CSCI503: Parallel Programming

1. Course Information

Lectures: Monday 2:00 - 4:50 PM Location: VKC 261

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

Instructors: Jacqueline Chame and Bob Lucas
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Office hours: Monday 1:00 - 2:00 PM **by appointment**.

TA: John Tran
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Office hours: Friday 8:30 - 9:30 AM or by appointment

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.** 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%

total grade	letter grade
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 projects	F

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 family emergency, students must communicate and make arrangement with the instructors and/or the TA in advance. Finally, in case of a medical ailment, 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 12	L1. Introduction to parallel programming		
Jan 19	—MLK's Birthday (University Holiday)—		
Jan 26	L2. Introduction to parallel algorithms	hw1	
	L3. Shared memory programing I		
Feb 2	L4. Shared memory programing II		
	L5. Memory hierarchy and performance		
Feb 9	L6. Message passing I	hw2	hw1
Feb 16	—Presidents' Day (University Holiday)—		
Feb 23	L7. Message passing II		hw2
Mar 2	L8. Data Parallel I	hw3	
Mar 9	L9. MapReduce	Project proposal	
	L10. Hadoop		
Mar 16	—Spring Break—		hw3
Mar 23	L11. Data parallel II	hw4	Project Proposal
Mar 30	L12. Data mining algorithms		
Apr 6	L13. Parallel I/O		hw4
Apr 13	L14. Programming heterogenous systems		
Apr 20	L15. Exascale, cloud, quantum		
Apr 27	L16. Performance: Tools and tuning		
May 4	—Study week—		
May 11	Project presentations		Project report

The schedule is subject to change. Note that we are trying to have all homework finished by early April, so that you have 4 weeks to work on the final project.