Advanced Biological Statistics Bi 610 Fall 2016

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.

Instructors of Record Information:

Dr. Bill Cresko	312 Pacific Hall	wcresko@uoregon.edu	Office hours TBA
Dr. Emily Beck	318 Pacific Hall	ebeck8@uoregon.edu	Office hours TBA

Course Information:

Schedule: Mon/Wed 10:00 AM - 11:50 AM, 142 Columbia Hall
Website: Bi 610 Canvas site (https://canvas.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	(~13% each)	40%
Independent analyses	(~13% each)	40%
Final Project		20%

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 Canvas course website. More details regarding the homeworks will be given at the appropriate time.

Independent analyses:

There will be three small projects during the course of the term. The projects will consist of analyzing data sets provided by the instructors. For each project you will produce a write-up of the analyses similar to the results section from a journal article. More details regarding the projects will be given at the appropriate time.

Final Project:

Each student will be required to use the concepts and approaches throughout the term to analyze a rich data set provided by the instructors. A brief summary of initial data exploration and plan for 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 independent analyses, as well as a set of appropriately formatted and finished tables and figures of the quality expected 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, we would like to meet with you in privacy the first week of the term to be sure you are appropriately accommodated. Please contact us in this case.

Academic Honesty:

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

Advanced Biological Statistics Bi 610 Fall 2015

Lecture Schedule

Week	*Date*	*Subject*	*Readings*	*Assignments*
1	Sep 26th Sep 28th	Data, variation and probability distributions Initial Data Exploration (IDE) & graphics The R programming environment	Logan: Chps 1-3 Q & K: Chps 1	
2	Oct 3rd Oct 5th	Estimation approaches & confidence intervals Hypothesis testing and significance Correlation and covariance	Logan: Chps 4-6 Q & K: Chps 2-4	Homework 1
3	Oct 10th Oct 12th	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 17th Oct 19th	Experimental design Revisiting type I & II errors Power	Logan: Chps 10 Q & K: Chps 7	
5	Oct 24th Oct 26th	Analysis of Variance (ANOVA) Single factor ANOVA Planned and *post hoc* comparisons	Logan: Chps 10 Q & K: Chps 8	Homework 2
6	Oct 31st Nov 2nd	Multiple factor ANOVA Factorial & Nested ANOVA ANCOVA	Logan: Chps 11-12 Q & K: Chps 9 & 12	Project 2
7	Nov 7th Nov 9th	Frequency analyses Contingency tests Generalized Linear Models (GLMs)	Logan: Chps 16-17 Q & K: Chps 13-14	*Final Project IDE*
8	Nov 14th Nov 16th	Mathematical basics of multivariate analyses Eigenvectors and Eigenvalues	Q & K: Chps 15	Homework 3
9	Nov 21st Nov 23rd	MANOVA Discriminant Function Analysis (DFA) Principal Component Analysis (PCA)	Q & K: Chps 16 & 17	Project 3
10	Nov 28th Nov 30th	Correspondence Analysis (CA) Multidimensional Scaling (MDS) Cluster analysis	Q & K: Chps 17-19	
Finals Week Week of Dec 5th		**FINAL PROJECT**		***Final Project Due***

<u>Homeworks and Projects</u>

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