MEETING TIMES: MWF 1:00 - 2:00
INSTRUCTOR: Mike Veatch
CONTACT: MacDonald Hall 218A (ext. 4375) veatch@gordon.edu (h) 978-777-6266
OFFICE HOURS: M 9:10 - 10:10, 3:20 - 4:20
(Also by appointment) W 3:20 - 4:20
Th 9:45 - 12:00
F 9:10 - 10:10
On Tuesdays I am at home and will read e-mail between 4:00 and 7:00, or you can call me if needed.


MATERIALS Occasional use of the SPSS program in the computer labs will be required.

COURSE DESCRIPTION
In our information age we are constantly bombarded with statistics. Methods for collecting data, extracting useful statistics, and drawing conclusions from them are used in almost every field, particularly management, engineering, social sciences, and laboratory sciences. This course gives a rigorous development of some common statistical methods. Their justification comes from the probability theory we study in MA 318. Specific topics to be covered are

- descriptive statistics
- estimation theory, confidence intervals, maximum likelihood estimation
- hypothesis testing theory; tests about means, variances, proportions and goodness-of-fit
- linear regression
- analysis of variance
- nonparametric statistics.

Students will also gain experience collecting, analyzing and presenting data for a project that they design themselves. However, those interested in statistical analysis should be aware that, because of our focus on theory, many issues involving data collection, experimental design, and other statistical methods are not covered.

In addition to lectures, the course will rely heavily on student presentations. Students will present most of the examples, as well as some of the methods and instructions for using SPSS. In the latter part of the course students will not all learn the same material; rather, the goal is to function as a team that collects knowledge and solves problems.

PREREQUISITES: MA 318 Probability or consent of instructor.

COURSE REQUIREMENTS
1. Class participation. Each of you plays a key role in the success of the class. You are expected to attend regularly, participate in group problem-solving, give presentations, and ask questions of other presenters.

2. Field trips. Two field trips are planned but have not been confirmed yet. The plans are to visit a manufacturing facility and a business or laboratory. Each will take the place of one class.

3. Presentations Graded as partially complete (50%), complete (90%), or exceptional (100%).

a) Problems (3 required): Work a problem from the book and present informally. Most of these require some reading ahead or work with SPSS.

b) Methods (2 required): Read about a methodology and/or learn to do it with SPSS, work an example, and make a 15 minute presentation.
c) **Presented project:** Design your own project involving the collection, analysis, and presentation of data. Meet with me at least twice to discuss methodology and results. Give formal 20 - 30 minute presentation or present a poster at the Gordon student research symposium. Write a brief summary. You may work with a partner if you choose a larger project.

4. **Written project:** Analyze an assigned data set and write up your results.

5. **Exams** There will be an in-class mid-term and a take-home final exam. You will not be required to answer all of the questions on the final, so that you can select topics you are more familiar with.

6. **Research tasks:** You will be asked to help in some way with my research or teaching. You might choose to put materials for this course on the web, search for journal articles, develop a stats project for other students, study advanced SPSS features, or review a book chapter.

No homework will be collected. In addition to the problems worked in class, some practice problems will be suggested and solutions posted.

**GRADING PROCEDURES**

- Participation/field trips: 10%
- Five presentations: 30%
- Presented project: 15%
- Written project: 10%
- Midterm: 15%
- Final exam: 15%
- Research task: 5%

**TENTATIVE SCHEDULE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>W 1/16</td>
<td>Introduction to statistical inference; review of descriptive statistics</td>
</tr>
<tr>
<td>F 1/18</td>
<td>Graphical description of data</td>
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| W 1/23 | 10.2 Unbiased estimators  
| | 10.3 Efficiency |
| F 1/25 | 11.1 Confidence intervals  
| | 11.2 The estimation of means |
| M 1/28 | 11.3 Estimation of the differences between means |
| W 1/30 | 11.4 The estimation of proportions  
| | 11.5 Estimation of differences between proportions |
| F 2/1 | 11.6 Estimation of variances |
| M 2/4 | 12.1, 12.2, 13.1 Introduction to hypothesis testing |
| W 2/6 | 13.2 Tests concerning means |
| F 2/8 | 13.3 Tests concerning differences between means |
| M 2/11 | 8.6 The F distribution  
| | 13.4 Tests concerning variances  
| | 13.5 Tests concerning proportions |
| W 2/13 | 13.6 Tests concerning differences among k proportions |
| F 2/15 | 13.7 Contingency tables |
M 2/18 13.8 Goodness of fit
W 2/20  Review problems
F 2/22  MIDTERM EXAM
M 2/25 14.2 Linear regression
        14.3 The method of least squares
W 2/27 14.4 Normal regression analysis
F 3/1  14.5 Correlation
M 3/4  14.6 Multiple linear regression
W 3/6  14.7 Multiple linear regression (matrix notation)
M 3/18 15.2 One-way analysis of variance
W 3/20 15.3 Experimental design
        15.4 Two-way analysis of variance
        15.5 Two-way analysis of variance with interactions
F 3/22 15.6 Multiple comparisons
M 3/25  Canceled for field trip?
W 3/27 12.4 The Neyman-Pearson lemma
        12.5 The power function
W 4/3  10.7 The method of moments
F 4/5  10.3 Efficiency (revisited)
M 4/8  10.8 The method of maximum likelihood
W 4/10 8.7 Order statistics
F 4/12 8.7 cont.
M 4/15 10.3 Efficiency (revisited again)
        16.1 Introduction to nonparametric tests
W 4/17 16.2 The sign test
        16.3 The (Wilcoxon) signed-rank test
F 4/19 16.4 The (Mann-Whitney) U test
        16.5 The (Kruskal-Wallis) H test
M 4/22 16.6 Tests based on runs
W 4/24  Canceled for field trip?
F 4/26, M 4/29, W 5/1, F 5/3  Project presentations
M 5/6  Review problems
W 5/8  Summary

**FINAL EXAM (take home) due:** Friday May 10, 4:00 p.m.