CS 4630: PYTHON FOR COMPUTATIONAL AND DATA SCIENCES

Semester Hours: 3.0  
Contact Hours: 3

Coordinator: Ray Kresman
Text: Various
Author(s): VARIOUS
Year: Various

SPECIFIC COURSE INFORMATION

Catalog Description:
Accelerated introduction to Python. Sample problems in STEM domains and computational approaches to solving them. Generic, and domain-specific libraries and tools. Introduction to data variety, analysis, and visualization. Prerequisite: MATH 1310 and C or better in CS 1010 or CS 2010 or consent of instructor. Cannot earn credit for both CS 4630 and CS 5630.

Course type: ELECTIVE

SPECIFIC COURSE GOALS

- I can use language libraries to solve basic computational problems in STEM domain [examples: a) sequence alignment and use of STEM datasets; b) scripting in STEM applications; c) hypothesis testing and optimization].
- I can explain language mechanisms for handling missing data, and cite sample STEM applications where missing data is prevalent.
- I can use basic visualization and data classification on STEM datasets.
- I can explain certain data formats in STEM fields.
- I can use the primitives in certain libraries, for example: Numpy, Scipy, Biopython-Sympy, Pyomo, Mathplotlib, Pandas.
LIST OF TOPICS COVERED

• Accelerated introduction to Python (~ 15%)
• Datasets in the sciences (~ 10%)
  o Data formats in STEM fields, examples: atmospheric science, biology
  o Missing data - for example, radar measurements
  o Data wrangling and analysis
• Applications - Math & Physics (~ 15%)
  o Matrix operations & ODE
  o Projectile motion and simple harmonic motion
  o Optimization
• Applications - Geology/Hydrology/GIS (~ 15%)
  o Raster & vector data
  o Line and contour plots
  o Basics of filtering and noise reduction
  o Process map layers and time series data
• Applications - Psychology and Statistics (~ 15%)
  o Descriptive and inferential statistics,
  o Models & hypothesis
  o Significance and hypothesis testing
• Applications - Chemistry/Biology/CS (~ 25%)
  o Chemical equations, stoichiometry
  o Bioinformatics and sequence alignment
  o Dynamic programming
  o Data and spatial visualization
  o Data science programming