Computer Science 689-002 Syllabus, Spring 2007

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Online syllabus: Throughout the entire semester, this syllabus will be online at the URL
http://www.mgnet.org/~douglas/Classes/discrete-math/2007s-notes/syllabus.pdf
University rules allow the syllabus to be changed during the semester as long as adequate warning is given to the class.

Course Description: Advanced topics in numerical analysis, scientific computation, and complexity of continuous problems. Specific topics may include, but are not limited to: iterative methods, advanced parallel algorithms in numerical linear algebra, multivariate function approximation and integration.
Prerequisites: Permission of instructor.

Specific Special Topic: Dynamic Data-Driven Application Systems (DDDAS) is a paradigm whereby applications (or simulations) and measurements become a symbiotic feedback control system. DDDAS entails the ability to dynamically incorporate additional data into an executing application, and in reverse, the ability of an application to dynamically steer the measurement process. Such capabilities promise more accurate analysis and prediction, more precise controls, and more reliable outcomes. The ability of an application to control and guide the measurement process and determine when, where, and how it is best to gather additional data has itself the potential of enabling more effective measurement methodologies. In this course, we will study several successful DDDAS applications that are extensively documented through the DDDAS community web site, http://www.dddas.org. DDDAS is already in use in Lexington: the entire traffic light system is run using a single computer cluster, a dynamic data-driven commodity transportation application, and a large number of sensors under many strategic streets. No prior knowledge of DDDAS is assumed nor knowledge of high level mathematics or computational sciences. This will be a self contained class. We will construct at least one DDDAS during the course in part based on the background of the students.

Classrooms: FPAT 257 (TR, 3:30-4:45)
Class web page: http://www.mgnet.org/~douglas/Classes/na-sp
Office hours: Tuesday 11:00-12:00 and Wednesday 10:00-11:00. Call 257-2438 before coming to 514H RMB (Robotics bulding).
Textbook: Angela B. Shiflet and George W. Shiflet, Introduction to Computational Science: Modeling and Simulation for theSciences, Princeton University Press, 2006, ISBN 0691125651. Textbook's web page: http://www.wofford-ecs.org/IntroComputationalScience/index.htm

Grading: 100% of the grade will come from the homework. No exams are planned. All homework must be turned in by the due date specified for each and no homework will be accepted after May 3.

Cheating Policy: Getting caught cheating or plagiarizing will result in a grade of E and possibly much worse, including expulsion from the university and legal proceedings against you. I have zero tolerance for cheaters. I will enforce whatever is the latest university policy. When in doubt, ask me first.

Requirements and Goals: You need to understand the concept of a rate of change (i.e., a derivative in math terms). If you understand this simple concept, you can get through the course. The textbook is self contained and assumes that the material is completely new to the reader. There is good motivational material in the book, useful references, and examples to make concepts more obvious. The goal at the end of this course is that you will know why using dynamic data and models is more useful than the traditional take some random data and run a computer into the ground until it gives one, and only one, prediction for some phenomena. Then keep repeating with another random data set until the computer eventually fails or is replaced with a faster one (then the data sets can get bigger). Repeat all until you retire or change jobs.