CSCI503: Parallel Programming

Revision: 1.4 – January 25, 2012

1. Course Information

Lectures: Monday 2:00 - 4:50 PM Location: KAP 140

Class webpage: `http://mega-sim.isi.edu/csci503/`

Instructors: Jacqueline Chame and Bob Lucas
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Course Description: Exploration of parallel programming paradigms, parallel computing architectures, hands-on parallel programming assignments, contemporary and historical examples and their impact, context with parallel algorithms.

Prerequisites: CSCI102 and CSCI445.
Textbook(s): Recommended: *High Performance Computing: Programing and Applications* by John Levesque, Richard Elliott Friedman, and Gene Wagenbreth. In addition to the text, you will be given additional reading materials – including papers, lecture notes, and tutorials.

2. Topics Covered

(1) Introduction to parallel machines and programming models
(2) Data locality and uniprocessor model
(3) Shared memory model (threads)
(4) Message passing model (MPI)
(5) Parallel algorithms
(6) MapReduce (Hadoop)
(7) Parallel I/O
(8) Data parallel (CUDA)
(9) Heterogenous systems
(10) Performance analysis tools
(11) Other models: exascale computing, cloude/edge, anton and quantum computing

3. Course Policy

3.1. **Grading policy.** Although there are no exams for this course, it is homework-intensive. Students are expected to independently complete 6 homework assignments and a collaborative course project. Failure to complete the course project will seriously jeopardize your final grade. Finally, request for regrade must be submitted in writing, with

carefully worked out explanation of why you believe that your assignment has not been properly graded.

3.2. **Grading Scale.** 95 - 100 → A, 90 - 94 → A-, 85 - 89 → B+, 80 - 84 → B, 75 - 79 → B-, 70 - 74 → C+, 65 - 69 → C, < 65 or not completing the course projects → F. The grading scale is fix. Your final grade will be a cummulative percentage of the grades earned for the homework assignment, class participation, and final project:

Homework 70%
Class and discussion board participation 5%
Final project 25%

3.2.1. *Class Participation.* Regarding the class participation grade, there are three components to earning the full 5%:

(1) You will need to be active in the discussion forums, for example: asking questions and posting answers to other students' questions.
(2) You will need to respond to at least 3 papers posted to the papers section. Your responses should reflect, obviously, that you've read the papers and that you've put some thoughts into the papers and the questions. Note that in order to prevent everyone from responding to the same paper, only first 10 responses per paper count. Early bird gets the worm.
(3) Although not required but highly recommended, you should make efforts to ensure that the instructors know who you are, ie participate in class, utilize office hours, and be engaged when working on the course project.

3.3. **Late submission.** *Late submissions will not be accepted. Therefore, please plan accordingly.* In extenuating circumstances, e.g. serious medical ailment or a dismemberment of various body parts, *etc*, students must communicate and make arrangement with the instructors and/or the TA in advance. Finally an original doctor's note must accompany the late submission.

3.4. **Academic Integrity.** Cheating will not be tolerated. All parties involved will receive a grade of F for the course and be reported to SJACS. If you have questions or concerns regarding what is permitted and not permitted in terms of collaboration or team work, please do not hesitate to confer with the instructors for clarifications.

4. Schedule

Date	Lecture	Assignments	Deadlines
Jan 9	L1. Introduction to parallel programming	hw1	
Jan 16	MLK's Birthday (University Holiday)		
Jan 23	L2. Shared memory (OpenMP & pThreads)		
Jan 30	L3. Shared memory cont. (memory hiearchy)	hw2	hw1
Feb 6	L4: Message passing (MPI)		
Feb 13	L5: Message passing (CSP, PVM, Zipcode)	hw3	hw2
Feb 20	Presidents' Day (University Holiday)		
Feb 27	L6. Map Reduce (Hadoop)	hw4	hw3
Mar 5	L7. Streaming and data parallel (CUDA)	hw5	
Mar 12	Spring Break		
Mar 19	L8. Parallel algorithms	hw6	hw5
Mar 26	L9. Parallel I/O	Proj proposal	hw6
Apr 2	L10. Debugging and performance tuning		Proj proposal
Apr 9	L11. Heterogenous systems		hw6
Apr 16	L12. Predictable future (exascale and cloud)		
Apr 23	L13. Exotic systems (Anton and quantum)		
Apr 30	Project poster session		Project report