

MATH 362: Probability & Statistics II  
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With the introduction of technology into the classroom, statistics is becoming more about communication and less about calculation. I joined the Piedmont Project in an effort to develop a writing element for my second semester mathematical statistics course, which focuses on inferential statistics. Teaching statistics through data investigation gives students an opportunity to apply what they have learned to real world situations and data. Throughout the semester students will analyze Emory's Sustainability Literacy Survey. They will learn how to articulate why the statistical methods they use are applicable, discuss what their results show (and don't show), and make recommendations for future studies based on their findings. In addition to the analysis, students will develop an intuition on what statistics measure and understand the difference between statistical significance and practical significance. By analyzing the survey data, I hope the project will also help them develop a sense of place. Through this writing project, students will have an opportunity to connect with their community and understand how their decisions can influence the community as a whole.

## **Syllabus for MATH 362: Probability & Statistics II**

**Text:** An Introduction to Mathematical Statistics and Its Applications (5th Edition) by Richard J. Larsen and Morris L. Marx, published by Prentice Hall.

**Course Description:** Introduction to the fundamentals of statistical inference. Topics include: estimation, properties of estimators, methods for comparing estimators, confidence intervals, and hypothesis testing. Statistical inference for linear models, including regression and analysis of variance, is also covered.

**Evaluation:** The overall course grade is determined as follows:

- Homework: 5%
- Tests [best 4 out of 5]: 20%
- Writing Assignments: 40%
- R Projects: 5%
- Final exam: 30%

The final examination will be on Thursday 27 April 11:30 a.m. - 2:00 p.m. This exam will cover all of the course material. The time of the final exam cannot be changed. The in-class midterms will be given on Wednesday 25 Feb and Wednesday April 1. The times will be confirmed in class well in advance of the exam dates.

**Homework:** Assignments will be given and graded weekly. You are encouraged to work together to find solutions, however, the write-up you turn in must be your own. There is no collaboration of any kind allowed on the tests or the final exam. Write legibly; if an answer is not readable, you will receive no credit.

Show all of your work on homework assignments, tests and the final exam, supplying all necessary reasoning and calculations. No work = no credit! If a graph is part of a solution, axes must be labeled, units marked off, functions labeled.

**Students with Disabilities:** If you have a disability and would like to request accommodations, please see me to discuss arrangements.

**Calculators, Laptops, Tablets, Phones:** You may use a calculator such as a TI-83 Plus for doing calculations on the homework and possibly for some questions on the midterms. All cellphones, PDAs, laptops, and any other devices with internet, phone or messaging capabilities must be turned off and put away at the beginning of each class.

**The Honor Code:** The Emory College Honor Code applies to all work in this class, including homework, midterms and the final examination. See

[http://college.emory.edu/home/academic/policy/honor\\_code.html](http://college.emory.edu/home/academic/policy/honor_code.html)

**Missed Exams:** Please see the section Incompletes and Absences at:

[http://college.emory.edu/home/academic/policy/incomplete\\_absence.html](http://college.emory.edu/home/academic/policy/incomplete_absence.html)

The in-class exams during the term are “required midterm examinations” so are subject to the rule described there. If you know that you will have to miss an exam in advance, due to illness or a university-sanctioned off-campus commitment, you must contact the course instructor before the exam. Excuses such as travel for other reasons, non-Emory exams, etc., are not valid reasons for missing exams.

**Homework Assignments:** Homework assignments from the book and additional problems using R will be assigned in-class and posted on Canvas.

**Writing Assignments:** Assignments marked with a G are group assignments.

Writing Assignment 1 : How does Emory deal with sustainability? 1-3 pages in L<sup>A</sup>T<sub>E</sub>X.

Writing Assignment 2 : Write a project proposal. Based on the survey what trends in the data would expect/like to find. 1-2 pages in L<sup>A</sup>T<sub>E</sub>X.

Writing Assignment 3 : Integrate at table and picture into your proposal. Describe what you see in each. 1-2 pages in L<sup>A</sup>T<sub>E</sub>X.

Writing Assignment 4 : Prepare a brief presentation of your project.

Writing Assignment 5G: Turn in your integrated file from Lab 6.

Writing Assignment 6G: Write the Methods section of your paper.

Writing Assignment 7G: Write the Results section of your paper.

Writing Assignment 8 : Review a paper

Writing Assignment 9 : Make changes and write a response to your reviewers.

Writing Assignment 10G: Final Paper Due

Writing Assignment 11G: Infographic and Presentation Due

**Schedule:** Below is a week-by-week listing of the topics to be covered in class. Please note that this schedule is tentative. It may be necessary to make changes to the topics and to the test dates. The sections refer to the text *An Introduction to Mathematical Statistics and Its Applications*.

11 Jan: Introduction Statistical Inference & Estimation [§5.1]

13 Jan: Lab 1 - Sustainability and L<sup>A</sup>T<sub>E</sub>X (Discussion: *What is Sustainability? What are some examples of Sustainability efforts at Emory? Introduction to L<sup>A</sup>T<sub>E</sub>X.*)

18 Jan: Maximum Likelihood Estimation & Method of Moments [§5.2]

20 Jan: Lab 2 - Emory's Sustainability Literacy Survey and R-studio (Discussion: *Look at the Survey. What types of answer do we expect? How much variation do we expect? Introduction to R and R-studio. Load the data to look at it.*)

23/25 Jan: Interval Estimation, Margin of Error & Sample Size [§5.3]

27 Jan: Lab 3 - Data Exploration in R (Discussion: *Common Visualization Tools. How to visualize your proposal?*)

30 Jan/1 Feb: Properties of Estimators, Minimum Variance Estimators, Sufficient Estimation & Consistency [§5.4-5.7]

3 Feb: Lab 4 - What can you conclude? Common misconceptions and overreaches. (Discussion: *This lab will be a group work lab with several actives with pictures and statements where the students need to judge if the statements are true based on the picture.*)

6 Feb: Test 1: Chapter 5

8 Feb: Hypothesis Testing, Decision Rule [§6.1-6.2]

10 Feb: Lab 5 - Project Presentations (Discussion: *Each student will prepare a brief presentation of what they would like to find in the data. Students will give feedback and discuss. Students will form groups for a collaborative final paper.*)

13/15 Feb: Testing Binomial Data & Type I and Type II Errors [§6.3-6.4]

17 Feb: Lab 6 - Formatting a Paper in L<sup>A</sup>T<sub>E</sub>X (Discussion: *During this lab*

*students will integrate their Writing Assignments 1-3 into a paper. Students will learn how to use BibTeX for their bibliography as well as a style file for the appropriate formatting. )*

20 Feb: Test 2: Chapter 6

22 Feb: Inferences based on the normal distribution [§7.1-7.2]

24 Feb: Lab 7 - Choosing the Correct Method (Discussion: *What method should you use to test your hypothesis about the data? Are all the assumptions of the test satisfied? Would it be okay to abuse some of the assumptions?*)

27 Feb/1 March: T-Distribution & Drawing Inferences About  $\mu$  &  $\sigma$  [§7.4-7.5]

3 Mar: Lab 8 - Test your Hypothesis (Discussion: *Use R to test your hypothesis. Is there statistical significance? Does the data reflect what you had hoped?*)

13 March: Test 3: Chapter 7

15 March: Two-Sample Inferences, Testing means [§9.1-9.2]

17 Mar: Lab 9 – Conclusions (Discussion: *What do your results say? How could your results be improved? What questions would you like answered?*)

20/22 March: Two-Sample Inferences, Testing variances, Binomial Data & Confidence Intervals for the Two-Sample problem [§9.3-9.5]

24 Mar: Lab 10 - How to Read and Review a Scientific Article (Discussion: *Summarize the Results, Explain the Approach, Critique the Analysis, Suggestions for the Author(s).* )

27/29 March: Goodness of Fit Tests & Contingency Tables [§10.1-10.5]

### **Spring Break : 6 – 10 March**

31 Mar: Lab 11 - How to Respond to Review a Scientific Article. (Discussion: *Address the readers concerns, and politely defend your approach.* )

10 April: Test 4: Chapters 9 & 10

12 April: Regression & Linear Models [§11.1-11.3]

7 April: Lab 12 - Proofread the paper and finalize your response (Discussion: *Read over the papers discuss what needs to be improved or removed.* )

17/19 April: Linear Models, Covariance and Correlations & The Bivariate Normal Distribution [§11.3-11.5]

14 April: Lab 13 - Prepare Infographic and Presentation (Discussion: *Condense your result into a poster or presentation.* )

20/22 April: ANOVA Chapter 12

21 April: Lab 14 - Present (Discussion: *Presentations of final projects.* )

24 April: Nonparametric Statistics

**Final Examination : Thursday 27 April 11:30 a.m. -2:00 p.m.**

Note: This syllabus is a general plan for the course; deviations may be necessary.