

Mathematics 107 - Introduction to Probability and Statistics

Fall, 2007 - Dr. Evelyn C. Bailey

Text and materials: *Elementary Statistics*, 6th ed., Allan G. Bluman; 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 samples], Kruskal Wallis). 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) As a service component and to reinforce concepts, students will explain some aspect of counting or probability to elementary students in Newton County by producing and presenting a children's book (Theory Practice Service Learning, TPSL).
- (3) Students will perform two experiments, using appropriate statistical techniques.
- (4) Group work for the TPSL project and 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, (c) complete a service project while working in a group, and (d) 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 TPSL project (and other projects and papers), and your experiments. 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; an individual journal for the TPSL project; 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 four tests, ten quizzes, the TPSL (Theory Practice Service Learning) project, two experiments and a comprehensive final exam, as follows:

4 tests @ 100	400	In general,
TPSL project	200	A, A-: 900 points and above
10 Pop Quizzes @ 10	100	B+, B, B-: 800-899 points
2 experiments @ 50	100	C+, C, C-: 700-799 points
final exam	<u>200</u>	D+, D: 600-699 points
total	1000	F: below 600 points

Tests, Quizzes and Final Exam:

Tests will be given during class time on September 21, October 12, November 9, and December 5. Each test will cover the topics listed for that test on the attached outline. At least 48 hours prior to each scheduled test, a topical outline will be posted on the Math 107 class conference. There are no practice tests or additional problems outside those in the text and notebook. Formulas will be provided and your calculator may be used for appropriate portions of tests, quizzes, experiments, and the final exam. You are expected to take tests at the scheduled times. Any emergencies will be handled on an individual basis and must be documented. The final exam will include material selected from the entire course. The final exam will be given at the time designated on the final exam schedule, no exceptions.

Quizzes are unannounced and may be given at any time. These quizzes primarily will check the student's verbal understanding of statistics (terms, concepts, people, or history) although there may be short problems on some quizzes. Quizzes should not take more than 10 minutes at the end of class. There is no make-up for missed quizzes.

TPSL Project (09A, 11A, 12A): In groups of four, students will work with fourth graders in designated elementary schools. Each group will produce a book that will explain an aspect of probability or counting and will make a presentation of the book to a class of fourth graders. During this process, each student will keep an individual journal of all writing attempts, observations and reflections.

Components of the TPSL Project:

Visits: Prior to making the group book presentations at the elementary schools, TPSL groups will sign up and visit their school for two visits of one hour each. Specific dates and times will be covered in class. These visits will be made on Tuesday and/or Thursday mornings (leaving between 8:00 and 8:30 am). In the initial two visits, students will work with the class in activities designated by the teacher (tutoring, etc). On the third visit TPSL groups will make 10 to 12 minute interactive presentations of their books. Each class will have one or two Math 107 groups assigned. Ms. Crystal McLaughlin will arrange your schedule and transportation. She will communicate on the class conference important information. You are required to dress appropriately for the visits.

Book: The book should clearly explain an aspect of probability or counting and should be at least 16 pages long but no longer than 24 pages. Topics must be grade appropriate (understandable and G-rated). Some class time and the class conference will provide discussions of possibilities for topics. By a specific date to be announced, each group will provide a draft of the book to your instructor. Groups may choose to make appointments with the instructor prior to this date. Your draft, with comments, will be returned in time to make corrections and adjustments. Each book will be presented in your Math 107 class and to the elementary students to whom you have been assigned. These books will be the property of the respective class, so make them sturdy!

Presentation: Each group will give a presentation that will be critiqued by the Math 107 class, providing an opportunity to polish each group's presentation. Afterward, the group presentation will be made to small groups of elementary school students, on a specified day and time (either class time or on a Tuesday/Thursday morning, arranged by Ms. McLaughlin). Since these presentations should be focused on elementary students, groups should show the book while they interact with the "audience" whether that is the Math 107 class or the elementary students. Each member of the group should have an integral part of the presentation.

Contributions: Each group must submit a single page sheet itemizing individual contributions to this project and signed by all group members. This will be due after the presentations to the elementary school(s).

Journal: Each student will need a spiral notebook or a lab-type notebook to document progress. Entries should include all work from you, all meetings and notes, all observations and reflections, all false starts; i.e., a complete record of the project from the student's point of view. Each entry must be dated and include what was accomplished or any observations from a visit. These journals are due approximately one week after completion of the presentations. This should give sufficient time for each student to write his/her individual reflections about the presentation and about this project in general.

Timetable: Dates will be provided for the following as soon as arrangements have finalized with the elementary schools. Watch the class conference and fill in below when these have been determined.

September 7 (during class)	Determine groups of four
September 7 (during class)	Visit from Ms. Crystal McLaughlin
Depends on your school, two one-hour visits scheduled	
October 3 (during class)	Draft of book due
October 10 (during class)	Draft returned
October 22 (during class)	Group presentation to the class
Depends on your school, presentation to the elementary students	
November 5 (during class)	Contribution sheet due
November 5 (during class)	Groups share experiences
November 12 (during class)	Journal due

Grading: Your grade on the TPSL project is based on 200 points as follows:

Book (draft, content, appropriateness, contribution)	80 points
Presentation (Math 107 class, elementary school)	40 points
Journal (visits, observations, reflections, problem-solving, opinions, meetings, group dynamics, etc., be complete!)	80 points

Experiments:

There will be two experiments, with students working in groups of two. Experiment 1 will be assigned in class on November 12, due November 19 and Experiment 2 will be assigned on November 28, due on December 7. These dates may be shifted depending on the arrangements for the TPSL projects. 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 (See the Notebook).

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 and the TPSL project, studying and reviewing for tests will require more time.

Office Hours/Outside Help:

Office hours will be posted weekly on the class conference. 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.

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

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. Student tutors are available in the mathematics department area (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. After two absences of any type, five points will be deducted for every unexcused absence. There must be documentation for a student to receive an excused absence after two.

Students who are absent for any aspect of the TPSL project will have points deducted from this project. 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:

8/29 (Wed.) 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.

8/31 (Fri.) 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.

9/3 (Mon.) Labor Day Holiday

9/5 (Wed.) 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. Notebook, notes and problems.

9/7 (Fri.) Discuss the TPSL project

Form groups (decide on your groups and leave the list). Begin TPSL Journal, determine TPSL group meeting times.

9/10, 9/12 (Mon., Wed.) Counting, Laws of Probability

Chapter 4, Section 4-5 p. 219 rules; p. 220: 1 – 51 odd. Chapter 4, Sections 4-2, 4-3, 4-4: 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.

9/14 (Fri.) Combining Probability and Counting, Bayes Theorem

Chapter 4, Section 4-6: 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. Appendix B-2, p. A-9; A-12: 1, 3, 5, 7, 9, 11;

9/17 (Mon.) Birthday problem, Game of Craps

p. 233: 3. Class notes. Notebook, notes and problems.

9/19 (Wed.) Review for test 1

9/21 (Fri.) Test 1

PART 2 for Test 2:

9/24 (Mon.) Probability Distributions

Chapter 5, Sections 5-2, 5-3: 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.

9/26, 9/28 (Wed, Fri.) More Probability Distributions

(Binomial, Multinomial, Poisson, Hypergeometric)

Chapter 5, Sections 5-4, 5-5: p. 263: 1, 3, 5, 9, 11, 13, 15, 19, 21, 23, 25; 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.

10/1, 10/3 (Mon, Wed.) Normal Distribution, Central Limit Theorem

Chapter 6: Normal Distribution p. 289; Central Limit Theorem p. 324; p. 302: 1-49 odd; p. 316: 3, 5, 9, 13, 15, 17, 19, 21, 23, 27, 33, 35, 38, 41; 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)

Draft of the TPSL book due on 10/3, class time; draft returned on 10/11

10/5 (Fri.) Review Probability Distributions

Problems in the Notebook

Mid-Semester break, 10/8

10/10 (Wed.) Review for test 2

10/13 (Fri.) Test 2

PART 3 for Test 3:

10/15 (Mon.) Confidence Intervals, Means

Chapter 7, Sections 7-2, 7-3: know the characteristics of the student t distribution; p. 358: 1, 3, 5, 9, 11, 13, 17, 21, 23, 25; p. 366: 1, 3, 5, 7, 11, 13, 15, 19.

10/17 (Wed.) Confidence Intervals, Proportions

Chapter 7, Section 7-4: p. 374: 3, 5, 7, 9, 11, 13, 15, 17, 19; p. 385: 1, 3, 5, 7, 9, 11; p. 387: 12-23.

10/20 (Fri.) Hypothesis Testing, Theory

Chapter 8, Sections 8-1, 8-2: know the five step hypothesis testing procedure, the two types of errors (p. 397); p. 404: 1-13; Read this first section slowly and carefully! Make notes.

10/22 (Mon.) Group presentations of the book

10/24, 10/26, 10/29 (Wed, Fri, Mon.) Hypothesis Testing from One Sample
Chapter 8, Sections 8-3, 8-4, 8-5, 8-7, 8-8, p. 451-452 Read: p. 414:1, 3, 5, 7, 9, 13, 14, 15, 17, 19, 25; p. 426: 1, 2, 3, 5, 7, 9, 11, 13, 15, 19; p. 434: 1-4, 5, 7, 11, 13, 15, 17, 19; p. 453: 1, 3, 5, 7; p. 455: 1, 3, 5, 7, 9, 19; Not Section 8-6; p. 458: 15, 17, 21, 23, 25, 33. Notebook, notes and problems.

10/31, 11/2 (Wed, Fri.) 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. Notebook, notes and problems

11/5 (Mon) Reflection, each group shares what happened at their school presentation
Contribution Sheet due for TPSL

11/8 (Wed.) Review for Test 3

11/10 (Fri.) Test 3

PART 4 for Test 4:

11/12 (Mon.) 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. Experiment 1 assigned, due on 11/19 (Mon.). TPSL Journal due.

11/14, 11/16 (Wed, Fri.) Correlation and Regression, USE Formal hypothesis testing
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.

11/19 (Mon.) ANOVA
Chapter 12, Sections 12-2, 12-3: p. 634: p. 1-7, 9, 17, 19; p. 652: 1, 5; p. 654: 15, 16. Notebook, notes and problem. Experiment 1 due, class time

Thanksgiving Break, 11/21-11/23

11/26 (Mon.) Spearman's correlation, Nonparametric statistics
Chapter 13, Sections 13-2, 13-7: Table L on p 779 gives the critical values; procedure summarized on page 690; p. 658: 5, 7, 9; p. 700: 10, 11.

11/28, 11/30 (Wed, Fri.) Wilcoxon Rank Sum Test and Kruskal-Wallis tests
Chapter 13, Sections 13-4, 13-6: p. 674: 5, 7, 9; p. 685: 1, 11; p. 700: 3, 5, 8; p. 702: 17, 19, 20, 21. Notebook, notes and problems Experiment 2 assigned, due on 12/7 (Mon.)

12/3 (Mon.) Review for Test 4

12/5 (Wed.) Test 4

12/7, 12/9 (Fri, Mon.) Review/ Uses of Statistics/ Evaluation
Chapter 14 terms: Sampling p. 709, 713, 714, 716, 717; Surveys and
Questionnaires design p. 723-725; simulation and Monte Carlo Method p. 726-727; p.
731: 1-13; p. 734:1-10; summary p. 732. Notebook p 46
Experiment 2 due on 12/7, class time

Final exams will be given according to the college schedule.

GOOD LUCK TO ALL!