Anth 410/510
Biological Anthropology Statistics

Dr. Frances White

**Anth 470 / 570 Statistical Analysis in Biological Anthropology**
**Spring 2009**

**Professor:** Dr. Frances White
**Office hours:** Tuesday 1 to 3 pm and by appointment, Condon Hall 352
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**Class times:** Tuesday / Thursday 10 to 12, Chapman 203 for most classes. Approximately every other week we will have one class that is a computer lab exercise in SSIL – see the schedule of lectures and labs

**Credit Hours:** 4

**Prerequisites:** Permission of Instructor. Demonstration of statistical knowledge and background from introductory level classes such as Math 111, Math 243, or equivalent classes.

**Short course description:**
The important methods in biometry (biological statistics) and their inherent assumptions, limitations, interpretations, and common uses (and misuses) as relevant to biological anthropology.

**Course content:**
This course is designed for upper-level undergraduates and beginning graduate students with some statistical knowledge and background. My goal is to provide you with a firm grounding in the statistical analysis of data from the field of biological anthropology. I intend to teach you a sophisticated knowledge of important methods in biometry (biological statistics) and their inherent values, assumptions, limitations, and common uses (and misuses). My approach will be to teach you to use the Sokal and Rohlf textbook <u>Biometry (third edition)</u> as a future resource as well as to aid your current understanding. Successful completion of this course will enable you to logically design research projects, to analyze your data in a correct, appropriate, and powerful fashion, and to understand and critically evaluate statistical analyses in the literature.

The course is divided into three major sections. The first short section will briefly cover probability statistics, descriptive statistics, hypothesis testing and experimental design. This first section should be a review of your background coming into this class together with a unification of different terminology you may have encountered in other textbooks. The second section will form the bulk of the class and will cover the different parametric and non-parametric methods of statistical analysis of analysis of variance (anova), correlation, linear regression, frequency analysis, and special topics such as time series data and randomization tests. Analyses will be introduced using univariate data, and bivariate and multivariate applications will be covered where appropriate. The third section of the class runs concurrently with the first two and will involve the use of computer programs for the data organization, statistical analysis, graphical presentation (SAS© for Windows, BIOMStat, SigmaPlot).

All exams in this class will be open book. A copy of the Statistical Tables and a simple, non-programmable calculator will be required in all classes, labs, and exams. Copies of previous exams will be posted on the class Blackboard site

**Course requirements:**

Students are required to attend class, including the labs that meet in SSIL, read the assigned book chapters, and completed the weekly homework assignments. Students are also required to complete the assigned computer exercise in the SSIL lab either during class or outside of class. There will be two graded mid-term exams and a graded take-home final exam.

**Undergraduate Student Grading:** The final grade for undergraduates will be based on:

Midterm exam 1 10%
Midterm exam 2 20%
Computer labs 20%
Homework exercises 20%
Final exam 30%

**Graduate student grading:**

Midterm exam 1 10%
Midterm exam 2 15%
Computer labs 15%
Homework exercises 15%
Final exam 25%
Research data analysis and write-up 20%

**Research data analysis report:** The research data analysis is a major undertaking that will require 2 to 4 hours of work per week and result in a publishable quality analysis and interpretation. Graduate students will complete a research-based statistical analysis of a data set. Graduate students may bring their own unanalyzed data set, request one from their advisor, or ask for one to be assigned. The report should be modeled on the Methods, and Results sections of a relevant journal and include brief first-level conclusions drawn from the analyses (without literature review) and suggestions for further data collection and analyses. This report should be approximately three written pages with attached computer print-outs of program and results and at least one publication-quality plot of the data.

**Textbooks:**

Sokal and Rohlf, Biometry (3rd edition), Freeman
Rohlf and Sokal, Statistical Tables, Freeman
O'Rouke et al. A Step by Step approach to using SAS for univariate and multivariate statistical analysis, SAS Publishing (optional)

Textbook and Tables should be brought to all classes including labs. The SAS© book will be useful for the labs.

| Week | Date and Location | Topic | Chapters (Sokal & Rohlf) |
|---|---|---|---|
| Week 1 | Tuesday CHA 203 | Descriptive statistics, parametric and non-parametric | 1, 2, 3, 4 |
| | Thursday CHA 203 | Probability distributions, normality | 5, 6 |
| Week 2 | Tuesday SSIL | Introduction to labs, moving data around and descriptive statistics in Excel | |
| | Thursday CHA 203 | Hypothesis testing, transformations | 7 |
| Week 3 | Tuesday CHA 203 | Analysis of variance | 8 |
| | Thursday CHA 203 | Single classification anova | 9 |
| Week 4 | Tuesday SSIL | Lab: testing for normality, assumptions and transformations, single class anova (Model I) | 13 |
| | Thursday CHA 203 | **<u>Midterm 1:</u>** descriptive statistics, definition of terms, single class anova, normality and transformations | |
| Week 5 | Tuesday CHA 203 | Model II and mixed model single class anova, multiple comparisons (planned and unplanned) | 9 |
| | Thursday CHA 203 | Model II two-level nested anova, correspondence across classes | 10 |
| Week 6 | Tuesday CHA 203 | Mixed model and multi-level nested anova. Model I, II and mixed model two-way anova, with and without replication | 11 |
| | Thursday CHA 203 | Non-parametric anova. Multiway anova with and without replication, Model I, II and mixed. | 13, 12 |
| Week 7 | Tuesday SSIL | Lab: non-parametric anova, nested and two-way anova, multiple comparisons. | 13 section 13.11 |
| | Thursday CHA 203 | **<u>Midterm 2:</u>** Multiple comparisons. Nested, 2-way multi-way, and non-parametric anova. | |
| Week 8 | Tuesday CHA 203 | Linear regression: Model I, with and without replication | 14 |
| | Thursday CHA 203 | Analysis of covariance, multiple regression, non-linear regression. Correlation | 15, 16 |
| Week 9 | Tuesday SSIL | Lab: regression and correlation, parametric and non-parametric. | |
| | Thursday CHA 203 | Frequency analysis. | 17 |
| Week 10 | Tuesday CHA 203 | Special topics (distribution free methods, time series, randomization tests) | 18 |
| | Thursday SSIL | Lab: frequency analysis, special topics | |