NATURAL RESOURCES STATISTICS (NRE 538)
WINTER 2016

Instructor
Dr. Shikha Marwah
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Office hours: Monday and Wednesday 10-11 a.m., and by appointment

GSIs
Scott Kalafatis
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Karl Bosse
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Lecture
Monday & Wednesday 2:30-4:00 p.m. in Dana 1040

Lab
Section 4: Thursday 3:00-5:00 pm. (Karl)
Section 5: Thursday 5:00-7:00 p.m. (Karl)
Section 2: Friday 12:00-2:00 p.m. (Scott)
Section 3: Friday 2:00-4:00 p.m. (Scott)

Summary: Statistics is the systematic analysis of quantitative data including the collection, organization, summarizing, analysis, interpretation, and presentation of data. People spend their entire careers developing and honing their statistical skills, so this introductory course aims to set a good foundation. In this course, you will be introduced to the basic concepts of probabilistic statistics and learn many of the standard statistical techniques.

Learning goals

▪ Understand the connections between basic probability and statistics
▪ Combine your knowledge of experimental design, sampling, statistical testing, and interpretation into a successful project
▪ When presented with a new data set and experimental design, you will be able to choose and implement the appropriate hypothesis test
▪ Adapt the statistical tools learned in this class to your own current and future research or projects
▪ When reading primary literature, you will be able to understand and critique the author’s statistical approach

Attendance: You are expected to attend all lectures and attendance at the lab session is required. If you cannot attend your scheduled lab session please contact your GSI. Please do not go to another lab session without prior permission, since there is limited space in the computer lab. Exams will focus on lecture discussions and lab exercises so attendance is crucial to receiving a good grade.

C-tools: The course website on C-tools has resources such as the syllabus, lecture notes, handouts, lab assignments, and course grades. Each lab section has its own C-tools site.
**Honesty:** Please abide by the Rackham “Statement on Academic and Professional Integrity”. Students can work together completing lab exercises but the problem sets associated with the labs must be done independently.

**Textbooks:** There is no required textbook, and lecture notes and handouts should be the primary source of information for the exams. However, if you would like recommendations on good sources of information:

“A Primer of Ecological Statistics” by Gotelli and Ellison  
Good introductory stats text with emphasis on designing experiments.

“Biostatistical Design and Analysis Using R” by Murray Logan  
Good book, with examples on how to run most every analysis using R (with code). Good review of basic statistical principles and heavy on R.

“Statistics: An Introduction Using R” by Crawley  
Great book for the basics of statistics (with code) in R. Light on stats but heavy on R.

“Biostatistical Analysis” by Zar  
Very dense and math-y but has everything you could ever want to know about parametric stats.

**Grading:**  
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<th>Component</th>
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<tr>
<td>Exam 1</td>
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<td>Final Exam</td>
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<td>Problem Sets</td>
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<td>Final project</td>
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**Exams:** Two midterm exams will be given in class on the dates noted on the class schedule below. A comprehensive final exam will be given on the University scheduled date. Students may bring a calculator and a single 3x5 index card with formulae for use during the exam. No make-up exams will be allowed so please mark these dates on your calendar now. Prior to each exam, the lab section will focus on practice exam problems.

**Lab:** The lab will be dedicated to applying the techniques learned in lecture to real data. Again attendance is required, and if you miss a lab session without prior permission you will receive zero points for that week’s problem set. We will use the open source program R for all the labs. Because it is open source, this program can be downloaded for free and used on your personal computer.
LECTURE SCHEDULE

Week 1 (1/6) - Introduction to statistics, descriptive statistics

Week 2 (1/11, 1/13) - Probability distributions

Week 3 (1/20) – Sampling design, no class 1/18 (MLK)

Week 4 (1/25, 1/27) – Hypothesis testing, T-tests

Week 5 (2/1, 2/3) - Chi-square test, review

2/8 - Midterm Exam 1

Week 6 (2/10) - One-way ANOVA

Week 7 (2/15, 2/17) - Multiple comparisons, two-way ANOVA

Week 8 (2/22, 2/24) - Multi-way ANOVA, assumptions, transformations

Spring break (2/27 - 3/6)

Week 9 (3/7, 3/9) - Simple linear regression

Week 10 (3/14, 3/16) - Non-linear regression, review

3/21 - Midterm exam 2

Week 11 (3/23) - Multiple regression

Week 12 (3/28, 4/30) - ANCOVA

Week 13 (4/4, 4/6) - Non-parametric Statistics

Week 14 (4/11, 4/13) – Multivariate Statistics

Week 15 (4/18) - Class wrap-up

4/20 - Final exam 1:30 a.m. - 3:30 p.m.
LAB SCHEDULE
(In 3rd floor computer lab, Dana 3325)

Week 1 (1/7 & 1/8) - No lab

Week 2 (1/14 & 1/15) - Lab 1: Introduction to R and descriptive statistics

Week 3 (1/21 & 1/22) - Lab 2: Sampling

Week 4 (1/28 & 1/29) - Lab 3: T-tests
Problem Set 1 due at the beginning of lab

Week 5 (2/4 & 2/5) - Exam review (Midterm 1)

Week 6 (2/11 & 2/12) - Lab 4: ANOVA

Week 7 (2/18 & 2/19) - Lab 5: Two-way ANOVA
Problem Set 2 due the beginning of lab

Week 8 (2/25 & 2/26) - Lab 6: Multi-way ANOVA

Spring Break

Week 9 (3/10 & 3/11) - Lab 7: Simple Linear Regression
Independent project short proposal due at the beginning of lab
Problem Set 3 due at the beginning of lab

Week 10 (3/17 & 3/18) - Exam review (Mid-term 2)

Week 11 (3/24 & 3/25) - Lab 8: Multiple Regression

Week 12 (3/31 & 4/1) - Lab 9: ANCOVA
Problem Set 4 due the beginning of lab

Week 13 (4/7 & 4/8) - Lab 10: Graphing

Week 14 (4/14 & 4/15) - Final exam review
Independent project report due in lab