ALL STS COURSE SYLLABI
Description: An introduction to concepts in statistics at a deeper quantitative level than that offered in MTH 110, General Statistics. This course emphasizes rationales, applications, and interpretations using advanced statistical software. Examples are drawn primarily from economics, education, psychology, sociology, political science, biology and medicine. Topics include introductory design of experiments, data acquisition, graphical exploration and presentation, descriptive statistics, one- and two- sample inferential techniques, simple/multiple regression, goodness of fit and independence, one-/two-way analysis of variance (ANOVA). Written reports link statistical theory and practice with communication of results. This course is recommended for students pursuing quantitatively-based careers.

Prerequisite: MTH 110, MTH 121, placement exemption, or permission of the Statistics Program Coordinator.

Required Materials: Bring the following materials to class every day:

1. A positive attitude – don’t ever forget this!
2. Calculator: TI84+ or other graphing calculator with equivalent statistical features.
3. Handouts: Check Moodle the day before each class to print handouts that have been posted!
4. Large 3-Ring Binder with tabs: This will help you to stay organized which will increase productivity.

Statistical Software: We will use be using the SAS software package for data analysis and exploration. You will be given instructions on how to use SAS as needed for this course. Note that knowing how to write code using SAS software looks great on your CV.

Tutors: Tutors are typically available for this course in Belk library Sunday through Thursday. Hours will be announced once they are set. Please see the class Moodle site or www.elon.edu/tutoring.

Outcomes: Statistics promotes quantitative critical thinking skills that should serve the student in the rest of their studies at Elon. Specific outcomes that should prove valuable include the ability to:

- Understand the basic concepts in data production.
- Develop an ability to evaluate the quality of data.
- Learn the techniques of data analysis and statistical inference.
- Gain an appreciation for the role data can play in improving our understanding of the world.
- Be able to intelligently discuss media reports that involve statistical issues.
- Improve in the communication of quantitative ideas, both in writing and in speech.
Objectives: A list of specific objectives follows each area of the content.

- After graphical exploration and presentation of data, the student will be able to:
  - Generate and read various visual displays of quantitative and qualitative data including bar graphs and/or histograms.
  - Recognize normal/bell-shaped, right and left skewed, and uniform distributions.
  - Recognize patterns/trends in data.

- After discovering various statistical measures, the student will be able to:
  - Compare and contrast statistical measures and their properties.
  - Compare data from different distributions.
  - Check data sets for outliers.
  - Construct and interpret box-plots.

- After one-sample inferential techniques, the student will be able to:
  - Describe the overall idea behind a sampling distribution.
  - Describe the overall idea behind inferential statistics.
  - Verify the requirements to perform one-sample inference.
  - Construct and interpret confidence intervals about the population mean (large and small sample), proportion and variance/standard deviation, with an emphasis on technology.
  - Use a confidence interval to test a claim about a parameter (without setting up the whole hypothesis testing structure).
  - Set up and perform an appropriate test of significance about a population mean, proportion and standard deviation using the classical and P-value methods. Emphasis on technology.
  - Compute the power of a test.

- Following the section on inference on categorical data, the student will be able to:
  - Obtain and read contingency tables.
  - Perform goodness of fit tests, tests for independence and homogeneity of proportions.

- After the sections on one- and two-way ANOVA, the student will be able to:
  - Verify the requirements to perform an ANOVA.
  - Test a claim regarding three or more means using ANOVA tables generated using technology.
  - Perform Tukey’s test for multiple comparisons using technology.

- Following the section on simple regression, the student will be able to:
  - Generate and read a scatter plot obtained using technology.
  - Interpret a correlation coefficient and coefficient of determination.
  - Obtain the least-squares regression line and interpret the coefficients.
  - Use technology to generate the statistics and graphs needed to test the significance of the least-squares regression model.
  - Perform residual analysis on a regression model including verifying the normality of residuals.
  - Use the least squares line to make predictions.
  - Construct prediction intervals for an individual response.

- After the section on multiple regression, the student will be able to:
  - Use technology to obtain a multiple regression equation.
  - Interpret the coefficients of a multiple regression equation.
  - Use technology to generate the statistics and graphs needed to test the significance of the regression coefficients and overall fit.
  - Build a regression model using various techniques such as backward or forward selection.
Grading and Exam Information:
Your grade in this class will be a weighted average based on the following:

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Points (%)</th>
<th>Grades are assigned as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>22</td>
<td>A 93-100</td>
</tr>
<tr>
<td>Exam 2</td>
<td>22</td>
<td>A- 90-92.9</td>
</tr>
<tr>
<td>Exam 3</td>
<td>22</td>
<td>B+ 87-89.9</td>
</tr>
<tr>
<td>Assignments</td>
<td>17</td>
<td>B 83-86.9</td>
</tr>
<tr>
<td>Projects</td>
<td>17</td>
<td>B- 80-82.9</td>
</tr>
<tr>
<td>Total Course Points (%)</td>
<td>100</td>
<td>C+ 77-79.9</td>
</tr>
</tbody>
</table>

Formula to calculate your grade:

\[
.2(\text{Exam1}) + .2(\text{Exam2}) + .2(\text{Exam3}) + .17(\text{Assignment Average}) + .17(\text{Project Average})
\]

Explanation of Categories:

A. *Exams* - There will be three unit examinations administered in this course. Students with an excused absence for the day of the exam must take the exam **BEFORE the exam is administered in class. If you miss an exam for any reason, you will have the option of taking a conclusive final exam to replace your missed exam grade. Tentative Exam dates are:**

TENTATIVE EXAM DATES GO HERE

B. *Homework* - Homework assignments will be assigned periodically throughout the semester with due dates given. These assignments may be discussed in study groups, but should be completed individually. Homework due dates and times are posted on Moodle. **No late homework assignments will be accepted.**

C. *In-class work* - In-class work includes activities, worksheets, and other forms of engagement during class. In-class work may be completed individually or in groups, depending on the specific activity. Not all activities will be graded. Students should plan to attend all classes and to participate in and complete all in-class assignments. In general, **in-class assessments cannot be made up** since part of the learning process is the discussion that develops during these activities. However, assessments can be made up with a university excused absence **within one week of the activity. It is your responsibility to contact me to arrange a make-up.**

D. *Term Project & Presentation* - You will work in groups to analyze real data using techniques covered in this course. This will allow you to apply the skills you learn in this course to the real world which in turn should enhance your appreciation and retention of the material. There will be **two project reports and a final presentation.** Guidelines and due dates will be provided on Moodle. Each person’s grade for the projects will be based upon the group’s grade and a smaller portion is based on individual performance and contributions. **The project presentation is scheduled for the exam block during final exams:**

FINAL EXAM BLOCK INFORMATION GOES HERE

**NOTE:** there is no conclusive final examination for this class (unless you miss an in-class exam).
Other Special Dates:

**INSERT DATES FOR FALL BREAK OR SPRING BREAK, ETC…**

Religious Holidays:
Please fill out a Religious Observance Notification Form and turn it in to the Truitt Center if you will be missing a class or classes for religious reasons. This form is available at the following website: [http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml](http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml)

Academic Accommodations:
If you are a student with a documented disability who will require accommodations in this course, please register with Disabilities Services in the Duke Building, Room 108 (278-6500), for assistance in developing a plan to address your academic needs. [http://www.elon.edu/e-web/academics/support/disabilities_services.xhtml](http://www.elon.edu/e-web/academics/support/disabilities_services.xhtml)

Moodle:
Most information concerning this course is contained in our Moodle site. You are responsible for checking the Moodle site regularly and printing materials from Moodle as needed. You can access the Moodle site at [https://idp.elon.edu/idp/Authn/UserPassword](https://idp.elon.edu/idp/Authn/UserPassword)

SAVING YOUR WORK:
If you are a current or potential statistics major, please be sure to maintain both electronic and hard copies of your major assignments from this course. During your senior year, statistics majors are required to put together a portfolio of their work in the major which includes examples of past assignments.

**ACADEMIC STATEMENT:**
An Elon student's highest purpose is academic citizenship: giving first attention to learning and reflection, developing intellectually, connecting knowledge and experiences, and upholding Elon's honor codes.

**HONOR CODE:**
Elon’s honor pledge calls for a commitment to Elon’s shared values of Honesty, Integrity, Respect and Responsibility. To be clear about what constitutes violations of these values, students should be familiar with the Judicial Affairs policies in the student handbook, including violations outlined at [http://www.elon.edu/e-web/students/handbook/violations/default.xhtml](http://www.elon.edu/e-web/students/handbook/violations/default.xhtml).

Students with questions about the specific interpretation of these values and violations as they relate to this course should contact this instructor immediately. Violations in academic-related areas will be documented in an incident report which will be maintained in the Office of Student Conduct, and may result in a lowering of the course grade and/or failure of the course with an Honor Code F.

Violations specifically covered by academic honor code policies include: plagiarism, cheating, lying, stealing and the facilitation of another’s dishonesty. Multiple violations will normally result in a student’s temporary suspension from the University.
Description: An introduction to the concepts and methods of statistical reasoning associated with sample surveys. This course emphasizes rationales, applications, and interpretations of sampling strategies used for estimation. Advanced statistical software such as SAS or R may be used. Case studies of survey methods are drawn primarily from the social sciences while field sampling applications to ecological and environmental research may be used. Topics include survey design issues, simple random sampling, stratified sampling, single and two-stage cluster sampling, systematic sampling, parameter estimation, and sample size calculation. Written reports link statistical theory and practice with communication of results.

Offered: Fall of odd-numbered years.

Prerequisite: MTH 110, STS 212/MTH220, or permission of the Statistics Program Coordinator.

Required Materials: Bring these materials to class every day:

1. A positive attitude: Don’t ever forget this – it’s the most important thing to bring to class!
3. Calculator: TI83, TI83+, TI84, TI84+, or TI89 graphing calculator. Another graphing calculator with equivalent statistical features will also be sufficient.
4. Handouts: Print off of Moodle — notes will be available before class.
5. Large 3-Ring Binder with Tabs

Statistical Software: We will use be using the SAS software package for data analysis and exploration. If you do not have experience programming in SAS, please see me as soon as possible. We may also be using R software, which you may not have ever used before.

Outcomes: Statistics promotes quantitative critical thinking skills that should serve the student in the rest of their course of studies at Elon. Specific outcomes that should prove valuable include the ability to:
1. Design valid statistical surveys.
2. Accurately apply survey methods in their own work.
3. Recognize the importance of unbiased sampling techniques in drawing inferences about a population.
4. Effectively organize and present data both visually, in writing, and through an oral presentation.
5. Become intelligent consumers of survey information so that it may be recognized when statistics is being used to inform and misinform the general public.

6. Assess confidence in results of statistical inference and making appropriate inferences about the population.

Objectives: A list of specific objectives follows each area of the content.

After studying sampling/design issues, the student will be able to:
• Distinguish between a population and a sample.
• Define and identify the sampling frame.
• Define the major sampling methods: simple random sampling, stratified sampling, systematic sampling, and single and multi-stage cluster sampling.
• Distinguish between sampling for estimation and sampling for modeling purposes.
• Identify sources of error in surveys.
• Suggest strategies for reduction of errors in surveys.
• Distinguish between survey question types and identify the advantages and disadvantages linked to each.
• Identify the parts required for a successfully planned survey.

After descriptive statistics, the student will be able to:
• Define a sampling distribution.
• Compute the mean, standard deviation, proportion, covariance and correlation.
• Use graphs such as histograms to summarize data
• Interpret/define a confidence interval.

After simple random sampling, the student will be able to:
• Draw a simple random sample using a random digits table and using technology.
• Estimate a population mean, proportion or total.
• Calculate the sample size required to estimate the population mean, proportion and total.
• Use 2-sample confidence intervals to compare estimates.
• Compare data from different distributions.

Following the section on stratified sampling, the student will be able to:
• Draw a stratified random sample.
• Estimate a population mean, proportion or total.
• Calculate the sample size required to estimate the population mean, proportion and total.
• Choose strata using an optimal rule.
• Perform stratification before and after sample selection.

After a brief introduction to estimation based on subsidiary variables, the student will be able to:
• Identify when surveys require the use of auxiliary variables.
• Use the ratio estimator as a means of reducing the variance of an estimator.
• Use the measurement of an auxiliary variable to obtain a better parameter estimator.
• Perform regression analysis.
• Calculate the bias of estimators.
• Calculate the relative efficiency of estimators.

After discussions of systematic sampling, the student will be able to:
• Draw a systematic sample.
• Estimate a population mean, proportion or total.
• Compute the optimal sample size required for estimation.
After studying single and multi-stage cluster sampling, the student will be able to:
• Draw a single and two-stage cluster sample.
• Estimate a population mean, proportion or total.
• Compare and contrast equal cluster sizes and simple random sampling methods.
• Select the sample size for estimating means, totals and proportions.
• Perform cluster sampling when combined with stratification.

After studying population size estimation, the student will be able to:
• Use direct and indirect sampling to estimate population size.
• Choose sample sizes for direct and inverse sampling.

After the section on survey procedures, the student will be able to:
• Discuss imputation methods.
• Decide on the number of callbacks for a survey.
• Make adjustments for non-response.
• Describe the bootstrap method and its function/use in survey sampling.

Grading and Exam Information:

Your grade in this class will be determined by 4 major assessments:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Course Points (%)</th>
<th>Grades are assigned as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams (2*20%)</td>
<td>40</td>
<td>A  93-100</td>
</tr>
<tr>
<td>Assignments, Quizzes, and Etiquette</td>
<td>15</td>
<td>C  73-76.9</td>
</tr>
<tr>
<td>Service Learning Project</td>
<td>20</td>
<td>A-  90-92.9</td>
</tr>
<tr>
<td>Final Exam (Cumulative)</td>
<td>25</td>
<td>C-  70-72.9</td>
</tr>
<tr>
<td>Total Course Points (%)</td>
<td>100</td>
<td>B+  87-89.9</td>
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<tr>
<td></td>
<td></td>
<td>B  83-86.9</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>F  0-59.9</td>
</tr>
</tbody>
</table>

Grades are assigned as follows:

A  93-100
A-  90-92.9
C  73-76.9
C-  70-72.9
B+  87-89.9
B  83-86.9
B-  80-82.9
C+  77-79.9
F  0-59.9

Explanation of Activities:

A. Assignments, Quizzes, and Etiquette — Homework assignments and quizzes may be online or turned in on paper. During the semester you will also work individually or in groups to complete assigned activities in class. Not all activities will be graded. Any quizzes that are given will be announced in advance. Homework, in-class activities, and quizzes can only be made up with a university excused absence. There will be one assignment grade based on classroom etiquette. Your etiquette score will be reduced for any incidences of poor classroom etiquette such as using the printer once class has started, texting or checking email during class, and using computers for non-scholarly pursuits.

B. Service Learning Project – Each student is required to participate in a service-learning project with a community agency. This involves the following things:

• As a member of the same group you will work with the agency to complete a project to answer their question(s). Time guideline: 40 hours per individual including analysis time. Focus on a question that can be reasonably answered by the end of this semester—there must be a survey component. The purpose is to learn about the community in which you live, contribute to the community by providing valuable statistical expertise, and apply the content of this course in a real and useful way. Specifically each project group will gather appropriate survey data based on the needs of the community partner they are working with, analyze the data, and present results based on the data obtained. Project groups may also help the community partner in
generating appropriate items to be included in the survey. Students will make an on-site visit to their community partner at least once during the semester.

- As an individual you will complete individual reflective assignments summarizing your experience in terms of what you learned about the community which you are now a part of. You will also discuss how you learned about the community partner. It is recommended that you learn as much as you can about your community partner before you begin working with them.

- As a group you will make a brief presentation to the community partners and to the class. These presentations are intended to be informative and creative.

- You will also submit a project report to your community partner. Guidelines will be discussed in class.

- Note: As you are working on your service learning project throughout the semester, be sure to document specifics on dates/times that you work on the project. Work such as meeting with the client, visiting the site, meeting as a group to work on generating the survey, visiting local organizations to collect data, analyzing data collected, writing the report, generating and practicing the presentation, etc… should ALL be clearly documented! My recommendation is to have an email that you continually resend to yourself as you work on this project so that you can be very organized in your record keeping and work on this project. Organization is the key to productivity!!

C. **Exams** - There will be two unit examinations administered in this course. If you miss an exam for an excused reason, you must make up the exam **before the next class period**. It is your responsibility to contact me to arrange the make-up. **Tentative** Exam Dates:

**TENTATIVE EXAM DATES GO HERE**

D. **Final Exam** – There will be a cumulative final exam on:

**FINAL EXAM BLOCK INFORMATION GOES HERE**

**Other Special Dates:**

**INSERT DATES FOR FALL BREAK OR SPRING BREAK, ETC…**

**Religious Holidays:**

Please fill out a Religious Observance Notification Form and turn it in to the Truitt Center if you will be missing a class or classes for religious reasons. This form is available at the following website: [http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml](http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml)
**Academic Accommodations:**
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http://www.elon.edu/e-web/academics/support/disabilities_services.xhtml

**Moodle:**
Most information concerning this course is contained in our Moodle site. **You are responsible for checking the Moodle site regularly and printing materials from Moodle as needed.** You can access the Moodle site at https://idp.elon.edu/idp/Authn/UserPassword

**SAVING YOUR WORK:**
If you are a current or potential statistics major, please be sure to maintain both electronic and hard copies of your major assignments from this course. During your senior year, statistics majors are required to put together a portfolio of their work in the major which includes examples of past assignments.

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An Elon student's highest purpose is academic citizenship: giving first attention to learning and reflection, developing intellectually, connecting knowledge and experiences, and upholding Elon's honor codes.

**HONOR CODE:**
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Violations specifically covered by academic honor code policies include: plagiarism, cheating, lying, stealing and the facilitation of another’s dishonesty. Multiple violations will normally result in a student’s temporary suspension from the University.
Description: This course emphasizes rationales, applications, and interpretations of regression methods using a case study approach. Advanced statistical software such as SAS or R may be used. Topics include simple linear regression, multiple linear regression, indicator variables, robustness, influence diagnostics, model selection, logistic regression for dichotomous response variables and binomial counts, and an introduction to non-linear regression models. Written reports link statistical theory and practice with communication of results.

Offered: Spring of even-numbered years.

Prerequisite: STS 212/MTH220 or permission of the Statistics Program Coordinator.

Required Materials: Bring the following materials to class every day.

2. Calculator: TI83, TI83+ or TI84 graphing calculator or other graphing calculator with equivalent statistical features.
3. Handouts: Handouts will be posted in advance on Moodle. Please bring a copy to class.
4. I suggest that you obtain a large 3-Ring Binder with tabs so that you can keep the course material organized.

Outcomes: Statistics promotes quantitative critical thinking skills that should serve the student in the rest of their course of studies at Elon. Specific outcomes that should prove valuable include the ability to:

- Fit and interpret simple linear and multiple linear regression models.
- Assess the suitability of models.
- Use various model selection procedures to build regression models.
- Determine when logistic regression models would be appropriate and use them to make inferences.
- Fit and interpret linear regression models with non-standard assumptions.
- Identify the general approach to non-linear regression problems.
- Identify which regression models are most appropriate in given real-world settings.
- Critically form, think about and assess scientific questions.
- Develop sufficient statistical skills to critically examine other people's research and carefully perform their own.
- Effectively organize and present data both visually and in writing.
Objectives: A list of specific objectives follows each area of the content.

After the unit on simple linear regression, the student will be able to
• Explain how statistical models differ from deterministic models.
• Make preliminary inferences about associations based on the predictor/response and scatterplots.
• Use sample data to motivate a hypothesized population linear regression model
• Algebraically represent the population model and interpret the components in context.
• Identify model assumptions.
• Fit a simple linear model to data.
• Define and interpret residuals.
• Describe the least-squares method of estimation.
• Compute and interpret the correlation coefficient and the coefficient of determination.
• Using ANOVA to estimate the mean squared error.
• Distinguish between correlation and causality
• Define and explain spurious correlation, confounding, Simpson’s paradox, reciprocal causation and ecological correlation
• Construct confidence intervals for regression parameters.
• Construct confidence intervals for the mean of Y at a given value of X.
• Discuss the dangers of extrapolation.
• Construct prediction intervals for an individual value of Y at a given value of X
• Compute statistical power and discuss appropriate methods to increase it.

Following coverage of the section on the tenability of regression assumptions, the student will be able to
• Identify the assumptions required for least squares estimation and inference, and discuss the robustness of these inferences.
• Identify the four major types of model violations—outliers, nonlinearity, heteroscedasticity and non-independence of errors.
• Determine whether the regression assumptions hold.
• Compute raw and studentized residuals, and construct and read residual plots.
• Use appropriate case-influence statistics to identify outliers (studentized residuals), influential cases (Cook’s Distance) or other unusual observation (Leverages for flagging such cases), and deal with them.
• Perform strategies to refine the model including testing terms and using partial residual plots.
• Perform appropriate transformations to achieve linearity.
• Explain the effects of logarithmic transformations.
• Discuss the consequences of linear fitting to non-linear data.
• Interpret the regression of Y on log(X), log(Y) on X and log(Y) on log(X).
• Select among alternative transformation options.

Following the multiple regression unit, the student will be able to
• Provide an algebraic representation of the multiple regression model.
• Explain how multiple regression helps or harms the precision of predictions.
• Estimate the parameters of the multiple regression model.
• Perform hypothesis tests and construct confidence intervals for single coefficients and for linear combinations of coefficients.
• Calculate and interpret the R-squared statistic in the multiple regression setting.
• Appropriately use the omnibus F-test in multiple regression.
• Summarize multiple regression results in both tables and figures including the matrix of pair-wise scatterplots.
• Discuss what is meant by statistical control and the problem of collinearity.
• Examine a correlation matrix and say what it foretells about the multiple regression.
• Measure the additional explanatory power of additional predictors.
• Discuss partial correlations—terminology, interpretation, and relationship to simple correlation.
• Perform sequential variable selection techniques: forward selection, backward elimination and stepwise regression.
• Perform model selection among all subsets: Akaike’s and Bayes information criteria; Cp statistic and plot.
• Discuss the dangers of multicollinearity, and strategies for identifying and dealing with it.

After studying logistic regression, the student will be able to
• Identify logistic regression as a generalized linear model.
• Explain how and why dummy variables are used.
• Algebraically represent a logistic regression model for binary response variables and interpret the coefficients.
• Explain the maximum likelihood estimation procedure’s approach for estimating the coefficients.
• Perform hypothesis tests and construct confidence intervals for single coefficients of the logistic regression model for binary response variables.
• Obtain graphic displays of regression findings and highlight appropriate effects.
• Explain the difference between logistic regression for binary response variables and logistic regression for binomial counts.
• Mathematically represent the logistic regression model for binomial counts.
• Assess the logistic regression model by using scatterplots of empirical logits versus Y, examination of residuals, and the deviance goodness-of-fit test.
• Perform inferences using Wald’s tests and confidence intervals for single coefficients in the logit model, and the Drop-in-Deviance test.

Following exposure to non-linear regression models, the student will be able to
• Formulate the statistical problem.
• Use iterative methods of solution and non-linear least squares computer programs.
• Perform approximate tests of hypotheses and confidence intervals.

**Grading and Exam information:**
Your grade in this class will be determined by the following categories:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Course Points (%)</th>
<th>Grades are assigned as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework, Activities, &amp; Quizzes</td>
<td>15</td>
<td>A  93-100  C  73-76.9</td>
</tr>
<tr>
<td>Exams (3*15%)</td>
<td>45</td>
<td>A- 90-92.9  C- 70-72.9</td>
</tr>
<tr>
<td>Mini Projects (3) and Presentation</td>
<td>20</td>
<td>B+ 87-89.9  D+ 67-69.9</td>
</tr>
<tr>
<td>Final Exam (Cumulative)</td>
<td>20</td>
<td>B  83-86.9  D  63-66.9</td>
</tr>
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<td>Total Course Points (%)</td>
<td>100</td>
<td>B- 80-82.9  D- 60-62.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C+ 77-79.9  F  0-59.9</td>
</tr>
</tbody>
</table>

**Explanation of Activities:**

**A. Homework & In-Class Activities --**

Homework may involve solving problem sets or using/creating SAS code. Assignments will be posted on Moodle. You are permitted and encouraged to discuss these assignments with other students, but you must write your own solutions/reports. Copying other students’ work is a violation of the Honor Code. **Late homework assignments will not be accepted.**

During the semester you will work individually or in groups to complete assigned tasks in class. Because a major part of our class will involve in-class work, not all activities will be graded or collected. **In-class activities cannot be made up** as the nature of the assignment is often working and discussing with your peers.

Quizzes will be assigned periodically so that you will be encouraged to review your notes on a regular basis. **Quizzes cannot be made up.**
B. **Exams** -- There will be 3 examinations administered in this course. Exam dates will be announced at least one week in advance.

C. **Mini-Projects and Presentation** -- You will work in pairs to describe and analyze related data three times during the semester to answer related questions of your choice using: 1) simple linear regression, 2) multiple regression, and 3) logistic regression on the collected variables. This will allow you to apply the skills you learn in this course to the real world which in turn will enhance your appreciation and retention of the material. There will be *three project reports* due during the semester—guidelines and due dates will be provided in a separate handout. During the final two weeks of classes, you will present all of your work to the class. You will also be required to turn in your compiled project. The write-up will be evaluated by the instructor based on the project and your individual contributions.

D. **Final Exam** -- There will be a cumulative final exam given on:

**FINAL EXAM BLOCK INFORMATION GOES HERE**

**General Policies:**
- Given the nature of this course, daily attendance is essential to your success. It is expected that you will be in class unless there is a compelling reason that necessitates your absence. The expectation is that your instructor and others affected by your absence be notified.
- You are expected to complete all assignments.
- You are encouraged to ask me questions during class or in my office hours.
- The last day to drop with a “W” is **INSERT DATE**
- An excused absence is as defined in the Student Handbook.
- Please be considerate of your classmates and make sure that all phones, Ipods, etc. are turned off or set to silent.

**Academic Accommodations:**
If you are a student with a documented disability who will require accommodations in order to fully participate in this course, please contact Disabilities Services in the Duke Building, Room 108 (278-6500), for assistance in developing a plan to address your academic needs.

**Moodle:**
Most information concerning this course is contained in our Moodle site. **You are responsible for checking the Moodle site regularly for announcements.** You can access blackboard at [www.elon.edu/moodle](http://www.elon.edu/moodle)
- Class emails will be sent to your Elon email address from Moodle.

**Disclaimer:**
The above policies and assignments in this course are subject to change in the event of extenuating circumstances or by mutual agreement between the instructor and the students.
ACADEMIC STATEMENT: An Elon student's highest purpose is academic citizenship: giving first attention to learning and reflection, developing intellectually, connecting knowledge and experiences, and upholding Elon's honor codes.

HONOR CODE: This course recognizes and adheres to the principles of the Elon Academic Honor Code. Students are expected to be familiar with the code and follow it consistently, regardless of whether the professor is present to enforce it. The Elon Academic Honor Code can be found in the current Elon Student Handbook or online at http://www.elon.edu/students/handbook/honor.asp. Questions about possible violations should be directed to the instructor. Suspected violations will be reported to the Associate Dean for Academic Affairs.
**Description:** This course focuses on data-oriented approaches to statistical estimation and inference using techniques that do not depend on the distribution of the variable(s) being assessed. Topics include classical rank-based methods, as well as modern tools such as permutation tests and bootstrap methods. SAS software will be used throughout this course. *Note that this course counts towards the Non-lab science requirement.*

**Prerequisite:** STS 212/MTH220 or permission of the Statistics Program Coordinator.

**Required Materials:** Bring these materials to class every day:

1. **A positive attitude!**
3. **Calculator:** TI83, TI83+, TI84, TI84+, or other graphing calculator with equivalent statistical features.
4. **Handouts:** Check Moodle the day before each class to print handouts that have been posted!
5. **Phoenix Card** for printing.
6. I highly suggest that you obtain a large 3-Ring Binder with tabs so that you can stay organized.

**Statistical Software:** We will use be using the SAS software package for data analysis and exploration. If you do not have experience programming in SAS, please see me as soon as possible. The instructor may show results of statistical simulations based on R software. There may be a few assignments or parts of assignments where R is used.

**Outcomes:** Statistics promotes quantitative critical thinking skills that should serve you in the rest of your course studies at Elon. Specific outcomes that should prove valuable include the ability to:

- Identify appropriate analyses given assumptions about the problem.
- Provide meaningful analysis of data using nonparametric methods.
- Effectively organize and communicate findings both visually and in writing.
- Assess confidence in results of statistical inference and make appropriate inferences about the population.

**Objectives:** A list of specific objectives follows each area of the content. After an introduction to nonparametric statistics, the student will be able to:

- Distinguish between parametric and nonparametric methods.
• Identify the classes of nonparametric methods.
• Recount the history of nonparametric methods in statistics.
• Discuss the advantages and disadvantages of nonparametric methods.

After one-sample nonparametric procedures, the student will be able to:
• Construct and interpret hypotheses and confidence intervals for the median, percentiles and the empirical cumulative distribution function.
• Make inferences about a location parameter using one-sample sign tests and Wilcoxon Signed-rank tests.
• Use the binomial test to make inferences about a population proportion.
• Perform one-sample runs tests for randomness.
• Explain why a particular nonparametric test may be preferred over a well-known normal-theory based test.
• Explain the difference between statistical and practical significance.
• Calculate power and use it to compare statistical tests.

After two-sample methods, the student will be able to:
• Explain the uses of permutation tests.
• Obtain p-values using two-sample permutation tests.
• Perform a Wilcoxon Rank-Sum test in addition to knowing when to adjust for ties.
• Conduct Mann-Whitney tests and explain their equivalence to Wilcoxon Rank-Sum tests.
• Perform tests for equality of scale parameters including Siegel-Tukey and Ansari-Bradley tests.
• Perform Kolmogorov-Smirnov tests.
• Select among available two-sample tests.

Following the section on multi-sample methods, the student will be able to:
• Perform K-sample permutation tests using the F statistic for studies involving K treatments.
• Use the Kruskal-Wallis test to make appropriate inferences.
• Perform rank transformations.
• Perform multiple comparison procedures (methods assuming ties and no ties) to determine which treatments differ significantly from the others.

After paired comparisons and blocked designs, the student will be able to:
• Identify situations where paired data may be obtained.
• Perform a paired-comparison permutation test and make inferences.
• Apply Wilcoxon signed-rank tests to appropriate data to make decisions.
• Define completely randomized block designs.
• Perform permutation tests for randomized complete block designs.
• Use Friedman’s test for completely randomized block designs.

After exposure to tests for trends and associations, the student will be able to:
• Perform a permutation test for correlation and slope.
• Calculate and interpret Spearman rank correlation.
• Compute Kendall’s Tau and W as measures of concordance.
• Perform tests associated with contingency tables including permutation tests, Mantel-Haenszel tests and Fisher’s exact test.

Following the section on bootstrap procedures, the student will be able to:
• Describe the bootstrap method and its functions/uses in sampling Compute bootstrap confidence intervals such as the percentile, t, and BCA and use coverage percentages to inform decisions
• Apply the bootstrap in the context of correlation and regression.
Grading and Exam Information:

Your grade in this class will be a weighted average based on the following:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Course Points (%)</th>
<th>Grades are assigned as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams (2*20%)</td>
<td>40</td>
<td>A  93-100</td>
</tr>
<tr>
<td>Homework, Activities, Quizzes</td>
<td>20</td>
<td>C  73-76.9</td>
</tr>
<tr>
<td>Projects</td>
<td>15</td>
<td>A-  90-92.9</td>
</tr>
<tr>
<td>Final Exam (Cumulative)</td>
<td>25</td>
<td>C-  70-72.9</td>
</tr>
<tr>
<td>Total Course Points (%)</td>
<td>100</td>
<td>B+  87-89.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B  83-86.9</td>
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<tr>
<td></td>
<td></td>
<td>B-  80-82.9</td>
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<td>C+  77-79.9</td>
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<td></td>
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<td></td>
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<td>D  63-66.9</td>
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<tr>
<td></td>
<td></td>
<td>D-  60-62.9</td>
</tr>
</tbody>
</table>

Total Course Points (%) 100

Grades are assigned as follows:

- A  93-100
- A-  90-92.9
- B+  87-89.9
- B  83-86.9
- B-  80-82.9
- C+  77-79.9
- C  70-72.9
- C-  70-72.9
- D+  67-69.9
- D  63-66.9
- D-  60-62.9
- F  0-59.9

Explanation of Activities:

A. **Exams** - There will be two unit examinations administered in this course. If you miss an exam for an excused reason, you must make up the exam **before the next class period**. It is your responsibility to contact me to arrange the make-up.

TENTATIVE EXAM DATES GO HERE

B. **Homework, Activities, Quizzes**

- Homework assignments may involve computational exercises from the textbook. Homework problems will often require you to analyze a data set (with the statistical software) to answer questions of interest, and to write a summary of your findings. At times you may be asked to type homework with appropriate output incorporated into the report. Homework will be assigned regularly throughout the semester. **No late homework assignments will be accepted.**
- Some class activities may be collected and graded as Complete/Incomplete or as the number of points correct.
- Quizzes may be given on occasion and will be announced in advance.
- In-class assessments can be made up with a university excused absence **within one week of the activity**. Any arrangements for make-ups must be made in person.

C. **Term Project & Presentation** - There will be a multi-part project due during the semester, along with a final presentation sometime during the last few days of class. You will work in groups to describe and analyze data using techniques covered in this course. This will allow you to apply the skills you learn in this course to the real world which in turn will help you appreciate and retain the material.

You will be given a data set to analyze. Guidelines and due dates for the different parts of the project will be provided in separate announcements on Moodle. Each person’s grade for the project will be based on the group grade and individual performance. Individual grades will be determined by the instructor and team member evaluations.

D. **Final Exam** - There will be a cumulative final exam on:

FINAL EXAM BLOCK INFORMATION GOES HERE

Note from the Elon website: Dates and times for final exams may not be changed for a class without prior approval from the appropriate Department Chairperson. The chair will notify the assistant vice president for academic affairs of course exam modifications when they are granted.
Other Special Dates:

INSERT DATES FOR FALL BREAK OR SPRING BREAK, ETC…

Religious Holidays:
Please fill out a Religious Observance Notification Form and turn it in to the Truitt Center if you will be missing a class or classes for religious reasons. This form is available at the following website:
http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml

Moodle:
A large amount of course information is located on the class Moodle site. You are responsible for checking the Moodle site regularly. The Moodle site can be accessed at http://www.elon.edu/moodle

Academic Accommodations:
If you are a student with a documented disability who will require accommodations in this course, please register with Disabilities Services in the Duke Building, Room 108 (336-278-6500) for assistance in developing a plan to address your academic needs. See http://www.elon.edu/e-web/academics/support/disabilities.xhtml to obtain more information. Once you’ve established eligibility, please see me so that we can talk about the accommodations that you require.

Saving Your Work:
If you are a current or potential statistics major, please be sure to maintain both electronic and hard copies of your major assignments from this course. During your senior year, majors are required to put together a portfolio of their work in the major which includes examples of past assignments.

ACADEMIC STATEMENT:
An Elon student's highest purpose is academic citizenship: giving first attention to learning and reflection, developing intellectually, connecting knowledge and experiences, and upholding Elon's honor codes.

HONOR CODE:
This course recognizes and adheres to the principles of the Elon Academic Honor Code. Students are expected to be familiar with the code and follow it consistently, regardless of whether the professor is present to enforce it. The Elon Academic Honor Code can be found online at http://www.elon.edu/e-web/students/handbook/honor.xhtml. Questions about possible violations should be directed to the instructor. Suspected violations will be reported to the Associate Dean for Academic Affairs.
DESCRIPTION: An intermediary course in statistical computing using both R and SAS software. This course introduces the software R with an emphasis on utilizing its powerful graphics and simulation capabilities. This course also emphasizes issues with messy data entry, management, macro writing, and analysis using SAS software. Topics include using computer software for data entry, sub-setting data, merging data sets, graphical descriptive statistics, numerical descriptive statistics, macros, standard statistical analysis using SAS and R, creating functions in R, and simulations in R. Recommended for students pursuing a statistics major or minor.

PREREQUISITE: STS 212/MTH220 or permission of the Statistics Program Coordinator.

REQUIRED MATERIALS: Bring these to class every day.
2. Phoenix Card for printing.
3. I highly suggest that you obtain a large 3-Ring Binder with tabs so that you can stay organized!
4. Handouts: Check Moodle the day before each class to see handouts that have been posted!
5. Calculator: May not be needed often, but bring it just in case!

STATISTICAL SOFTWARE: We will use be using the SAS software package for data analysis, exploration, and management. SAS is available campus-wide (but not on Mac Computers). We will also be using the R software package for data analysis and exploration. R can be downloaded for free at [http://www.r-project.org/](http://www.r-project.org/).

OUTCOMES: Statistics promotes quantitative critical thinking skills that should serve the student in the rest of their course of studies at Elon. Specific outcomes that should prove valuable include the ability to:
1. Program in SAS proficiently and capably in R.
2. Create and manage (small and large) data sets using computer software.
3. Generate appropriate and meaningful graphics and statistics.
4. Understand the syntax in order to perform standard statistical analysis techniques.
5. Create macros in SAS and functions in R.
6. Perform simulations using appropriate software.
7. Identify and correct errors in syntax.

OBJECTIVES: A list of specific course objectives is given below.

After an introduction to SAS students will be able to:
- Identify the Output, Editor, Log, and Graph windows.
- Edit and debug SAS programs based on information from the Log window.
• Use the SAS Online Documentation to look up information.
• Produce readable output using appropriate options.

After studying the section on data entry in SAS the student will be able to:
• Input data using the cards/datalines statement.
• Obtain data from a file using the infile statement.
• Use the Import and Export functions in SAS.
• Read-in data in various formats.
• Create and redefine variables.
• Use the LIBNAME statement to generate permanent data sets.
• Distinguish between permanent and temporary data sets in SAS.
• Print data to output window.

After studying the section on data management in SAS students will be able to:
• Create new variables using IF/THEN statements.
• Create new data sets using the SET and WHERE statements.
• Merge or subset data sets as necessary.
• Manage data sets using PROC SQL.
• Generate custom reports using PROC REPORT.
• Sort data when necessary.

After studying the section on data analysis in SAS students will be able to:
• Obtain descriptive statistics using the MEANS and UNIVARIATE procedures.
• Summarize the data using a variety of procedures such as FREQ, SUMMARY, CHART, and TABULATE.
• Generate appropriate graphical statistics using the PROC PLOT and GCHART and other procedures with appropriate options.
• Understand the syntax for t-tests, ANOVA, and regression.
• Employ the SORT, CLASS, and BY statement to generate descriptive statistics and analyses for subsets of data.
• Produce output files in various formats using the Output Delivery System (ODS).

After studying macros in SAS students will be able to:
• Write macros when necessary.
• Run macros that are located in the same or separate files.
• Identify when it is advantageous to use a macro.

After an introduction to R students will be able to:
• Identify different types of objects (vectors, matrices, etc…).
• Use the appropriate search options to locate help information.
• Manage objects in the R workspace.
• Enter data using the concatenate function.
• Create simple sequences in a variety of ways.
• Read-in data from a separate file.
• Perform calculations as needed using objects in the workspace.
• Generate basic descriptive statistics.
• Subset the data using logical operations.
• Perform repetitive calculations using the APPLY statement or a FOR loop.

After studying graphing methods in R students will be able to:
• Produce histograms, stem-and-leaf plots, boxplots, scatterplots, etc…
• Produce well-labeled graphics by using appropriate symbols, colors, labels, and legends.
- Rescale axes appropriately.
- Label axes and include titles.
- Plot multiple objects in one graph.
- Plot multiple graphs in one window.
- Superimpose a graph of a function onto a plot.
- Save graphs in multiple formats.

After studying the section on data analysis in R students will be able to:
- Identify the appropriate built-in functions to perform linear regression, t-tests, and ANOVA.
- Use the help functions to identify the appropriate arguments and options.
- Obtain the appropriate numerical results based on the R output.
- Use the appropriate distribution functions to find p-values for hypothesis testing and critical values for confidence intervals.

After studying the section on function and simulations in R students will be able to:
- Write functions.
- Evaluate user created functions for specified values.
- Edit and modify functions as needed.
- Incorporate debugging code into functions.
- Debug functions.
- Generate random data from various distributions.
- Understand the mechanics of a simulation.
- Generate a simulated sampling distribution for various statistics.
- Carry out a simulation study.

Grading and Test information:
Your grade in this class will be determined by 4 major assessments:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Course Points (%)</th>
<th>Grades are assigned as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm</td>
<td>30</td>
<td>A 93-100  C 73-76.9</td>
</tr>
<tr>
<td>Final</td>
<td>40</td>
<td>A- 90-92.9 C- 70-72.9</td>
</tr>
<tr>
<td>Classwork &amp; Quizzes &amp; Etiquette</td>
<td>15</td>
<td>B+ 87-89.9 D+ 67-69.9</td>
</tr>
<tr>
<td>Homework</td>
<td>15</td>
<td>B 83-86.9 D 63-66.9</td>
</tr>
<tr>
<td>Total Course Points (%)</td>
<td>100</td>
<td>B- 80-82.9 D- 60-62.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C+ 77-79.9 F 0-59.9</td>
</tr>
</tbody>
</table>

Activity Explanation and General Policies:

A. **Classwork & Quizzes & Etiquette** - Students will program independently or in groups to complete class assignments. Quizzes will be administered on occasion. One Classwork score will be assigned to assess your overall classroom participation and etiquette in the course. Computers can serve as a major source of distraction. Your etiquette score will be reduced for any incidences of poor classroom etiquette such as texting, using computers for non-scholarly pursuits, etc.

B. **Homework** - Programming assignments will be given on a regular basis. On some assignments or on some portions of assignments you will be given the opportunity to collaborate with your classmates. These assignments/individual problems will be clearly labeled.

C. **Exams** - There will be a midterm that will cover topics in SAS. The final exam will cover topics in SAS and R. Both exams will have an in-class portion and a take-home portion. (Tentative Midterm Date: INSERT DATE, Final Exam: INSERT DATE)
General Policies:
- At the top of the lecture notes, textbook sections will be noted. It is expected that students will read these sections of the textbook which may at times include additional information beyond what can be included in the lecture notes/examples/assignments.
- Given the nature of this course, daily attendance is essential to your success. It is expected that you will be in class unless there is a very compelling reason that necessitates your absence.
- You are expected to complete all assignments.
- Late assignments will not be accepted.
- You are encouraged to ask me questions during class or in my office hours.
- The last day to drop with a “W” is INSERT DATE.
- An excused absence is as defined in the Student Handbook.
- Please be considerate of your classmates and make sure that all phones, Ipods, etc. are turned off or set to silent.
- I will plan to give breaks periodically during class.
- It is expected that you put time into this class EVERY DAY, as falling behind will be detrimental to your success in this 3 week course.

Academic Accommodations:
If you are a student with a documented disability who will require accommodations in this course, please register with Disabilities Services in the Duke Building, Room 108 (336-278-6500) for assistance in developing a plan to address your academic needs. Once you’ve established eligibility, please see me during my office hours so that we can talk about the accommodations that you require. See http://www.elon.edu/e-web/academics/advising/ds/ to obtain more information.

Disclaimer:
The above policies and assignments in this course are subject to change in the event of extenuating circumstances or by mutual agreement between the instructor and the students.

ACADEMIC STATEMENT:  An Elon student's highest purpose is academic citizenship: giving first attention to learning and reflection, developing intellectually, connecting knowledge and experiences, and upholding Elon’s honor codes.

HONOR CODE:  This course recognizes and adheres to the principles of the Elon Academic Honor Code. Students are expected to be familiar with the code and follow it consistently, regardless of whether the professor is present to enforce it. The Elon Academic Honor Code can be found in the current Elon Student Handbook or online at http://www.elon.edu/students/handbook/honor.asp. Questions about possible violations should be directed to the instructor. Suspected violations will be reported to the Associate Dean for Academic Affairs.
Description:
Topics include axiomatic probability, counting principles, discrete and continuous random variables and their distributions, sampling distributions, central limit theorem, confidence intervals and hypothesis testing. Prerequisite: MTH 251. Offered fall of even-numbered years.

Prerequisite:
MTH 251

Required Materials:
Text: *A Course in Probability* by Neil A. Weiss

Course Goals:
This course will explore the following topics:

- Properties of probability
- Combinatorics
- Random variables and their distributions
- Inferential statistics

The course will focus on the necessary writing and technology skills that relate to these topics.

Course Objectives:
Upon the successful completion of this course, students will be able to:

- Compute probabilities when outcomes are equally likely.
- Work with common discrete and continuous random variables in computing probabilities and variance.
- Work with confidence intervals and hypothesis tests for common distributions.

Feedback and Evaluation:
- Weekly problem sets will be worth 20% of your final grade. They are to be completed as *Mathematica* files submitted electronically via Moodle; unexcused late work will not be graded.
- There will be three projects, each worth 10% of your final grade.
- There will be three exams, each worth 10% of your final grade.
- The final exam will be cumulative and will be worth 20% of your final grade.
Grades will be assigned as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93-100</td>
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<tr>
<td>A-</td>
<td>90-92.9</td>
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<tr>
<td>B+</td>
<td>87-89.9</td>
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<td>C</td>
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</tr>
<tr>
<td>D+</td>
<td>67-69.9</td>
</tr>
<tr>
<td>D</td>
<td>63-66.9</td>
</tr>
<tr>
<td>D-</td>
<td>60-62.9</td>
</tr>
<tr>
<td>F</td>
<td>0-59.9</td>
</tr>
</tbody>
</table>

**Religious Holidays:**
Please fill out a Religious Observance Notification Form and turn it in to the Truitt Center if you will be missing a class or classes for religious reasons. This form is available at the following website: [http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml](http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml)

**Academic Accommodations:**
If you are a student with a documented disability who will require accommodations in this course, please register with Disabilities Services in the Duke Building, Room 108 (278-6500), for assistance in developing a plan to address your academic needs. [http://www.elon.edu/e-web/academics/support/disabilities_services.xhtml](http://www.elon.edu/e-web/academics/support/disabilities_services.xhtml)

**SAVING YOUR WORK:**
If you are a current or potential statistics major, please be sure to maintain both electronic and hard copies of your major assignments from this course. During your senior year, statistics majors are required to put together a portfolio of their work in the major which includes examples of past assignments.

**ACADEMIC STATEMENT:**
An Elon student's highest purpose is academic citizenship: giving first attention to learning and reflection, developing intellectually, connecting knowledge and experiences, and upholding Elon's honor codes.

**HONOR CODE:**
Elon’s honor pledge calls for a commitment to Elon’s shared values of Honesty, Integrity, Respect and Responsibility. To be clear about what constitutes violations of these values, students should be familiar with the Judicial Affairs policies in the student handbook, including violations outlined at [http://www.elon.edu/e-web/students/handbook/violations/default.xhtml](http://www.elon.edu/e-web/students/handbook/violations/default.xhtml).

Students with questions about the specific interpretation of these values and violations as they relate to this course should contact this instructor immediately. Violations in academic-related areas will be documented in an incident report which will be maintained in the Office of Student Conduct, and may result in a lowering of the course grade and/or failure of the course with an Honor Code F.

Violations specifically covered by academic honor code policies include: plagiarism, cheating, lying, stealing and the facilitation of another’s dishonesty. Multiple violations will normally result in a student’s temporary suspension from the University.
Description:
This course offers an introduction to theoretical concepts in mathematical statistics. Topics include introduction to the limit theorems and the theory of point estimation, interval estimation, tests of hypotheses and likelihood ratio tests. Although this is primarily a proofs-based course, advanced statistical software such as SAS or R may be used. Offered spring of odd-numbered years.

Prerequisite: MTH 220/STS 212, MTH 251 and MTH 329/STS 341 or permission of the Statistics Program Coordinator

Required Materials: Bring the following materials to class every day:

1. A positive attitude – don’t ever forget this!
2. Handouts: Check Moodle the day before each class to print handouts that have been posted!
3. Large 3-Ring Binder with tabs: This will help you to stay organized which will increase productivity.
4. Text: John E. Freund’s Mathematical Statistics with Applications (8th edition) by Irwin Miller and Maryless Miller
5. Calculator: TI84+ or other graphing calculator with equivalent statistical features.

Statistical Software: We will occasionally be using R software, but mostly R will be used by the instructor in class for demonstration purposes. Information needed about this software will be provided in class.

Outcomes: Statistics promotes quantitative critical thinking skills that should serve the student in the rest of their studies at Elon. Specific outcomes that should prove valuable include the ability to:

- Have a basic understanding of the principles of probability and statistical inference.
- Analyze data using appropriate statistical techniques.
- Discuss the major theoretical principles in mathematical statistics.
- Prove and articulate common results in probability and statistics.
Objectives: A list of specific objectives follows each area of the content.

Following the section on limit theorems, the student will be able to:
- State the strong and weak Laws of Large Numbers.
- Define convergence in probability, almost sure convergence and convergence in distribution.
- Define and explain the sampling distribution of a statistic.
- State the Central Limit Theorem and use it to find probabilities.

After reviewing parameter estimation, the student will be able to:
- Explain the concept of parameter estimation.
- Describe the Method of Moments approach to estimation.
- Perform estimation using the Method of Moments.
- Define a general Maximum Likelihood estimator.
- Calculate the maximum likelihood estimates of multinomial cell probabilities.
- Discuss large sample theory for maximum likelihood estimates.
- Discuss the theory behind and construct confidence intervals based on maximum likelihood estimates.
- Define efficiency and evaluate it.
- Use the Cramer-Rao lower bound.

After studying theory of hypothesis and goodness-of-fit tests, the student will be able to:
- Discuss the Neyman-Pearson paradigm.
- Appropriately apply the Neyman-Pearson Lemma.
- Establish the duality of confidence intervals and hypothesis tests.
- Discuss the theory behind generalized likelihood ratio tests and likelihood tests for the multinomial distribution.
- Discuss the theory behind normal probability plots and construct the said plots.
- Perform tests for normality.

Grading and Exam Information:
Your grade in this class will be a weighted average based on the following:

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Points (%)</th>
<th>Grades are assigned as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW/CW/Quizzes</td>
<td>35</td>
<td>A     93-100             C  73-76.9</td>
</tr>
<tr>
<td>Exams (3x15%)</td>
<td>45</td>
<td>A-    90-92.9            C-  70-72.9</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20</td>
<td>B+    87-89.9            D+  67-69.9</td>
</tr>
<tr>
<td>Total Course Points</td>
<td>100</td>
<td>B     83-86.9            D  63-66.9</td>
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<td></td>
<td></td>
<td>B-     80-82.9           D-  60-62.9</td>
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<tr>
<td></td>
<td></td>
<td>C+     77-79.9           F   0-59.9</td>
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<tr>
<td></td>
<td></td>
<td>C      77-79.9           F   0-59.9</td>
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<tr>
<td></td>
<td></td>
<td>D       63-66.9           F   0-59.9</td>
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<td></td>
<td>A       93-100             C  73-76.9</td>
</tr>
</tbody>
</table>

Explanation of Category:
A. HW/CW/Quizzes
- HW - Regular homework assignments will be assigned during the semester and will be due at the beginning of class on the specified date. Please make an honest attempt on every problem. Partial credit will be given. Also please make your work/reasoning as clear as is
possible and staple all work—untidy or unreadable work will not be graded. Late homework will not be accepted. Your lowest HW grade will be dropped at the end of the term. Please recognize that HW is an important way of practicing the material and getting direct feedback. While collaboration on homework problem techniques is strongly encouraged, write-ups must be done individually and direct copying is not allowed.

- CW - Classwork assignments include activities, worksheets, and other forms of engagement during class. In-class work may be completed individually or in groups, depending on the specific activity. Classwork may also involve presenting the solution to a problem at the board. Not all class assignments will be graded. You should plan to attend all classes and to participate in and complete all in-class assignments. In general, in-class assessments cannot be made up since part of the learning process is the discussion that develops during these activities. However, assessments can be made up with a university excused absence within one week of the activity. It is your responsibility to contact me to arrange a make-up.

- Quizzes - Short quizzes may be given to test your knowledge of a specific topic(s).

B. Exams
There will be three “unit” exams administered. Examination dates will be announced at least one week in advance. These tests will most likely be closed book, closed notes and closed neighbors. If an exam, excluding the final is missed because of an excused absence, you must contact me before the next scheduled class period to schedule a make-up. If this is not possible, then the final exam percentage score will be applied to the missed exam to determine the number of points assigned for it. This can only be done once. If you miss more than 1 exam, please contact me before the next class period. Also tell me ahead of time, if possible, when you have an excused reason for missing a test.

C. Final Exam
The final exam in this course is cumulative. According to OnTrack, the final exam date is

INSERT FINAL EXAM BLOCK INFORMATION

Special Dates:

INSERT DATES FOR FALL BREAK OR SPRING BREAK, ETC…

Religious Holidays:
Please fill out a Religious Observance Notification Form and turn it in to the Truitt Center if you will be missing a class or classes for religious reasons. This form is available at the following website: http://www.elon.edu/e-web/students/religious_life/ReligiousHolidays.xhtml

Academic Accommodations:
If you are a student with a documented disability who will require accommodations in this course, please register with Disabilities Services in the Duke Building, Room 108 (278-6500), for assistance in developing a plan to address your academic needs. http://www.elon.edu/e-web/academics/support/disabilities_services.xhtml
Moodle:
Most information concerning this course is contained in our Moodle site. **You are responsible for checking the Moodle site regularly and printing materials from Moodle as needed.** Note that it is extremely important to print any necessary handouts before class! It will be much more difficult to follow along with the material if you do not have the necessary notes. Also, problems, questions, and other material provided in the notes may not be written on the board or overhead web-cam. Therefore it is critical to print any necessary materials from Moodle before class.

SAVING YOUR WORK:
If you are a current or potential statistics major, please be sure to maintain both electronic and hard copies of your major assignments from this course. During your senior year, statistics majors are required to put together a portfolio of their work in the major which includes examples of past assignments.

ACADEMIC STATEMENT:
An Elon student’s highest purpose is academic citizenship: giving first attention to learning and reflection, developing intellectually, connecting knowledge and experiences, and upholding Elon’s honor codes.

HONOR CODE:
Elon’s honor pledge calls for a commitment to Elon’s shared values of Honesty, Integrity, Respect and Responsibility. To be clear about what constitutes violations of these values, students should be familiar with the Judicial Affairs policies in the student handbook, including violations outlined at [http://www.elon.edu/e-web/students/handbook/violations/default.xhtml](http://www.elon.edu/e-web/students/handbook/violations/default.xhtml).

Students with questions about the specific interpretation of these values and violations as they relate to this course should contact this instructor immediately. Violations in academic-related areas will be documented in an incident report which will be maintained in the Office of Student Conduct, and may result in a lowering of the course grade and/or failure of the course with an Honor Code F.

Violations specifically covered by academic honor code policies include: plagiarism, cheating, lying, stealing and the facilitation of another’s dishonesty. Multiple violations will normally result in a student’s temporary suspension from the University.