**Department of Mathematics**

**Lafayette College**

**MATH 286: Introduction to Probability and Mathematical Statistics**

**Spring 2017**

**Instructor**: Jeffrey Liebner

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**Office Hours:** W 9 am – 10 am; ThF 1 pm – 4 pm

 Other times: by appointment

**Texts:** Devore, J. (2012) Probability & Statistics for Engineering and the Sciences, Eighth Edition, Brooks/Cole.

**Overview/Objectives:**

A mathematics course that uses tools from the calculus sequence to introduce topics in probability, sampling distributions, methods of inferential statistics, and least squares analysis. Students will also be introduced to a statistical computing package.

**Intended Student Learning Outcomes**

At the conclusion of this class, students will be able to:

* Apply the basic axioms of probability to real life situations.
* Identify various probability distributions and be able to appropriately use these to perform probability calculations.
* Perform simulation studies to assess the probabilistic nature of different situations.
* Apply the basic rules of statistics to real life situations.
* Correctly apply the appropriate inference to data, allowing for the assessment of the statistical validity of various claims.
* Make inferences about the relationship of variables and interpret the results.
* Perform statistical analyses on data utilizing computer software.

**Prerequisites:**

Students are expected to have successfully completed the calculus sequence (Math 161-162-263). Students are expected to be able to use techniques covered in this sequence.

**Attendance:**

Attendance for class is mandatory. Unexcused absences will have an adverse effect on your grade. Excessive unexcused absences will result in a grade of F for the course.

**Course Information:**

The Moodle system will be used to maintain course information. Students should check here for assignments, course handouts, and other course related materials. A special note regarding Moodle privacy, via the Moodle homepage:

Moodle contains student information that is protected by the Family Educational Right to Privacy Act (FERPA).  Disclosure to unauthorized parties violates federal privacy laws.  Courses using Moodle will make student information visible to other students in this class.  Please remember that this information is protected by these federal privacy laws and must not be shared with anyone outside the class.  Questions can be referred to the Registrar's Office.

**Class Cancellations*:***

Lafayette College almost never cancels daytime classes. In the event that an unexpected problem requires that a class be cancelled, I will send an e-mail to all students prior to class. If you do not receive an e-mail, expect class to be in session. As I am originally from Buffalo, never assume that snow is a reason for class cancellation.

**Incompletes:**

An incomplete will only be given if the majority of the work in the course is completed and an emergency situation exists that prevents the student from completing the course by the time of the final examination.

**Special Needs:**

In compliance with Lafayette College policy and equal access laws, I am available to discuss appropriate academic accommodations that you may require as a student with a disability. Requests for academic accommodations need to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students must register with the Office of the Dean of the College for disability verification and for determination of reasonable academic accommodations.

Note that to be eligible for appropriate accommodations, you must provide me with the appropriate form from ATTIC prior to any class event which would require these accommodations.

**Homework Assignments:**

Homework will be assigned on a weekly basis to be submitted for grading. Homework must be submitted on time to receive full credit. Assignments submitted after the due date will not be graded. Students may discuss the assignment with others in the class, but the submitted material must be each student’s own work. Failure to abide by these standards will result in disciplinary measures being taken.

**Course Project:**

Probability and statistics is not only a study of mathematics, but an exercise in communicating mathematical results to others. Thus, in addition to the weekly homework assignments, there will be a course project involving simulation of probabilistic games. Additional information regarding the project will be provided at a later time.

**Exams:**

There will be two 75 minute in-class exams presented during the course of the semester and a final exam scheduled at the end of the course. Exams will include material covered in lecture, assigned readings, and assigned homework. In the event of an excused absence from an exam, the exam will be made-up within a week of the student’s return to class. Unexcused absences will receive a score of zero for the exam.

**Grading:**

Grades will be based on the following breakdown:

 Assigned Homework: 15%

 Course Project: 15%

 In-class Exams (2 at 17%/22%): 39%

 Take Home Quiz: 9%

 Final Exam: 22%

 Students can expect that the following grade distribution will be roughly followed when assigning final grades: A: 90-100%, B: 80-90%, C: 70-80%, D: 60-70%, F: below 60%. Pluses and minuses will be distributed within each range.

**Academic Honesty**:

You are reminded of the college policy on Intellectual Honesty (detailed in your student handbook). Any case of academic dishonesty will be brought to the attention of the dean. If there are any questions on this matter please speak with me.

**Federal Compliance:**

The student work in this course is in full compliance with the federal definition of a four credit hour course. Please see the Lafayette College Compliance webpage (http://registrar.lafayette.edu/files/2012/07/Federal-Credit-Hour-Policy-Web-Statement.doc) for the full policy and practice statement.

**Course Outline**

**Date Lecture # HW# Assigned Section Topic\_\_\_\_\_\_\_\_\_\_\_**

1/23 1 1.1-1.4 Introduction

1/25 2 2.1-2.2 Probability axioms

1/27 3 1 2.3 Counting techniques

1/30 4 2.4-2.5 Conditional probability and

 independence

2/1 5 2.4 Law of total probability and Bayes’

 Theorem

2/3 6 2 3.1-3.2 Random variables and discrete

 distributions

2/6 7 3.3 Expected value and variance

2/8 8 3.4 Binomial distribution

2/10 9 3 3.5 Hypergeometric and negative

 binomial distributions

2/13 10 3.6 Poisson distribution

2/15 11 4.1-4.2 Continuous distributions

2/17 12 4 4.3 Normal distribution

2/20 13 4.4 Gamma family

2/22 14 4.4-4.5 Exponential, Chi-squared, and other

 continuous distributions

2/24 15 5 Review for test

2/27 16 Exam #1

3/1 17 5.1 Joint distributions

3/3 18 5.2 Correlation and covariance

3/6 19 5.5 Distribution of linear combinations

3/8 20 5.4 Distribution of sample mean

3/10 21 6 5.4 Central limit theorem computer lab

3/13 No Class – Spring Break

3/15 No Class – Spring Break

3/17 No Class – Spring Break

3/20 22 6.1-6.2 Point estimation

3/22 23 7.1 Confidence intervals

3/24 24 7 7.2-7.3 CIs for means and proportions

3/27 25 7.4 CIs for variances

3/29 26 7.1-7.4 Computer lab for confidence

 intervals

3/31 27 8 Review for test

4/3 28 Exam #2

4/5 29 8.1, 8.4 Introduction to hypothesis tests

4/7 30 8.2 Tests of a single mean

4/10 31 8.3 Tests of single proportion

4/12 32 8.1-8.3 Power

4/14 33 9 9.1 Tests between two means

4/17 34 9.2-9.3 Two-sample t-tests vs. paired t-tests

4/19 35 9.4 Tests of two proportions

4/21 36 10 9.5 Tests of two variances

4/24 37 12.1 Simple linear regression

4/26 38 12.2 Estimating regression parameters

4/28 39 Quiz 12.3-12.4 Inferences for regression

5/1 40 13.1 Assessing regression models

5/3 41 13.4 Multiple regression

5/5 42 11 Review