**Department of Mathematics**

**Lafayette College**

**MATH 336: Mathematical Statistics**

**Spring 2019**

**Instructor**: Jeffrey Liebner

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 610-330-5910

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**Office Hours:** WThF 1 pm – 4 pm

 Other times: by appointment

**Texts:** Devore, J. and Berk, K. (2012) Modern Mathematical Statistics with Applications, Second Edition, Springer.

**Overview/Objectives:**

This course will be a mathematical development of fundamental results and techniques in statistics. Topics include estimation, sampling distributions, hypothesis testing, correlation and regression.

**Intended Student Learning Outcomes**

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

* Apply the basic rules of statistics to real life situations.
* Develop estimators and be able to determine the best estimators in given 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 MATH 335 (Probability). Students are also expected to use techniques covered in the calculus 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 the Academic Resource Hub (formerly 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 advanced statistical techniques. 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 (<https://registrar.lafayette.edu/wp-content/uploads/sites/193/2013/04/Federal-Credit-Hour-Policy-Web-Statement.doc>) for the full policy and practice statement.

**Course Outline**

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

1/28 1 1.1-6.4 Introduction

1/30 2 1.1-6.4 Review of 335

2/1 3 1.1-6.4 Review of 335

2/4 4 6.3 Sample mean and variance

2/6 5 6.4 Chi-squared distribution

2/8 6 1 6.4 T and F distributions

2/11 7 7.1 Point estimation and MSE

2/13 8 7.2 Method of moments

2/15 9 2 7.2 Maximum likelihood estimation

2/18 10 7.2 More MLEs

2/20 11 7.4 Fisher information

2/22 12 3 7.4 UMVUE

2/25 13 8.1-8.2 Confidence intervals

2/27 14 8.3-8.4 More CIs

3/1 15 4 Review for test

3/4 16 Exam #1

3/6 17 Computer lab – Confidence

 Intervals

3/8 18 9.1-9.2 Hypothesis testing - Simple

 hypotheses

3/11 19 9.4 P-values

3/13 20 9.3 Tests of a single proportion

3/15 21 5 9.1-9.3 Power

3/18 No Class – Spring Break

3/20 No Class – Spring Break

3/22 No Class – Spring Break

3/25 22 9.5 Neyman-Pearson lemma; likelihood

 ratio tests

3/27 23 10.1-10.2 Tests for two sample means

3/29 24 6 10.2-10.3 Two sample t-tests vs. paired t-tests

4/1 25 10.4 Tests of two proportions

4/3 26 10.5 Tests of two variances

4/5 27 7 Review for test

4/8 28 Test #2

4/10 29 12.1 Least Squares; regression

4/12 30 12.2 Regression coefficients

4/15 31 12.3-12.4 Inference and prediction

4/17 32 12.6 Assessing regression models

4/19 33 8 12.7 Multiple regression

4/22 34 Regression computer lab

4/24 35 13.1 Categorical goodness of fit tests

4/26 36 9 13.3 Contingency tables

4/29 37 Class Presentations

5/1 38 Class Presentations

5/3 39 Quiz Class Presentations

5/6 40 Extra topic

5/8 41 Extra topic

5/10 42 10 Extra topic