9-2002

CS 471.01: Scientific Computing with Geophysical Applications

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University of Montana - Missoula

Computer Science 471 - Autumn 2002

Scientific Computing (with Geophysical Applications)

Prerequisites

- Equivalent of one semester of programming in a high level language such as Java, C/C++, Fortran or Basic
- The equivalent of two semesters of calculus
- The equivalent of one semester of physics
- High motivation level and maturity - willingness to "learn by doing" outside of the classroom

Objectives

- Develop an appreciation and foundation in the physical components of the atmospheric and subsurface regimes, and the very complicated interactions of these components
- Exposure to scientific visualisation techniques for analysing behaviour of complicated geophysical processes
- Develop a foundation of numerical methods for solving difficult math problems as applied to the geophysical applications
- Exposure to high-performance computing methods for optimisation of computationally demanding problems.

Instructor Information

Don Morton
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Office Hours

See http://MRoCCS.cs.umt.edu/~morton/office_sched.html for current information.

Class Meeting Times/Place

- 1810 - 1930 TuTh
- Social Science 362 (Sometimes Social Science 423)

Attendance Policy

Class attendance is not a factor in determining grades. When a class is missed, it is the STUDENT'S responsibility to obtain any notes, assignments, etc. from classmates.

Textbooks

A Climate Modelling Primer, 2nd edition, by K. McGuffie and A. Henderson-Sellers - **REQUIRED**

Scientific Computing - An Introductory Survey, 2nd edition, by Michael T. Heath - **REQUIRED**

Teach Yourself Unix in 24 Hours, 3rd edition, by Dave Taylor - **OPTIONAL**

Introduction to Fortran 90 for Scientists and Engineers, by Larry R. Nyhoff and Sanford C. Leestma - **OPTIONAL**

Grade Evaluation

- **15-20 programming / project /lab assignments - 85%**
  - Most assignments will focus on some problem in the geophysical domain, requiring computational methods for solution
  - Most, if not all, assignments will require some analysis, computer programming, evaluation, and creation of a type-written report.
  - Assignments will *NOT* be accepted after the stated deadlines - better to turn in an incomplete assignment on-time, than to expect to be able to turn in a late assignment.
  - In general, no extensions of deadlines - plan ahead and anticipate system outages, etc.

- **Final Project - 15%**
  - Research and/or Development
  - Turn in substantial written report
  - Class presentation
  - Topic chosen by student subject to approval of instructor

Grading Scale

Grade	Average
A	**90 or greater**
B	**80-89**
C	**70-79**
D	**60-69**
F	**less than 60**

Tentative Course Topics (not necessarily in this order)

- Throughout course - supplemental material on geophysical applications
- Scientific Computing Overview
- Scientific datasets
- Scientific Visualisation
- Machine precision
- Error analysis
- Sensitivity and Conditioning
- Solving nonlinear equations
- Solving systems of linear equations
- Interpolation
- Integration
- Differential equations
- Partial differential equations
- Parallel computing
- Discrete fourier transforms / spectral methods

Miscellaneous Issues

- Collaboration in assignments - You are encouraged to collaborate in your assignments as described below:
  - General discussions on how to derive solutions, how to use particular software, compilers, etc.
  - General discussions and help in debugging programs and datasets
  - Any part of an assignment that was not done by you alone must acknowledge who you collaborated with and in what capacity.

  A general rule of thumb is that everybody who turns in the assignment is expected to have done their own work (e.g. write their OWN program and their OWN report) and should have full comprehension of the material they turned in. Strictly forbidden is the sharing of files, to include programs or program segments, datasets, etc. You will probably be safest if you look at collaboration as the sharing of intellectual resources and avoid the sharing of any materials that are ultimately part of your assignment solution and/or report.

  Note that the class email list has been set up to facilitate class-wide discussions.

- In performing your assignments, it is considered highly unethical to "cut and paste" from sources other than your own. In particular, unless stated otherwise, you should NOT take the source code that I make available to you as examples and simply modify it for your own purposes.
- Do not use cell phones in the classroom. If you need to have a ringer turned on for emergency situations, you should sit by the door and immediately vacate the classroom to take the call. Year after year, "other" students complain about the use of cell phones by their classmates during class - it is very distracting and viewed as highly inconsiderate.
- If you feel the need to engage in private conversations during class, this is understandable, but please take it out of the classroom. Again, this is very distracting to both instructor and other students and is viewed as inconsiderate.
- If you have a disability for which you need special consideration in this course, you should provide me with a letter from Disability Services describing the special consideration needed by you. Additionally, it is your responsibility to provide me with timely (usually a week in advance) reminders for any special consideration needed in taking exams, etc.

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