15, 19, 21, 23, 25.

2/15 (Thu.) More Probability Distributions (Multinomial, Poisson, Hypergeometric)

Chapter 5, Section 5-5: p. 276: 1, 3, 5, 9, 11, 13, 15, 17, 19; p. 279: 1, 3, 7, 9, 13, 17, 19, 21, 23, 25, 27, 29, 31; p. 281: 11, 13, 16, 17, 18, 19, 21, 22, 24, 25, 27, 29, 31.

2/20 (Tue.) Normal Distribution

Chapter 6, Sections 6-2, 6-3, 6-4: Normal Distribution p. 289; p. 302: 1-49 odd; p. 316: 3, 5, 9, 13, 15, 17, 19, 21, 23, 27, 33, 35, 38, 41.

2/22 (Thu.) Central Limit Theorem, Normal Approximation to the Binomial

Chapter 6, Sections 6-5, 6-6: Central Limit Theorem p. 324; p. 329: 9, 11, 13, 15, 17, 19, 21; p. 337: 1, 3, 5; p. 339: 3, 5, 7, 9, 13, 15, 16; p. 341: 1-34 (for more problems, if you need them)

Experiment 1 due 2/23

2/27 (Tue.) Confidence Intervals

Chapter 7, Section 7-2: p. 358: 1, 3, 5, 9, 11, 13, 17, 21, 23, 25.

3/1 (Thu.) Review for test 2
 Notebook notes and problems, p.11-16.

3/2 (Fri.) **Test 2**

PART 3 for Test 3:

3/6 (Tue.) Confidence Intervals, Means and Proportions
 Chapter 7, Sections 7-3, 7-4: know the characteristics of the student t distribution;
 p. 366: 1, 3, 5, 7, 11, 13 15, 19; p. 374:3, 5, 7, 9, 11, 13, 15, 17, 19; p. 385:1, 3, 5, 7, 9,
 11; p. 387: 12-23.

3/8 (Thu.) Hypothesis Testing
 Chapter 8, Sections 8-1, 8-2, 8-3, know the five step hypothesis testing procedure,
 the two types of errors (p. 397); Read section 8-2 slowly and carefully! Make notes. p.
 404: 1-13; p. 414:1, 3, 5, 7, 9, 13, 14, 15, 17, 19, 25.

3/12 (Mon.) through 3/16 (Fri.) Spring Break
 Read the history portion of the Notebook, pages 62-71. This history will be
 included on tests 3 and 4. Make notes so you can remember what you read.

3/20 (Tue.) Hypothesis Testing Means
 Chapter 8, Section 8-4, Read pg 451-452: p. 426: 1, 2, 3, 5, 7, 9, 11, 13, 15, 19; p.
 455: 1, 3, 5, 7.

3/22 (Thu.) Review for Test 3
 Notebook notes and problems, p.17-24 (all EXCEPT 4,9,10,11c,15, 16(3),19).
 Also history p. 62-66.

3/23 (Fri.) **Test 3**

PART 4 for Test 4:

3/27 (Tue.) Hypothesis Testing Proportions
 Chapter 8, Sections 8-5, 8-7, 8-8: p. 434: 1-4, 5, 7, 11, 13, 15, 17, 19; p. 453: 1, 3,
 5, 7; p. 455: 9, 19; Not Section 8-6; p. 458: 15, 17, 21, 23, 25, 33.

3/29 (Thu.), and 4/3 (Tue.) Inferences from Two Samples
 Chapter 9: F-distribution p. 477; p. 471: 5, 7, 9, 11, 13, 15, 17, 19, 21; p. 483: 7,
 9, 13, 19; p. 492: 1, 3, 7, 9, 13; p. 506: 3, 5, 7, 9; p. 514: 1, 3, 5, 9, 11, 13, 17; p. 519: 1, 9,
 13; p. 521:14, 15, 16, 22, 26, 27, 29.

Experiment 2 due March 30

4/5 (Thu.) Review for Test 4

Notebook notes and problems, p. 17-24, p. 25-31, history p. 67-70.

4/6 (Fri.) **Test 4**

PART 5 for Test 5:

4/10 (Tue.) Correlation and Regression

Chapter 10, 10-2, 10-3, 10-4 and parts of 10-5, p. 575 summary: p. 542: 13, 17, 19, 25; p. 551: 13, 17, 19, 25; p. 577: 1, 3, 5, 7; answer problems/questions, p. 578: 1-21.

4/12 (Thu.) Chi Square Models

Chapter 11: Characteristics of the Chi Square function pp 378-379; p. 593: 5, 7, 9, 11, 13, 15; p. 605: 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31; p. 613: 1, 3, 5, 7, 9; p. 615: 11, 13, 15, 17, 19.

4/17 (Tue.) ANOVA

Chapter 12, Sections 12-2, 12-3: p. 634: p. 1-7, 9, 17, 19; p. 652: 1, 5; p. 654: 15, 16.

4/19 (Thu.) Wilcoxon Rank Sum and Kruskal-Wallis tests

Chapter 13, Sections 13-2, 13-4, 13-6: p. 674: 5, 7, 9; p. 685: 1, 11; p. 700: 3, 5, 8; p. 702: 17, 19, 20, 21.

Experiment 3 due April 20

4/24 (Tue.) Spearman's correlation

Chapter 13, Section 13-7: Table L on p 779 gives the critical values; procedure summarized on page 690; p. 695: 5, 7, 9; p. 700: 10, 11.

4/26 (Thu.) Review for Test 5

Notebook notes and problems, p. 32-46.

4/27 (Fri.) **Test 5**

5/1 (Tue.) Review for Final