CDS 130 - 003
Computing for Scientists

Syllabus

Fall 2010
Prerequisites: Analytic Geometry and Calculus (Math 113)
Credits: 3

Date: Tuesday and Thursday
Time: 09:00 AM to 10:15 AM
Place: Research Building 1, room 301

Instructors: Prof. Jie Zhang
Contact Info: (703)993-1998 (phone), jzhang7@gmu.edu (e-mail)
Office Hour: 10:30 AM to 11:30 AM, Thursday, or by appointment
Office: Room 351, Research Bldg 1

Teaching Assistant: Dr. Joseph Marr
Contact info: jmarr2@gmu.edu
Dr. Marr will grade homework and exams and answer questions that you pose on BlackBoard

Description: This is a newly approved course (April, 2010) for science majors at GMU and fulfills the General Education Information Technology requirement. In this course, students will learn how to use computers to solve practical scientific problems. Topics will include creating effective scientific presentations, analysis of experimental data, on-line literature, data/information ethics, scientific modeling, and communication/collaboration tools. Beyond just introducing computing tools, this course will equip students with the knowledge and confidence they need to make productive use of future hardware and software both as students and throughout their career

Content:

- Computer fundamentals - Binary representation of data, data storage, logic tables and circuits.
- Measurements - Sensors, sensor limits, calibration, analog to digital converters, signal-to-noise, precision, *accuracy*, and bias.
- Basic Data Structures – tables, spreadsheets, arrays
- Visualization – Data representation types, creating visualizations, creating and visualizing images
- Data analysis - statistical analysis, data fitting
- On-line information systems – scientific databases, SQL, queries, data storage, data and information quality, literature searches
- Data Ethics – ethical use of publications, data, and code, ethical issues in scientific data including human subject research, confidentiality, presentation of data
- Scientific simulation – using computers to simulate dynamical systems, mathematical models, iteration, verification, validation

- Effective scientific publications and collaborations – creating effective visualization to communicate ideas, tables, citations, computational tools for effective writing, presentations, and collaborations
- The future of scientific computing – data-intensive computing, cloud computing, quantum computing, and cyber-enabled science & discovery limits to numerical resolution, data storage, processing, data communications, networking, programming concepts, algorithms, programming languages

Software Tools: Excel, Matlab

Homework: There will be a weekly homework. Homework will be multiple choice and short answer. The grading scheme for short answer questions is 0/1/2, where 2 = substantial understanding of concepts and/or correct answer and at most one grammatical error; 1 = an understanding of underlying concepts, with some gaps and/or almost correct answer and at most two grammatical errors; 0 = little or no understanding of concepts and/or incorrect answer. Answers should be 1-5 sentences in length.

Projects: There will be one comprehensive project throughout the semester. The project will consist of multiple phases, each of which has its own requirement and due date.

Exams: There will be one midterm and one final exam.

Grading: Homework (25%), Project (20%), Midterm (25%), Final Exam (25%), Class Participation (5%)

Class URL: http://blackboard.gmu.edu/
http://solar.gmu.edu/teaching/2010_CDS130

Text Book: None - no suitable textbook exists for this course. On-line notes and web-based content will be used to supplement the lectures and in-class assignments.

Honor Code: As in any class, you are allowed to study with other students. However, tests and homework assignments must be completed on your own unless stated specifically in the assignment guidelines. In some assignments, you will be directed toward on-line sources for papers, data and code. If these data, code, or papers are used for a project, then you MUST cite where it came from. Specifically, you may not copy any text, computer code, image, data or any other material from the Internet or any other source and represent it as your own. Any material that is taken in whole or in part from any other source (including web-pages) that is not properly cited will be treated as a violation of Mason's academic honor code and will be submitted to the honor committee for adjudication, as will other violations of the honor code.