Numerical Methods I

Jan 7 – May 15, 2019
Mondays + Wednesdays, 11:30 am

Lecturer: Kabir Ramola
Grader: Anoop Mutneja

Grades will be assigned as follows

50% Assignments
25% Midterm Exam
25% Coding Project (of your choice/assigned by PhD supervisor (language of your choice))

LIST OF TOPICS

I. Introduction to Programming and Data Visualization (10 Lectures)

- Introduction to Command Line / Linux / Ubuntu (2 Lectures)
- Installing gnuplot / gfortran / gcc / python / Mathematica / Matlab (1 Lecture)
- Introduction to gnuplot (1 Lecture)
- Introduction to gfortran (1 Lecture)
- Introduction to gcc (1 Lecture)
- Programming in gfortran and gcc / python superstructures (3 Lectures)
- Introduction to Mathematica (1 Lecture)

II. Theoretical Underpinnings (Midterm Exam will be based on this) (10 Lectures)

- Error analysis and error propagation (1 Lecture)
- Differentiation and Integration (1 Lecture)

- Finding Roots (1 Lecture)
- Linear Algebra (matrix manipulation) (2 Lectures)
- Solving Differential Equations (2 Lectures)
- Fourier Transforms / Fast Fourier Transforms (2 Lectures)
- Fitting Data Sets (1 Lecture)

III. Monte Carlo Simulations and Optimization Techniques (4 Lectures)

- Introduction to Monte Carlo techniques (2 Lectures)
- Linear Programming (1 Lecture)
- Simulated Annealing (1 Lecture)

IV. Coding Project (4 Lectures)

- We will be available in class to discuss individual projects

Reference Materials

Part I

- Various online links
- *The C Programming Language* by B. Kernighan and D. Ritchie

Parts II and III

- *Numerical Analysis* by R. L. Burden and J. D. Faires
- *Numerical Methods for Scientists and Engineers* by H. M. Antia