

BIOMETRY (MTH207) SYLLABUS – WINTER, 2013

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 hypotheses are objectively tested with inferential statistical methods. As such, understanding statistics is a major component of understanding how to conduct and interpret scientific research. Understanding statistics includes knowing how to properly collect data ("design") and 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 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 1200-1250p, R 1200-1350

Instructor: Dr. Derek H. Ogle

Contact: CSE239; 682-1300; dogle@northland.edu

Office Hours: MW 1500-1600, R 1030-1130, or by appointment

Accommodations: Students in need of academic or medical accommodation should contact Kathleen Skoraczewski, Campus Counselor, ext. 1369, Ponzio Center Rm. 202B, kskoraczewski@northland.edu.

Web Page: www.ncfaculty.net/dogle/ then select the "Biometry" button.

E-mail: All class-related communication will be distributed to you via your Northland e-mail.

Textbook: I will provide a PDF document that acts as the "text" for this course. This document is available for download on the class web page. However, it cannot be printed because it is nearly 200 pages and printing it in the computer labs would be a waste of paper, very costly, and hard on the printers. I will make arrangements to have the document printed, copied, and available for purchase (for the cost of copying) on the first day of class. Students interested in purchasing a copy of the text must contact me on the first day of class as I will only have as many copies produced as are requested.

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 and RStudio can be installed on your personal computer by downloading (for free) the installation links from the “Resources” link on the class webpage. Work in this course will also depend heavily on the **NCSstats** package (installation link also available on the “Resources” page).

Conduct: Your conduct in class should revolve around the idea of being respectful of me and others in the class. I will ask you to leave class if you behave disrespectfully. Adhering to the following policies should be considered the minimum requirements to being respectful of others:

- 1) Arrive to class on time. If a situation arises where you will arrive late, then take the first available seat as quietly as possible.
- 2) Do not bring friends, children, pets, meals, or anything else to class that should not be there.
- 3) Turn off and store out-of-sight all cell phones and other electronic devices (personal laptop computers may be used).
- 4) Do not use the college or personal computers for other than assigned tasks.
- 5) Do not engage in side discussions while I or others are speaking to the entire class.
- 6) Do not use disrespectful language when addressing others.

Grading: An overall percentage score will be determined by computing a weighted average of scores from homework assignments (25%), exams (40%), and a final portfolio (35%). 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

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, decide to eliminate one or more of your homework or exam grades. Your attendance record will be one item considered when I make this decision.

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.

Exams: Exams will be given in class on **14-Feb, 14-Mar, and 18-Apr.** You are expected to take each of these exams during the assigned time. Make-up exams 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 need to provide a note from a professional – e.g., nurse or doctor). The purpose of these exams is to serve as an assessment of your state of knowledge on recent topics.

Portfolio: The portfolio project is designed to allow you flexibility in demonstrating a working knowledge of the major topics of the course. The portfolio will serve as the capstone experience for the course. In general, the portfolio will consist of a thorough analysis of data using **four** (*cannot use any topic more than once*) of the following major topics in the course: (I) One-Way ANOVA (*must have 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 for my approval.

For each topic you must gather and appropriately analyze data. The data can originate from your original research, another class (but cannot be exactly like an assignment for another class), textbooks, journal articles (you may have to recreate the data from a graphic or table – 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 one of the five topics from this class, and should be interesting to you. ***Finding appropriate data may be the hardest part of the portfolio.*** Thus, you must submit an initial proposal to me by **22-Feb** that briefly describes the data you will use, the types (i.e., quantitative or categorical) of response and explanatory variable(s), the question to be asked or hypotheses to be tested with the data, and which topic you will use to answer the question. The initial proposal is worth an ***all-or-nothing*** 10% of the overall grade for the portfolio. I strongly urge you to discuss your initial proposal with me before turning it in.

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.
- ***Assumptions:*** describe all assumption checking and data transformations.
- ***Results:*** describe the results of your analysis.
- ***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.

It is possible that all four analyses can be conducted from the same large data set. Thus, it is possible to have a single introduction and single methodology describing the data collection, but separate methods for analysis, assumption checking, results, and discussion. Alternatively, if different data sets were used for each topic then separate introductions, methods, assumption checking, results, and discussion will be required. The final portfolio should be typed, written grammatically correct, and refer to supporting graphics and tables. The final portfolio is due on **15-Apr.**

Incomplete Grades: Under Northland College policy, an incomplete grade will be given **ONLY** under extreme circumstances beyond your control, such as a major illness. An incomplete grade will be given **ONLY** if you have successfully completed the entire course except for the final exam. If the final exam is not completed by the incomplete deadline, a grade of zero will be entered and the final grade will be calculated based on the points completed.