# Math 111 - Introduction to Applied Statistics
# Course Syllabus

## CRN 22445
## Spring 2012

**SUMMARY INFORMATION**
**Instructor:** Dr Rachel M. Dunwell
**Office:** 319 in Ohlendorf Hall
**Office Hours:** MWF 4:00-6:00 p.m., TTh 2:00-3:00 p.m.
**Office Phone:** (901) 843 3724
**Email Address:** `dunwellr@rhodes.edu`

**Class Location:** Barret Library 033
**Class Time:** MWF 12:00 p.m. to 12:50 p.m.

**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 $17^{\text{th}}$ 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 $19^{\text{th}}$ 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 *SPSS*. 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 ME.** My name is Rachel Dunwell. In addition to being an assistant professor in the Department of Mathematics and Computer Science I coordinate all the extra academic support for the department, this includes tutoring. My officail office hours are on Monday, Wednesday, and Fridays at 4:00-6:00 p.m., and on Tuesday and Thurdays at 2:00-2:50 p.m, but am happy to talk with you any time, please stop by my office anytime.

**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 Library 033 to talk about statistics and data analysis on Monday, Wednesday and Friday from 12:00 p.m. to 12:50 p.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, though it will only be taken indirectly. We will implicitly take attendance by collecting your daily exercises—see the section below.

**ON DAILY EXERCISES.** After nearly every class meeting, we will make a set of exercises available to you on Moodle 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*, *SPSS*, an online calculator, or scratch paper.

1. 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.

2. You must grade your daily exercise solutions prior to the next class period. Solutions (along with instructions on how to grade each exercise) will be available on Moodle and in the Math Support Center (in hard copy format, in case you prefer that format or would like to consult with tutors).

3. You must staple your daily exercises in the upper left-hand corner. A stapler is a great investment. Buy one.

4. You must write

   - your name,
   - section of Math 111,
   - the number of the exercise, and
   - your score

   on the upper right-hand corner of the first page of each set of daily exercises. Otherwise, you will not receive credit for doing the daily exercise. If you follow this protocol and make a good effort on a daily exercise, you will receive full credit.

5. Turning in your daily exercises on, for example, a Friday is an indication that you attended class on Wednesday and are actively participating in the course. Hence, daily exercises must be turned in at the beginning of the class period. They will not be accepted at any other time.

6. After we record your completion (and grading) of the daily exercises, we will place those daily exercises in a file box in the Math Support Center. Periodically, we will throw away all of the daily exercises in this file box, so you must come to the Math Support Center occasionally to pick up your daily exercises (if you'd like to have them back, of course).

**ON HOMEWORK ASSIGNMENTS.** Many times during the semester, you will be given a homework assignment that is somewhat more involved than a set of daily exercises. While you are allowed to work with your colleagues, or with assistance from tutors at the Math Support Center, on these assignments, you must type up 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. **Late homework assignments are not permitted under any circumstances.**

**ON CLASS PROJECTS.** There are two main class projects during the semester. 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 well-written 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.** Early in the course we will take two brief quizzes, which will be held in a computer laboratory on one of two evening times. 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. The times and dates of the quizzes are noted on the course outline. **We do not offer make-up quizzes in this course for any reason.** The dates are

| Quiz | Main Date and Time | Alternate Date and Time |
|---|---|---|
| Quiz 1 | Tuesday 17 January at 3:00 p.m. | Tuesday 17 January at 6:00 p.m. |
| Quiz 2 | Monday 30 January at 6:00 p.m. | Tuesday 31 January at 6:00 p.m. |

**ON TESTS.** Twice during the semester, tests in a computer laboratory on one of two evening times. **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.** The times and dates of the tests are below:

| Test | Main Date and Time | Alternate Date and Time |
|---|---|---|
| Test 1 | Monday 20 February at 6:00 p.m. | Tuesday 21 February at 6:00 p.m. |
| Test 2 | Monday 2 April at 6:00 p.m. | Tuesday 3 April at 6:00 p.m. |

**ON THE FINAL EXAMINATION.** A final, written, comprehensive 2.5-hour examination will be held on 29 April at 5:30 p.m. in one of the computer laboratories. There is also an opportunity for people, **as space allows**, to take a comparable version of the examination on 3 May at 1:00 p.m. in one of the computer laboratories.

**ON GRADING.** In this class, we will use calculate a final grade as a weighted average of your scores on the various components of the course. This weighting is given below:

| **Component** | **Weight** |
|---|---|
| Quizzes | 8% |
| Tests | 20% |
| Daily exercises | 14% |
| Homework assignments | 24% |
| Two class projects | 14% |
| Final examination | 20% |

From this course average, your letter grade will be assigned in accordance with the table below:

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

**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.**

**ON SNOW-DAYS.** If classes at the college are cancelled for any reason, then make-up lectures will be held at 7:00 p.m., in FJ-A, on the first Monday (and repeated on the first Tuesday) after the college reopens. You will be expected to attend a make-up session for every lecture that is cancelled.

**ON SAFE ZONES** Along with many other members of the Rhodes community, I partici- pate in the Safe Zones program, the description of which is located at

http://www.rhodes.edu/campuslife/11503.asp.

I expect an overarching mutual respect among all participants, regardless of sex, race, ethnicity, sexual orientation, gender identity or expression, national origin, and religion. As Carl Friedrich Gauss stated "Mathematics is the queen of all academic disciplines" and I believe that every human being has a right to experience, and possibly be uplifted by, its power, applicability, and beauty.