

STAT 430 – Statistical Computing II

Spring 2007

1. Catalog Description

STAT 430 Statistical Computing II (4)

Design and use of statistical software in programming statistical applications; object oriented statistical languages; random number generation; Monte Carlo methods including resampling (bootstrap and jack-knife), randomization tests, and simulation; exploratory data analysis using linked, Trellis, and dynamic graphics; smoothing algorithms; and regression/classification trees. 4 lectures. Prerequisites: STAT 322, 330, and 323 or 324

2. Required Background and/or Experience

STAT 322, 330, and 323 or 324

3. Expected Outcomes

The student should be able to:

- a. Write efficient and correct code for descriptive and inferential statistics.
- b. Understand the object oriented programming environment.
- c. Understand how random numbers are generated from probability models.
- d. Recognize applications that require specialized computing algorithms.
- e. Program Monte Carlo experiments and simulations.
- f. Understand the basic idea of the bootstrap and jackknife methods.
- g. Understand the role of smoothing in exploratory data analysis.
- h. Understand the role of linked, Trellis, and dynamic graphics in exploratory data analysis.
- i. Understand the role of cross-validation in model selection.

4. Suggested texts or References

The Basics of S-PLUS, Fourth Edition, A. Krause and M. Olson, Springer, 2005.
Modern Applied Statistics with S, Fourth Edition, W.N. Venables and B.D. Ripley, 2002

5. Minimum Student Materials

One 3-½ inch floppy disk.

6. Minimum University Facilities

Classroom with PC workstations, S-PLUS or R software, chalkboard and overhead projector. Video projection equipment is preferable.

7. Description of Content and Method

TOPICS	NUMBER OF LECTURES
A. INTRODUCTION TO S-PLUS FOR WINDOWS	6
1. Components of S-PLUS or R system	
2. Simple structures	
3. Mathematical operations	
4. Basic statistics	
B. DATA STRUCTURES	3
1. Matrices	
2. Arrays	
3. Data Frames	
4. Lists	
C. GRAPHICS	4
1. Trellis graphs	
2. Brush and Spin	
3. Custom Graphics	
D. PROGRAMMING	6
1. Object oriented approaches	
2. Iteration	
3. Functions	
E. MONTE CARLO METHODS	8
1. Bootstrap	
2. Jackknife	
3. Randomization tests	
4. Simulation	
F. ADVANCED STATISTICS	9
1. Cross validation in statistical models	
2. Smoothing algorithms	
a. Running medians	
b. Lowess	
c. Spline	
d. Kernel Smoothers	
3. Classification and regression trees	
4. Other modern statistical methodologies at instructors discretion	_____
Total	36

METHOD

Theoretical material will be presented in a lecture format and class discussions. Applied material will be presented using lectures, real-time computer-screen projections, and supervised student computer-activities.

8. Method of Evaluating Outcome

Homework assignments, projects, and examinations.