Course Outline: Winter 2010

University of Saskatchewan
Department of Computer Science

PARALLEL PROGRAMMING FOR SCIENTIFIC COMPUTING (CMPT 898)

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Prerequisites: Permission of the instructor (experience in numerical analysis / programming useful)
Text: Peter S. Pacheco, *Parallel Programming with MPI*, Morgan Kaufmann, 1997.
Lecture Notes: Lecture notes are provided on the course website; however, they are not a substitute for attending class.

Overview: Despite the extraordinary advances in computing technology, we continue to need ever greater computing power to address important fundamental questions. Because individual compute processors have essentially reached their performance limits, the need for greater computing power can only be met through the use of parallel computers. This course is intended for students who are interested in learning how to take advantage of parallel and distributed computing with the focus of writing parallel code for processor-intensive applications to be run on clusters or the grid (e.g., WestGrid). The goal of this course is to give the students an understanding of parallel computing and enable them to write parallel code for their high-performance application. Extensive use of pertinent and practical examples will be made throughout. The programming languages used will be Matlab, Fortran, and C. Both the shared and distributed paradigms of parallel computing will be covered via OpenMP and MPI.

Lecture Topics:

1. Introduction and Overview of Parallel Computing
2. Collective Communication and Grouping Data for Communication
3. Communicators and Topologies and Dealing with I/O
4. Design and Coding of Parallel Programs
5. Performance; Debugging and Profiling
6. Parallel Algorithms and Libraries
7. Applications (e.g., quadrature, linear systems, optimization, finite element method, bioinformatics)

Method of Evaluation: Assigned Course Work and Relative Marking Weights:

- Assignments (4): 20 %
- Mid-Term Test (in class): 25 %
- Project: 55 %
  - 2 presentations: interim 5 %; final 10%
  - interim progress report 10 %
  - final report 30 %

Rules and Regulations:

- All students must be properly registered in order to attend lectures and receive credit for this course.
- Failure to complete the assigned course work or the final report will result in a failing grade for the course.
- Failure to obtain a mark of at least 40% on the final report will result in a failing grade for the course.
- The course website lists other regulations regarding the project, the mid-term examination, assignments, and academic honesty.