Advanced Biological Statistics Bi 610 Fall 2013

Course Description:

This course aims to provide students with an understanding of the core concepts and approaches for the analysis of biological data, particularly large data sets. This is meant as a first, foundational course for graduate students. It is advanced in that we will move through the material quickly with the goal of covering all major topics in univariate and multivariate data analysis, forming a foundation for subsequent learning.

Instructor Information:

Dr. William A. Cresko, 312 Pacific Hall, 346-4779, wcresko@uoregon.edu
Office hours: Tuesday 2:00 to 3:30
Dr. Clay Small, 318 Pacific Hall, csmall@uoregon.edu
Office hours: Tuesday 2:00 to 3:30

Course Information:

Schedule: Tue/Thur, 10:00 AM - NOON, 245 Lillis Hall
Website: Bi 610 blackboard site (https://blackboard.uoregon.edu/)

Textbooks:

Logan, M. 2010. Biostatistical Design and Analysis Using R. Wiley-Blackwell.
Quinn, G. & M. Keough. 2002. Experimental Design and Data Analysis for Biologists. Cambridge Univ. Press.

Software:

Latest version of **R** from the R Project (www.r-project.org)
An R scripting environment such as **RStudio** (www.r-project.org)or **TextWrangler** (free version of **BBEdit**)

Prerequisites:

None, but students should be comfortable with algebra and the basics of calculus.

Grading:

Homework assignments (10% each)	30%
Interim Projects (15% each)	45%
Final Project	25%

The final course letter grade will be determined based on a curve of total performance in the course

Homework assignments:

Three problem sets will be assigned to be turned in the same week (see course schedule). The intent of each homework is to expose students to running specific analyses in R. You will complete the analyses and submit both your R code and resultant output via the blackboard course website. More details regarding the homeworks will be given at the appropriate time.

Interim projects:

There will be three projects during the course of the term. The projects will consist of analyzing provided data sets, and producing a write-up of the analyses in the form of the results section from a journal article. More details regarding the projects will be given at the appropriate time.

Final Projects:

Each student will be required to use the concepts and approaches throughout the term to analyze an independent project that is relevant to her or his work. Possible topics should be discussed with me early in the term, and a brief one page prospectus of the dataset and proposed analyses will be due in the seventh week of the term. The final project will be due during finals week, and should comprise a write-up similar to the interim projects, as well as a set of appropriately formatted and finished tables and figures that could be used for a conference presentation or manuscript. More details regarding the projects will be given at the appropriate time.

Students with Disabilities:

If you require an accommodation based on disability, I would like to meet with you in the privacy of my office the first week of the semester to be sure you are appropriately accommodated.

Academic Honesty:

All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures.

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Lecture Schedule

Week	*Date*	*Subject*	*Readings*	*Assignments*
1	Oct 1st Oct 3rd	The R programming environment Data, variation and probability distributions Initial Data Exploration (IDE) & graphics	Logan: Chps 1-3 Q & K: Chps 1	
2	Oct 8th Oct 10th	Estimation approaches & confidence intervals Hypothesis testing and significance Correlation and covariance	Logan: Chps 4-6 Q & K: Chps 2-4	Homework 1
3	Oct 15th Oct 17th	Ordinary Linear Models (OLMs) Simple linear regression Introduction to multiple linear regression	Logan: Chps 7-9 Q & K: Chps 5-6	Project 1
4	Oct 22nd Oct 24th	Experimental design Revisiting type I & II errors Power	Logan: Chps 10 Q & K: Chps 7	*Final Project Initial Plan*
5	Oct 29th Oct 31st	Analysis of Variance (ANOVA) Single factor ANOVA Planned and *post hoc* comparisons	Logan: Chps 10 Q & K: Chps 8	Homework 2
6	Nov 5th Nov 7th	Multiple factor ANOVA Factorial & Nested ANOVA ANCOVA	Logan: Chps 11-12 Q & K: Chps 9 & 12	Project 2
7	Nov 12th Nov 14th	Frequency analyses Contingency tests Generalized Linear Models (GLMs)	Logan: Chps 16-17 Q & K: Chps 13-14	*Final Project Prospectus*
8	Nov 19th Nov 21st	Mathematical basics of multivariate analyses Eigenvectors and Eigenvalues	Q & K: Chps 15	Homework 3
9	Nov 26th Nov 28th	MANOVA Discriminant Function Analysis (DFA) Principal Component Analysis (PCA)	Q & K: Chps 16 & 17	Project 3
10	Dec 3rd Dec 5th	Correspondence Analysis (CA) Multidimensional Scaling (MDS) Cluster analysis	Q & K: Chps 17 & 18	
Finals Week		**FINAL PROJECT**	Q & K: Chps 19	***Final Project Due***

Homeworks and Projects

Homework 1 - IDE and hypothesis tests
Homework 2 - Simple ANOVA
Homework 3 - Logistic regression

Project 1 - Simple regression
Project 2 - Two factor ANOVA
Project 3 - Principal Component Analysis