CSC 415/592: Introduction to Parallel Computing
Spring 2018

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Staff and Office Hours

<table>
<thead>
<tr>
<th>Role</th>
<th>Office Hours</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marco Alvarez</td>
<td>F 3p</td>
<td>Tyler 257</td>
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<tr>
<td>TBA</td>
<td>TBA</td>
<td>Tyler Hall Lounge</td>
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</tbody>
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Meetings Times

Class meetings will be held three times per week: MWF 9a–9:50p @ Tyler 108. Students are expected to attend and participate in all lectures.

Course Description

Programming techniques to engage a collection of autonomous processors to solve large-scale numerical and non-numerical problems. Processor interconnections. Parallel programming languages and models. Performance measures.

Prerequisites

CSC 301, and student must be admitted to a degree-granting college.
**Student Learning Objectives**

Upon successful completion of this course, each student will be able to:

- describe fundamentals concepts of parallel computing;
- describe a variety of architectures, such as multicore CPUs, GPUs and HPC systems, including their relationships with key concepts in parallel computing (e.g. shared memory, synchronization, interconnection);
- design and implement programs using multiple threads;
- design and implement programs using MPI and CUDA programming models;
- choose appropriate elements of parallel and concurrent program design to solve real-world problems;
- perform analysis and optimization of basic parallel algorithms.

**Recommended Textbooks**

No programming assignments or exam questions will be given directly from a particular textbook. You may choose not to purchase a textbook if you like. However, students are strongly encouraged to read at least one of the following references:

- *Introduction to Parallel Computing*, 2nd Ed, A. Grama, G. Karypis, V. Kumar, A. Gupta, 2003
- *An Introduction to Parallel Programming*, 1st Ed, P. Pacheco, 2011
## Tentative Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>lectures:</strong> Introduction to CSC 415, Computer Organization (review)</td>
</tr>
<tr>
<td>2</td>
<td><strong>lectures:</strong> Computer Architecture (review)</td>
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</tbody>
</table>
| 3    | **lectures:** Operating Systems (review)  
**assignment:** Programming Assignment 1 due on Fri 11:59p |
| 4    | **lectures:** Parallel Machines and Platforms |
| 5    | **lectures:** Parallel Programming Models |
| 6    | **lectures:** Performance  
**assignment:** Programming Assignment 2 due on Fri 11:59p |
| 7    | **lectures:** Message Passing  
**exam:** Midterm Exam 1 |
| 8    | **lectures:** Message Passing |
| 9    | **lectures:** Shared Memory  
**assignment:** Programming Assignment 3 due on Fri 11:59p |
| 10   | **lectures:** Shared Memory |
| 11   | **lectures:** GPU Architecture  
**assignment:** Programming Assignment 4 due on Fri 11:59p |
| 12   | **lectures:** CUDA  
**lab:** STL Containers |
| 13   | **lectures:** Parallel Algorithms on Dense Matrices  
**assignment:** Programming Assignment 5 due on Fri 11:59p |
| 14   | **lectures:** Parallel Algorithms on Graphs  
**exam:** Midterm Exam 2 |

## Programming Assignments

Programming assignments are done on an individual basis. Students will have roughly 2-3 weeks to work on each assignment, and there will be approximately 5 assignments in total. Each programming assignment has a specific due date/time listed on the course web site. Late submissions will not be accepted. Assignments will be graded during interactive sessions with the TA or the instructor. Students are strongly encouraged to bring their code to TA or instructor’s office hours prior to the due date.
Exams

Exams are closed-book and held during lecture times. You are allowed to bring a cheat sheet to every exam. This reference page is a single sheet, in which you can include hand-written annotations only, on both sides. Students will be notified of the contents prior to the exam. Make-up exams are given only in rare cases of documented events.

Class Presentations

Students are required to prepare a 25-minute oral presentation on a topic proposed by the instructor. Oral presentations will be performed in pairs. Students will know ahead of time on which day they must present. No make-up presentations will be allowed without written documentation of a medical emergency.

Grading

Coursework consists of programming assignments, class presentations, and exams. Your final grade will be calculated according to the following table:

<table>
<thead>
<tr>
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<th>How many</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Programming Assignments</td>
<td>5</td>
<td>40%</td>
</tr>
<tr>
<td>Class Presentation</td>
<td>1</td>
<td>30%</td>
</tr>
<tr>
<td>Midterm Exams</td>
<td>2</td>
<td>30%</td>
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Your final letter grade will be calculated using the cutoffs in the table below. These cutoffs might be lowered, but they will not be raised. Your final letter grade will be the letter corresponding to the highest cutoff value less or equal than your final grade. Consider that those values are strict. For example, a final grade of 93.99 is an A- and not an A.

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<thead>
<tr>
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<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>C+</th>
<th>C-</th>
<th>D+</th>
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Academic Honesty

Discussions with others to understand general homework problems and class-related concepts are strongly encouraged. Students may also help each other answering questions from textbooks and other materials. However, when working on assignments, all written work and source code must be your own. You might not look at anyone’s written solution. Students
are prohibited from accessing or comparing homework answers with those of other students prior to submitting each assignment. Copying another individual solution is plagiarism, a serious offense, and the one most common in computer science courses. Anyone that provides homework answers, program code for a programming assignment to another individual is also guilty of academic dishonesty. Both will be prosecuted in accordance with the University’s Policy of Academic Honesty. If you do not have sufficient time to complete an assignment, then submit a partial solution.

Disability Accommodations

Any student with a documented disability is welcome to contact me as early in the semester as possible, so that we may arrange reasonable accommodations. As part of this process, please be in touch with Disability Services for Students Office.

Religious Holidays

It is the policy of the University of Rhode Island to accord students, on an individual basis, the opportunity to observe their traditional religious holidays. Students desiring to observe a holiday of special importance must provide written notification to each instructor.