# Biometry (MTH207) Syllabus – Winter, 2011

**Description:** Foundational principles of probability including methods of counting and specific probability distribution and density functions; linear models including one- and two-way ANOVA with post-hoc multiple comparisons and transformations, simple and multiple linear regression including transformations and indicator variables, and logistic regression; and basic principles of sample and experimental design. The theoretical constructs of all topics will be developed and applied to real-life or realistic situations in the life and natural sciences. Pre-requisite MTH107. 4 cr.

**Importance:** Statistics is central to scientific inquiry because hypotheses are generated from exploratory data analyses of existing or preliminary data and, more importantly, hypotheses are objectively tested with inferential statistical methods. As such, understanding statistics is a major component of understanding how to conduct and interpret research. Understanding statistics includes knowing how to properly collect data ("design") and then how to properly analyze data so that appropriate conclusions can be made ("analysis"). In this course you will learn (1) how to properly design a variety of studies that are commonly used in natural and social science fields and (2) how to properly analyze the data collected from those studies. Throughout the course you will focus on the generalities of major concepts so that your knowledge will extend beyond the specific situations examined in class. In addition, because the communication of results is critical to your success as a researcher, you will also focus on correct report or manuscript writing.

**Outcomes:** At the end of this class you will be able to ...

1. explain why statistics is central to scientific inquiry (& your field of interest);
2. perform, including assumption checks, and interpret the results from one-way and two-way analysis of variances;
3. perform appropriate multiple comparisons following a significant analysis of variance result;
4. perform, including assumption checks, and interpret the results from simple, indicator variable, and multiple linear regression;
5. perform, including assumption checks, and interpret the results from simple logistic regression;
6. use variable transformations and interaction terms where appropriate,
7. compare and contrast the advantages and limitations of one-factor and two-factor experimental designs; and
8. write a concise, detailed, accurate, and interesting paper explaining the design and interpreting the results of a statistical analysis.

**Location:** Center for the Science and Environment, Room 236

**Time:** MWF 1200-1330p

**Instructor:** Dr. Derek H. Ogle **Contact:** CSE239; 682-1300; dogle@northland.edu

**Office Hours:** MW 1400-1500, or by appointment

**TA Hours:** Laura Schmidt (schmidtl01@myemail.northland.edu) – Tues 1200-1330; Thurs 1600-1700

**Accomm-** Students in need of academic or medical accommodation should contact Patti Fenner-Leino

**odations:** Disabilities Coordinator, ext. 1230, Ponzio Center Rm. 229.

**Web Page:** [**www.ncfaculty.net/dogle/**](http://www.ncfaculty.net/dogle/) then select the “Biometry” button.

**Textbook:** There is no text for this course. Instead, I will provide PDF documents that, taken as a whole, will serve as a “text” for the topics of this course. These documents will be made available for download on the class web page. I expect that you will read the materials provided.

**Computing:** We will use computers extensively in this class as you will be asked to type homework problems and perform statistical analyses using R. R for Windows or the Macintosh can be installed on your personal computer by downloading (for free) the installation links from the “R Resources for Northland College” link on the class webpage. Work in this course will also depend heavily on the **NCStats** package available from the “R Resources for Northland College” page. If using Windows, I also suggest that you install and use the TINN-R software (also free).

**Grading:** An overall percentage score will be determined by computing a weighted average of scores from homework assignments, quizzes, and a final portfolio. These three assessments will be equally weighted for determining an overall score for the course. Lowest possible final letter grades will be assigned by comparing your overall percentage score (rounded to a whole number) to the following rubric

**A** 92-100 **A-** 90-91

**B+** 87-89 **B** 82-86 **B-** 80-81

**C+** 77-79 **C** 70-76

**D+** 67-69 **D** 60-66

**F** 0-59

**Homework:** Several homework assignments will be assigned per major course topic. Grading of each assignment will be described on the assignment sheet. Completed homework assignments will be due at the beginning of the class period on dates announced when the homework was assigned. Assignments will be accepted up to one day late but will be reduced by 50% of the worth of the assignment. Assignments not handed in at the beginning of the class period will be considered one day late.

Each homework should include the following statement along with your signature

**“*I have neither given nor received unauthorized aid in completing this work, nor have I presented someone else’s work as my own.*”**

Unauthorized aid includes working “too much” with other students, either in the current class or not. In other words, you can discuss homework problems and course content with other students but if you find yourself always looking to someone else for help on how to do something or how to explain something then you are not substantively working independently. Start the homework early so that you can ask ME questions rather than relying on following exactly what a friend has done. If I suspect that you and another person have violated this rule then I will verbally warn each of you at the first such suggestion and then assign you no credit for each subsequent offending homework. If any homework is ***largely*** a verbatim copy or rephrasing of another person’s work then ***both*** of you will receive no credit for that homework, even if it is the first such offense.

**Quizzes:** Quizzes will be given in class on **18-Feb**, **18-Mar**, and **20-Apr**. You can have an extra 60 minutes for each quiz by starting up to an hour early (1130) or finishing up to one hour later (1430). The purpose of these quizzes is to serve as an assessment of your state of knowledge on recent topics. You are expected to take each of these quizzes during the assigned time. Make-up quizzes will only be given to students that missed class because of events sponsored by the College (e.g., field trips, athletic events), prior commitments communicated to me very early in the semester, and extreme extenuating circumstances (for which you may be required to provide a note from a professional – e.g., nurse or doctor).

**Portfolio:** The portfolio project is designed to allow you some flexibility in demonstrating a working knowledge of the major topics of the course. The portfolio will serve as the capstone experience of the course. In general, the portfolio will consist of a thorough analysis of data using **four** (*cannot use any more than once*) of the following major topics in the course: (I) One-Way ANOVA (more than two groups), (II) Two-Way ANOVA, (III) Simple Linear Regression, (IV) Indicator Variable Regression, or (V) Logistic Regression. Alternatively, you can propose an alternative topic of interest to you for my approval.

For each topic you must gather and appropriately analyze data. The data analyzed can originate from your original research, another class (but not be exactly like an assignment for another class), textbooks, journal articles (you may have to visually recreate the data from a graphic – see me for help with this), reputable internet sources, or any other reliable source. The data should be real, should be able to be analyzed with a topic from this class, and should be interesting to you. You should not wait until the end of the semester to begin looking for data – ***finding appropriate data may be the hardest part of the portfolio***. I strongly urge you to discuss potential data sources with me as I can likely give you an indication of whether the data will be appropriate for the assignment and how difficult the data may be to work with.

For each topic and data analysis you will write a research report detailing your results and conclusions. The report should contain the following sections:

* ***Introduction:*** describe any background information needed to understand the data, why the data are important to people, why you were interested in the data, and what the objectives of the study were (i.e., the research hypothesis).
* ***Methods:*** describe the methodology you (or the authors) used to collect and you used to analyze the data.
* ***Results:*** describe the results of your analysis including all assumption checking.
* ***Discussion:*** describe what you found and how it relates to your reasoning from the introduction.
* ***Works cited:*** list of references (if any) used to support your project.

Each report should be typed, written grammatically correct, and refer to supporting graphics and tables. A report may be submitted to me once before **1-Apr** for an un-graded review.

**Attendance:** For most students, achievement is strongly positively related to attendance. I will take attendance each day but attendance will not factor into your final grade with the following exception. At the end of the semester I may, at my discretion, eliminate one or more of your homework or quiz grades. Your attendance record will be one item considered when I decide to eliminate one of your assessment grades or not.

**Course Outline:**

1. Linear Models Foundation
2. One-way ANOVA
3. Two-way ANOVA
4. Simple Linear Regression
5. Indicator Variable Regression
6. Logistic Regression

**Important Dates:**

**No Classes** – 2Feb (WiAFS meeting); 9&11Mar (Midterm break)

**Quizzes** – 18Feb, 18Mar, 20Apr

**Portfolio Draft –** on or before 1Apr

**Portfolio Final –** 20Apr (by 1200)