Introduction to Statistical Computing - STAT 445/645

Fall 2018—DMSC 106—Mon,Wed 2:30pm - 3:45pm

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Office:	DMSC 224	**Hours**:	Tue 2:30pm-3:30pm, Wed 1:30pm-2:30pm, or by appointment

Catalog Description

Introduction to statistical computing; data visualization and manipulation; document creation; graphics; simulation techniques; parallel computing; estimation; optimization; advanced statistical methods.

400-level Student Learning Outcomes

UG1 Students will be able to implement statistical simulation, re-sampling techniques, and maximum likelihood estimation.

UG2 Students will be able to conduct a simulation-based power analysis.

UG3 Students will be able to write professional quality reports and computer code.

GRAD1 Students will be able to use statistical computing methods to complete a research project and effectively communicate their findings.

Course outcomes

Students will be able to ...

1. install R and RStudio
2. use basic git commands
3. produce HTML, PDF, or Word documents using R Markdown
4. install R packages for computing tasks
5. use vectors.
6. use lists.
7. use DATA.FRAMES
8. apply data types (factor, numeric, etc.)
9. explore data structures using STR, HEAD, TAIL, ETC.
10. use indexing and iteration to complete computing tasks
11. manipulate text in R (splitting, searching, cleaning)
12. use the APPLY family of functions to compute efficiently
13. demonstrate mastery of above content in Midterm 1
14. plot data using 1D, 2D, 3D strategies using BASE,GRAPHICS

15. apply the grammar of graphics through GGPLOT2
16. write R functions
17. simulate data using pseudo random-number generation
18. import/export data in various formats
19. demonstrate mastery of all above content in Midterm 2
20. apply the split-apply-combine data-analysis strategy
21. perform parallel computing tasks (parallelization)
22. fit basic statistical models and make predictions
23. integrate functions using Monte Carlo techniques
24. use re-sampling for statistical inference (bootstrap, jackknife)
25. use maximum likelihood estimation for statistical inference
26. use Markov Chain Monte Carlo (MCMC) to sample from probability distributions
27. demonstrate mastery of all topics in a Final Exam