Course Syllabus

MATH 3404 PROBABILITY AND STATISTICS WITH COMPUTER APPLICATIONS

Spring Semester, 2013-14

Mathematics Department, Dr. Ernest Pyle, Department Chair

COURSE DESCRIPTION

A mathematical development of the basic concepts of probability and statistics, emphasizing the theory of discrete and continuous random variables, with applications in science and engineering. Topics include descriptive statistics, probability theory, random variables, expected value, probability density functions, probability distributions, correlation and regression, and an introduction to statistical inference. This course includes one semester hour credit for laboratory sessions.

COURSE SEQUENCE IN CURRICULUM

This course is not a prerequisite for any other course. It is required for a major in mathematical studies. It may also be used to satisfy the requirement for "3 additional upper-level hours in mathematics" for students majoring in math. Beginning in 2009, it may also be used to satisfy one of the requirements for a single major in math under the applied math track or under the pure and applied math track.

PRE-REQUISITE INFORMATION

MATH 1451 Calculus I

INSTRUCTOR INFORMATION

Name:	Dr. Paul Lewis
E-mail:	plewis@hbu.edu
Office Phone:	281-649-3688
Office Location:	N209
Office Hours:	By appointment
Web Page Address, Web Board, ListServ:	Blackboard

LEARNING RESOURCES

Course Text:	*Probability and Statistics for Engineering and the Sciences*, 8th edition, by Jay Devore, Duxbury Press, Pacific Grove, CA, 2008, ISBN 0-495-38217-5.
Laboratory Text	None
Supplementary Text:	*MINITAB Handbook*, 5th edition, by Barbara Ryan, Brian Joiner, and Jonathon Cryer, Brooks/Cole, Pacific Grove, CA, 2005, ISBN 0-534-49600-8 (optional). *Student Solutions Manual for Devore's Probability and Statistics*, 7th ed. by Julie Ann Seely, Duxbury Press, Pacific Grove, CA, 2004, ISBN 0-0-495-38219-1 (optional but strongly recommended).
Other Required Materials:	Either a TI-83, a TI-84, or a TI-86 graphing calculator. Note: A TI-89, TI-92, or a comparable graphing calculator that will do symbolic manipulations may be used on homework assignments but may not be used on tests without special permission. Unauthorized use of such a calculator is considered cheating and will result in a grade of 0 on that test. You may be asked to clear the memory or delete programs or data (other than the TI statistical functions on the TI-86) from any calculator used on a test. If your calculator contains programs or data that you want

to keep, you should save them before the test or arrange to use a different calculator during the test. Programs and data on a TI-83, TI-84, or TI-86 can be transferred to another calculator of the same model by using the link cable which comes with the calculator or to a computer by using a TI Connectivity Cable.

COURSE OBJECTIVES

Purpose of the course:

This course is an introduction to the fundamental concepts of probability and statistics. Both descriptive and inferential statistics are covered, but the emphasis is on inferential statistics with applications to science and engineering. Probability concepts that are essential to the development of inferential statistics are introduced, using calculus concepts when appropriate. Some of the most commonly used discrete and continuous probability distributions are introduced, including the binomial, hypergeometric, Poisson, normal, exponential, and Student's t distribution. The course also includes an introduction to correlation and regression, interval estimation, and hypothesis testing.

Aims for the course:

This course is intended to introduce students to many commonly used statistical techniques and the probability concepts behind them so that they will have an understanding of the use and misuse of statistics and be able to confidently apply statistical techniques in everyday life and in their chosen professions. Computer instruction is included so that students will be able to solve statistical problems they encounter in other courses or in everyday life which require analysis and manipulation of data sets which are too large to be treated by hand or by calculator. This course is also intended to prepare students for more advanced courses in probability and statistics.

On completion of this course, students should be able to:

1. Use statistical terminology and notation in both descriptive and inferential statistics and elementary probability theory.
2. Construct and interpret commonly used statistical graphs and tables, such as frequency distribution tables, bar graphs, histograms, box plots, dot plots, pie charts, scatter plots, and stem-and-leaf displays.
3. Compute and interpret summary numerical measures, including means, medians, modes, trimmed means, standard deviations, variances, quartiles, percentiles, and ranges.
4. Use the axioms for a probability space and Venn diagrams to compute probabilities of simple events and be able to derive additional probability rules for computing probabilities of more complex events.
5. Compute absolute and conditional probabilities using counting methods involving permutations and combinations, the Basic Counting Principle, Bayes' Rule, and formulas derived from the probability axioms.
6. Compute statistical parameters, such as the expected value and variance, of selected discrete and continuous random variables by using the definitions.
7. Use standard probability distributions, including the binomial distribution, the hypergeometric distribution, the Poisson distribution, the uniform distribution, the normal distribution, the exponential distribution, and the t-distribution to compute probabilities and make statistical inferences.
8. Find the sampling distributions of certain random variables, find the mean and variance of sampling distributions, and be able to use sampling distributions to compute probabilities and make statistical inferences.

9. Construct confidence intervals and perform hypothesis tests for means and proportions and for differences between means and proportions of both small and large samples.
10. Determine when a statistically significant linear or nonlinear relationship exists between two variables, compute a correlation coefficient to determine the strength of a linear relationship, and use a least squares regression line or curve to predict the value of one variable from the value of other variables.

RELATION TO DEPARTMENTAL GOALS AND PURPOSES

The Mathematics/Physics Department "…will offer an academically rigorous, undergraduate curriculum in classical and modern mathematics. The curriculum will prepare students majoring in mathematics and mathematical studies for careers and further education in mathematics and will encourage a lifetime of learning."

"…will provide academically rigorous and modern courses in mathematics to support other programs at the University."

"…will offer courses to enable all graduates of the University to become mathematically literate and develop useful skills in mathematics."

"…will provide the appropriate administrative processes, facilities, research experiences, and faculty to achieve the goals stated above."

RELATION TO COLLEGE GOALS AND PURPOSES

"…to prepare students for careers and further education in the natural sciences and mathematics in a nurturing Christian environment. The College will also serve the HBU community by providing science and mathematics classes that empower HBU students to meet the goals and requirements of their field of study and enrich their liberal arts education."

RELATION TO THE PURPOSE STATEMENT OF THE UNIVERSITY

University mission and purpose statement from the Houston Baptist University Catalog, 2009-2010: "…to provide a learning experience that instills in students a passion for academic, spiritual, and professional excellence as a result of our central confession, "Jesus Christ is Lord"

"…Committed to providing a responsible and intellectually stimulating environment that:

- fosters spiritual maturity, strength of character, and moral virtue as the foundation for successful living
- develops professional behaviors and personal characteristics for life-long learning and service to God and to the community
- meets the changing needs of the community and society
- remains faithful to the **'Nature of the Institution'** statement"

"…Promotes learning, scholarship, creative endeavor, and service".

ATTENDANCE

Please see the official Attendance Policy in the HBU Classroom Policy on Blackboard. Students missing more than 25% of the class will be given a failing grade.

ACADEMIC ACCOMODATIONS

Students needing learning accommodations should inform the professor immediately and consult the Academic Accommodations section of the HBU Classroom Policy posted on Blackboard.

COURSE REQUIREMENTS & GRADE SCALE

Course requirements:

There will be three regular exams and a comprehensive final exam. Homework from the textbook will be assigned daily but will not be collected; instead, there will be weekly quizzes over assigned homework problems. An assignment will be made for each computer lab and collected the following week. The grades on these assignments will be averaged to determine a computer lab grade. The lab final exam will consist of a project for which you will collect and analyze data, write a report, and give a presentation during the Lab Final Exam period.

Grading standards:

Course grading is as follows:

Final grades will be determined according to the following percentages:

Exams (3 at 15% each)	45%
Quizzes	5%
Labs	20%
Lab Final	5%
Final Exam	25%

The final exam will be comprehensive.

The grading scale is:

The letter grade for the course will then be determined by applying the following grading scale:

A = 90 – 100; B = 80 – 89; C = 65 – 79; D = 50 – 64; F = Below 50.

PROFICIENCIES:

Technology component:

Students will use a commercially available software package (Minitab) to compute summary statistics, construct tables, graphs, and charts, do probability simulations, and carry out basic tasks in inferential statistics, including interval estimation, hypothesis testing, correlation and regression.

Designated essay/writing component:

Some questions on examinations and homework assignments may require essay-type answers.

Reading component:

Students are required to read the textbook. They are responsible for all assigned material even if it is not covered in class.

Oral communication component:

Not applicable for this course.

Mathematics component:

Entire course.

Critical thinking component:

Students are required to read, understand and analyze problems, develop solution strategies, implement these strategies to solve the problems, then interpret and verify their results.

LATE WORK & TEST POLICY

Late work:

Late work will be accepted only when there is a legitimate reason for the work being late, such as an extended illness. Documentation for the reason the work was late will be required. There will be a 10% penalty for each late paper unless there are extenuating circumstances, such as a severe illness. If you are unable to attend class, you may hand in your paper early or have a friend or classmate hand it in for you. No lab assignments may be handed in more than one week after the date they are due unless there are strong mitigating circumstances, such as an extended hospital stay.

Missed tests:

A grade of 0 will be assigned for any test missed because of an unexcused absence. The grade on the final exam will be used in place of the first test missed because of an **excused** absence. A makeup test will be given for any subsequent test missed because of an **excused** absence. **All absences will be assumed to be unexcused unless written evidence, such as a note from an attending physician, is presented to demonstrate otherwise.**

EVALUATION

Method of student appraisal of faculty:

Students will be given an opportunity to appraise the professor by completing the IDEA Faculty Evaluation Questionnaire, and/or the COSM course evaluation at the end of the semester. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

Method of evaluating student response to course:

Students will be given an opportunity to describe their response to the course by completing the IDEA Faculty Evaluation Questionnaire and/or the COSM course Evaluation at the end of the course. The instructor, the department chairman and dean will review the responses of the students after the completion of the course.

LABORATORY DRESS CODE

Students may be asked in advance to wear closed-toed shoes and long pants during certain experimental procedures.

LABORATORY CONDUCT AND SAFETY

Not applicable.

TOPICAL OUTLINE - ***include table, calendar, or topical outline with dates***

Topics Covered:

Tentative Schedule:

Week	MONDAY	WEDNESDAY	FRIDAY
1		§1.1 Populations, Samples, and Processes	§1.2 Pictorial and Tabular Methods in Descriptive Statistics
2	§1.3 Measures of Location	§1.4 Measures of Variability	§2.1 Sample Spaces and Events
3	§2.2 Axioms of Probability	§2.2 Axioms of Probability §2.3 Counting Techniques	§2.3 Counting Techniques
4	§2.4 Conditional Probability	§2.5 Independence	§3.1 Introduction to Random Variables
5	§3.2 Probability Distributions for Discrete Random Variables	**Review for Exam 1 (time permitting)—Exam tomorrow in Lab (Feb. 20, 2014)**	§3.2 Probability Distributions for Discrete Random Variables §3.3 Expected Values of Discrete Random Variables
5	§3.3 Expected Values of Discrete Random Variables	§3.4 The Binomial Distribution	§3.5 The Hypergeometric and Negative Binomial Distributions*
6	§3.6 The Poisson Distribution	§4.1 Continuous Random Variables and Probability Density Functions	§4.2 Cumulative Distribution Functions and Expected Values
7	§4.2 Cumulative Distribution Functions and Expected Values	§4.2 Cumulative Distribution Functions and Expected Values	§4.3 The Normal Distribution
	Spring	Break	March 10-14
8	§4.4 The Exponential Distribution	**Review for Exam 2 (time permitting)—Exam tomorrow in Lab (March 20, 2013)**	§5.1 Jointly Distributed Random Variables
9	§5.2 Expected Value, Covariance, and Correlation	§5.3 Statistics and Their Distributions	§5.4 The Distribution of the Sample Mean
10	§5.5 The Distribution of a Linear Combination	Chapter 5 Review §6.1 Point Estimation—Notation and Terminology Only (Omit remainder of §6.1 and Chapter 6)	§7.1 Basic Properties of Confidence Intervals
11	§7.2 Large Sample Confidence Intervals for a Population Mean and Proportion	§7.2 Large Sample Confidence Intervals for a Population Mean and Proportion (cont.)	§7.3 Intervals Based on a Normal Probability Distribution (the *t*-Distribution
12	§7.4 Confidence Intervals for the Variance and Standard Deviation of a Normal Population*	§8.1 Hypotheses and Test Procedures	**Easter Holiday (Good Friday, April 18, 2014)**

Week	MONDAY	WEDNESDAY	FRIDAY
13	§8.2 Tests About a Population Mean	§8.3 Tests Concerning a Population Proportion	§8.4 *P*-Values
14	§9.1 Tests and Confidence Intervals for a Difference Between Two Population Means	**Review for Exam 3 (time permitting)—Exam tomorrow in Lab (May 1, 2014)**	§9.2 The Two Sample *t*-Test and Confidence Interval
15	§9.2 The Two Sample *t*-Test and Confidence Interval (cont.)	§9.3 Analysis of Paired Data*	**Review for Final Exam (time permitting)**

*This section may be omitted due to time constraints.

Note: The above schedule is provided for planning purposes only. Although the topics shown will be covered in the order listed, there may be some deviations from the dates shown or deletions due to time constraints.

Preparation of Lab Assignments:

A computer printout showing the solution to each assigned problem is required for each lab assignment. You should include a copy of the output from the Session window showing the steps you used to solve these problems along with the solutions obtained. Use Minitab's ReportPad to type a lab report which includes your name, the number of the lab assignment, and the date the assignment was due, a brief statement of each assigned problem, and the solutions for all assigned problems.

There will be a 10% penalty for each late assignment unless there are extenuating circumstances. No lab assignment may be handed in more than one week after the due date unless there are strong mitigating circumstances (such as an extended hospital stay). **Lab homework papers are due at the beginning of the next lab period; if you hand in your paper at the end of the lab, it will be considered late.** If you are unable to attend class, you may hand in your paper early or have a friend or classmate hand it in for you.

Homework/Quizzes

Most homework problems assigned will be odd-numbered problems whose answers are given in the back of the textbook; complete solutions to these problems may be found in the *Student's Solutions Manual*, available in the University Bookstore. Although homework will be assigned daily, it will not be collected or graded; instead, a quiz will be given during each Thursday lab session, except on days when exams are scheduled. The quiz may also contain problems related to the previous week's lab. In addition, there may be other unannounced quizzes over homework or lab during regular class sessions. The two lowest quiz grades will be dropped before the quiz grade is computed. **Because two quiz grades will be dropped, no make ups will be given for quizzes. If you are late for class, you will not be given extra time to complete a quiz nor will you be allowed to make up the quiz for that day.**

The content of this outline and the attached schedule are subject to change at the discretion of the professor.

Student Signature – I have read and understand the syllabus for this class. I understand that the content of this syllabus and the topical outline are subject to change at the discretion of the professor. I have read and understand the HBU Classroom Policy posted on Black Board.

I promise to uphold the Code of Academic Integrity at Houston Baptist University and will not tolerate its violation by others.