

Biometry

BIO 415

Spring 2007

Instructor: John Sabo

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Office hours: TH 11-12

LSA 322/329 {By Appointment}

TA: Tammy Harms

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Office Hours: **T** 4:30-6:30, LSE 244

Lectures (LSA 109):

- T,H 9:40-10:55

Labs (LSE 244)

- Morning Lab: F 9-12
- Afternoon Lab: F 2:40 -5:40

Required Text: Zar, J.H. *Biostatistical Analysis*, 4th Addition.

Required Readings: Posted in PDF format on Blackboard : <https://my.asu.edu>

Supplemental Texts:

Scheiner, S.M. and J. Gurevitch. *Design and Analysis of Ecological Experiments*. 2nd Edition

Burnham K.P. and D. R. Anderson. *Model Selection and Multimodel Inference*.

Course Objectives

The goal of this class is threefold: **1)** to introduce you to a wide range of statistical tools that you can apply to analyze data from ecological or evolutionary studies, **2)** hone your analysis skills in Excel, Systat and Matlab, and **3)** teach you the situations in which specific tools are called for and in which situations you must use caution in applying each tool. To do this, we will spend 1-2 weeks on each topic, devoting typically two lecture “modules” to each. During the first lecture (Tuesday), I will introduce a statistical test, discuss assumptions and limits of application. In the following lecture we will discuss how to deal with cases in which data violate the simple assumptions of the test, discuss alternate tests. In the last half of this lecture we will DISCUSS a paper that uses the tool of the week and evaluate whether the test has been used appropriately. In lab, you will learn to visualize data, apply the tool of the week and will then analyze the data from the paper used in discussion in Thursday’s lecture. These data will be altered so that the interpretation and result differ from the published outcome. Your job will be to analyze the data and rewrite the results section of the same paper.

Grading

Grades will be based on three class components:

- 1) Take home exams (2). The midterm exam is worth 20%, the final exam 30% of your final grade—**50% of final grade**
- 2) Lab Write-ups (**10**) each one worth 4%, and you may drop your worst score out of 10 labs—**40% of your final grade (grade scaled to 40% based on best 9 labs)**. These assignments should be turned into **YOUR TA (LSA 311)** by **5:00** pm the

- Thursday following each Lab exercise.** Late work will be accepted but penalized 1 letter grade (i.e., 10% deduction) per day after the due date. No late work will be accepted after the Wednesday following the posted due date.
- 3) Attendance and participation in discussions (11), participation will be “encouraged” by 2-3 calls to *student teams* throughout the semester to answer questions about weekly *readings* being discussed—**10% of final grade.**

Syllabus

Date	Topic	Text/ Reading	Supplemental ¹ Reading	Assignment Due
Week 1				
T 01-16	Introduction, Normal Distribution, Central Tendency, Moments and other descriptive statistics	Text: Zar Ch. 1-4 (40 pp total)	Scheiner &Gurevitch Ch. 1	
H 01-18	Other Important Probability Distributions; Statistical Schools of Thought I: Parametric or Non-Parametric?	Text: Evans et al. Chs. 6, 26, 29, 32 (20 pp total)		
F 01-19	Excel Basics; Descriptive Statistics	--	--	Lab 1: Due 01-25
Week 2				
T 01-23	Assumptions of Parametric Statistics—“LINE”; Type I and II error; Statistical Power	Text: Zar Ch. 6	Scheiner &Gurevitch Ch. 1	
H 01-25	Experimental Design; Pseudoreplication <i>Discussion: “Pseudoreplication and non-demonic intrusion in ecological experiments”</i>	Reading: Hurlbert 1984 Haven 1973	Scheiner &Gurevitch Ch. 3	
F 01-26	Systat Basics; Testing Assumptions—LINE	--	--	Lab 2: Due 02-01
Week 3				
T 01-30	One and Two Sample Hypothesis Testing:	Text: Zar Chs. 7-8	--	
H 02-01	Assessing LINE, Power and Sample Size <i>Discussion: “Dynamics of a strong interaction?”</i>	Reading: Power et al. 1985	--	

F 02-02	One and Two Sample <i>t</i>-tests	--	--	Lab 3: Due 02-08
Week 4				
T 02-06	Paired Sample <i>t</i> -tests	Text: Zar Ch. 9		
H 02-08	Non-parametric <i>t</i> -test analogues: Mann-Whitney U and Wilcoxon Sign-Rank tests; Multiple tests, error inflation and Bonferroni correction		--	
F 02-09	Paired Sample <i>t</i>-tests	--	--	Lab 4: Due 02-15
Week 5				
T 02-13	3+ sample hypothesis testing: Analysis of Variance (ANOVA)	Text: Zar Ch. 10	Scheiner &Gurevitch Chs. 3-4	
H 02-15	Assessing LINE, Power and Sample Size <i>Discussion: "Diversity in Intertidal Boulder Fields"</i>	Reading: Sousa 1979	--	
F 02-16	ANOVA	--	--	NO LAB DUE
Week 6				
T 02-20	Data Transformations Non-parametric ANOVA analogues: the Kruskal-Wallis H	Text: Zar Ch. 13	--	
H 02-22	Multiple Comparisons Tests <i>Discussion: "Succession in intertidal boulder fields"</i>	Text: Zar Ch. 11 Reading: Sousa 1980	--	
F 02-23	Non-parametric ANOVA Multiple Comparisons	--	--	ANOVA Lab (Lab 5): Due 03-01
Week 7				
T 02-27	General Linear Models (GLM) and more complex experimental designs 2-way ANOVA Multiple comparisons in 2-way designs	Text: Zar Ch. 12	Scheiner &Gurevitch Ch. 4	Take Home Mid Term Distributed in Class
H03-01	Assessing LINE, Power and Sample Size	Reading: Peckarsky and	--	

		Penton 1985		
F 03-02	Lab Time for Take Home Mid Term	--	--	Take Home Midterm Exam Due: 03-08, 5pm LSA 322
Week 8				
T 03-06	Controlling for Spatial Effects: Randomized Block ANOVA Multiple comparisons in CRB designs	Text: Zar Ch. 12	Scheiner & Gurevitch Ch. 3	
H 03-08	Assessing LINE, Power and Sample Size <i>Double Discussion: "Behavior, Predation and Competition" AND "Riverine subsidies to lizards"</i>	Reading: Sabo and Power 2002	--	
F 03-09	GLM: 2-Way and Completely Randomized Block (CRB) ANOVA	--	--	GLM Lab (Lab 6) Due: 03-22
03-10— 03-18	SPRING BREAK	SPRING BREAK	SPRING BREAK	SPRING BREAK
Week 9				
T 03-20	Repeated Measures ANOVA	Reading: Scheiner & Gurevitch Ch. 6	--	
H 03-22	Repeated Measures ANOVA: Other experimental designs and assumptions		--	
F 03-23	rmANOVA	--	--	rmANOVA Lab (Lab 7) Due: 03-29
Week 10				
T 03-27	GLM: Linear Regression, Assessing LINE, Power and Sample Size	Text: Zar Ch. 17	--	
H 03-29 Candan Soykan	GLM: Linear Regression and Correlation <i>Discussion: "ANOVA or regression?"</i>	Text: Zar Ch. 19	Reading: Cottingham 2005	

F 03-30	Linear Regression Testing the Assumptions	--	--	No Lab due
Week 11				
T 04-03 (Tammy Harms)	Multiple Linear Regression	Text: Zar Ch. 20	--	
H 04-05	ANCOVA	Text: Zar Ch. 18	--	
F 04-06	Multiple Linear Regression	--	--	Regression Lab (Lab 8) Due: 04- 12
Week 12				
T 04-10	Simple Goodness of Fit Tests: Chi Square and the Log-Likelihood Ratio	Text: Zar Ch. 22	--	
H 04-12	Generalized Contingency Tables <i>Discussion: "Hot rocks or no hot rocks "</i>	Reading: Sabo 2003	--	--
F 04-13	Chi-Square Analysis	--	--	Chi-Square Lab (Lab 10) Due: 04-19
Week 13				
T 04-17	Distribution Free/Randomization Tests: Bootstrap and Jackknife	Text: Efron Ch. 1	Scheiner and Gurevitch Chs. 11,13	
H 04-19	Non-linear regression	Text: Zar Ch. 21	--	
F 04-20	Randomization Tests: Bootstrapping a confidence interval	--	--	Bootstrap Lab (Lab 9) Due: 04- 26
Week 14				
T 04-24	Likelihood Theory & Information Criteria and Model Selection	Text: Burnham & Anderson Ch. 1	--	Take Home Final Distributed in Lecture
H 04-26	Statistical Schools of Thought II: Bayesian vs. Frequentist Philosophies	Text: Dennis 1996	--	
F 04-27	Fitting Population Models to Time Series of Abundance Data	--	--	No Lab Assignment Due

Week 15				
T 05-01	Meta-analysis <i>Discussion: Putting the pieces together</i>	Text: Gurevitch et al. 2001 Reading: Sabo et al. <i>in press</i>	Scheiner and Gurevitch Ch. 17	
<u>W</u> 05-02	Lab Time for Take Home Final	Lab Time for Take Home Final	Lab Time for Take Home Final	Take Home Final Due 12-07 By 5 pm LSA 322