Math 111 - Introduction to Statistics - Section 1 - Spring 2011
Course Syllabus

SUMMARY INFORMATION
Instructor: Rachel Dunwell
Office: Ohlendorf 319
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Class Location: Barret 033

Class Time: MWF: 11:00am – 11:50 am

ON STATISTICS. Statistics is widely considered an exciting, dynamic, and intrinsically interdisciplinary science. The work of statisticians powers search engines like Google, has proven critical to the exploration of the human genome, and is used by hedge fund managers to detect arbitrage opportunities (risk-free trading strategies that yield profit with positive probability) that are profitable *only on average* (called **statistical arbitrage**). *The New York Times* recently declared that, over the next decade, statisticians will enjoy one of the highest-paying, highly-coveted careers.

Statistics is often considered a mathematical science quite distinct from mathematics itself. It arguably began in the 17th century with the development of probability theory by Blaise Pascal and Pierre de Fermat. Probability theory itself arose due to interest in games of chance. In contrast to probability theorists (who propose probability models and then study those models with somewhat less regard for the particular random realizations generated by those models), statisticians are interested in the random realizations themselves (called **data**), and what those random realizations suggest about the parameters that govern the underlying probability models.

A critical development in the history of statistics was the method of least squares, which was probably first described by Carl Friedrich Gauss in 1794. Early applications of statistical thinking revolved around the needs of states to base public policy on demographic, economic, and public health data. The scope of the discipline of statistics broadened in the early 19th century to include the collection and analysis of data in general.

Today, statistics is widely employed in government, business, and the natural and social sciences. Computers are transforming the field at a breathtaking pace. In fact, this semester, our approach to the two main tasks of statistical inference—constructing **confidence intervals** and executing **hypothesis tests**—will be motivated by simulations and visualizations in a software environment. Please be aware that there can ultimately be no escape from approaching statistics in this fashion. Because hard drive space is becoming much cheaper (i.e., it is easy to collect and store vast quantities of data) and processing speeds are becoming much faster (i.e., it is easy to do more things with data than ever before), the world of tomorrow will be dominated by the computer-driven data analysis we will undertake this semester!

ON COURSE GOALS. Any student who successfully completes this course should understand the following:

- That statistics helps us acquire knowledge and make decisions;
- That variation occurs in every measurable process;
- That inferences about populations are made based on the characteristics of samples;

- That valid inference requires randomization (or good sampling techniques);
- That valid conclusions can be drawn from experiments only when the experimental design is sound; and
- That because variation occurs, all inferences have probabilities that quantify the uncertainties associated with them.

In addition, students who successfully complete this course should be able to execute randomization-based tests using a software package like *Fathom* as well as more traditional normality-based tests using a software package like *PASW Statistics*. Students should be able to use either approach to undertake statistical investigations in appropriate upper-division work at Rhodes College. The tests we will learn from these two perspectives are, namely: one- and two-sample tests on proportions and means, tests on Pearson correlation coefficients, the tests commonly associated with properly implementation and analysis of a linear regression model, and at least one of the following tests: one-way ANOVA, the Wilcoxon rank-sum test, tests for statistical significance of Spearman's rank correlation, and the chi-square test for association.

ABOUT YOU. You should be hard-working and enthusiastic about learning! This course features a relatively new, modern introduction to inferential statistics. You should have a strong working knowledge of high school algebra to succeed in this course. Additionally, you should already be familiar with—though you will have an opportunity to review—the appropriate use of techniques for illustrating data (pie charts, bar charts, histograms, line graphs, etc.)

ABOUT US. We will meet in Barret 33 to talk about statistics and data analysis on Mondays, Wednesdays, and Fridays from 11:00 a.m. to 11:50 a.m. There is no required textbook for this course. You will need to take notes during the lectures diligently and work carefully to develop a list of the terminology that we will introduce in this course.

ON ATTENDANCE. Attendance is expected in this course. Each day, I will pass around a sign-in sheet. Signing in for any person other than yourself is a violation of the Rhodes College Honor Code. Your first four absences (for **any** reason) will trigger no penalty. For each absence in excess of four, your final grade in this course will be reduced by 1%. You may not miss a quiz or midterm examination except under the most extreme circumstances, and even then only with advance consent from me.

ON DAILY EXERCISES. After nearly every class meeting, you will be given a set of exercises that will encourage you to think carefully about and practice computations related to the material introduced in the class lecture that day. These exercises may require you to use *Fathom*, *PASW Statistics*, an online calculator, or scratch paper. While you may work on daily exercises with colleagues and/or tutors in the Math Support Center, you must write up solutions to the daily review exercises in your own words. You must access solutions to these daily review assignments in the Math Support Center, grade your work, and then record your participation in this process on Moodle. Thrice during the semester, we will ask you to bring by your portfolio of daily exercises for us (or a Math Support Center tutor) to spot check and discuss with you.

ON HOMEWORK ASSIGNMENTS. Many times during the semester, you will be given a homework assignment that is somewhat more involved than a daily review assignment. While you are allowed to work with your colleagues, or with assistance from tutors at the Math Support Center, on these assignments, you must write down a set of solutions to each homework assignment in your own words. I will grade each homework assignment and return it to you with feedback.

ON CLASS PROJECTS. There are two main class projects during the semester, which I will ask you to augment at a point later in the semester (this augmentation will be called a "third

project"). Each project will generally ask you to synthesize skills and concepts from multiple class lectures and to present, by way of a particular application, your synthesis. Each project will require you to work in a group, and turn in a single scientific report on behalf of the group. In general, you will be able to choose the data for these projects from a collection of data sets that we have assembled for this course. Some of these data sets are from research projects undertaken by Rhodes faculty! **Late class projects will not be accepted under any circumstances.**

ON QUIZZES. On two occasions (18 January, 6pm and 31 January, 6pm) we will take brief quizzes, note that these are held in the evenings. The purpose of these quizzes is to give you timely feedback about your current understanding of the content of this course **prior** to important add/drop and withdrawal deadlines. **We do not offer make-up quizzes in this course for any reason.**

ON TESTS. During two evening meetings during the semester (24 February, 6pm and 7 April, 6pm), we will take tests in a computer laboratory. If you cannot make these evening times then you may take the test at the scheduled lecture time the following day, but you will only have 50 minutes to complete the questions. **You may not miss a test except under the most dire of circumstances, and even then you may only do so if you receive approval from me in advance of the test.**

ON THE FINAL EXAMINATION. A final, written, comprehensive 2.5-hour examination will be held on Saturday 7 May 2011, at 8:30am in Barret 033. Since Profs. Hamrick, Sheard, and I will be offering comparable versions of the final examination, you may elect to take the examination under the supervision of another professor on Tuesday 3 May 2011, at 8:30am or Monday 2 May 2011, at 5:30pm **if space allows**.

ON GRADING. In this class the final letter grade will be awarded as follows

A	[93, 100]	B-	[80, 83)	D+	[67, 70)
A-	[90, 93)	C+	[77, 80)	D	[63, 67)
B+	[87, 90)	C	[73, 77)	D-	[60, 63)
B	[83, 87)	C-	[70, 73)	F	[0, 60)

Your grade in this course will be computed according to the following weights:

Component	**Weight**
Quizzes (2)	8%
Tests (2)	20%
Daily exercises	14%
Homework assignments (7)	21%
Projects (3)	15%
Final examination	19%
Periodic checks (by instructor/tutor) of your portfolio of daily exercises	3%

ON CHEATING. In this class, we will adhere to the provisions of the Rhodes College Honor Code. In general, I encourage you to work on daily exercises and homework assignments with colleagues. **However, you may not copy work from colleagues verbatim or simply paraphrase their work**. You may not work with other students on examinations and you may not use crib notes or a textbook during an examination. **In general, if you have doubts about what constitutes cheating, please ask me.**