STAT 327-3 (also -6 and -9): Advanced Data Analysis with R

Course outcome: Students will integrate R with high performance computing tools to do scientific computing at an introductory level.

Unit	Objectives Students will:	Assessment	Read, View, Do
1 **Optimization**	1. Understand the basics of golden section search, gradient descent, Newton's method, and Nelder-Mead search. 2. Find minima or maxima of functions and classify as local or global. 3. Use optimization in a statistical context like nonlinear least squares. 4. Know that analytical results may not exist and numerical results may be unstable.	HW1 (Huber robust regression, exponential smoothing)	1optimization.pdf, lecture 1, goldenSectionSearch.R, gradientDescent.R, Newton.R, group work (optimization)
2 **Create an R package**	1. Implement R methods corresponding to generic functions. 2. Wrap code in a package, the standard form for code distribution among collaborators.	HW2 (least absolute deviations regression package)	2package.pdf, lecture 2 3generic.pdf, lecture 3, utilities.tar.gz
3 **Improve R code**	1. Use basic testing and debugging methods and tools. 2. Profile code to find where it spends its time. 3. Time code to choose among competing approaches. 4. Write efficient code (general tips).		4testDebug.pdf, lecture 4 5profile.pdf, lecture 5 nflProfile.R, loopTiming.R, group work (review)
4 **Multicore computing**	Use parallel multicore computing to speed up embarrassingly parallel computations.	HW3 (mean filter image smoothing, standard deviation edge detection)	6multicore.pdf, lecture 6 nfl.R, mandelbrot.R
5 **Call C/C++**	1. Call C++ code from R via the Rcpp package. 2. Translate basic R functions to basic C++.		7Rcpp.pdf, lecture 7 escapeTime.cpp

Prerequisite: STAT 327-2