Ryerson University
Faculty of Engineering & Architectural Science
Graduate Studies

F2019

Department of Electrical, Computer and Biomedical Engineering
Graduate Program in Computer Engineering

EE8218: Parallel Computing F2020

Prerequisites / co-requisites

Computer architecture, mathematics, algorithms and programming

Date, Time and Location of Course

Instructor Information

Dr. Nagi Mekhiel
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Office hours: Th 5-6 PM Through ZOOM
Lecture hours: Th 6-9 PM Through Zoom
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Course website: www.ee.ryerson.ca/~courses/ee8218

NOTE: In accordance with the Policy on Ryerson Student E-mail Accounts (Policy 157), Ryerson requires that any electronic communication by students to Ryerson faculty or staff be sent from their official Ryerson email account

Course information

Course Description

This course introduces students to parallel computing including parallel algorithms, parallel programming and the different parallel architectures. The course covers the basic programming models used in parallel computers, parallel algorithms, parallel programming, the shared memory multiprocessor and NUMA multiprocessor. The Laboratory projects include parallel programming using one of the parallel models
(MPI, OPENMP, GPU).

Course objectives and intended learning outcomes

At the end of this course, students will be able to:

To introduce students to parallel computing including algorithms, architectures and parallel programming (MPI, OPENMP, GPU).

Topics to be covered

Introduction to Parallel Architecture
Parallel Programs
Programming for Performance
Shared Memory Multiprocessors
Message Passing
GPU

Texts and readings

David E. Culler, Jaswinder Pal Singh, with Anoop Gupta`Parallel Computer Architecture: A Software/Hardware Approach" Morgan Kaufmann Publishers, San Francisco, California ISBN 1-55860-343

Teaching methodology

Class Preparation

1-Download Software for implementing parallel computing
2-Install software
3-Run a parallel programs
4-Evaluate the performance gain for using parallel computing

Class Participation

1-Each group select a topic and present a 15 minutes plan (due date: week 4)
2-Each group present 1/2 hour on progress in implementing parallel programming (download, installing..) (due date: week 5,6).
3-Each group discuss the use of parallel computing to run an application (due date: week 7,8,9,10,11).
4-Presentation of final results and conclusions (due date: week 12)

Course schedule and deadlines

Date	*Topic*	*Homework & Project discussion*
Week 1	**Introduction to Parallel Architecture** -shared memory -message passing -other parallel architectures -programming model and communication	LAB1: Running application using OpenMP -Install and Compile
Week 2	**Parallel Programs** -Examples of Parallel Applications	LAB1: -Run application and Demonstrate
Week3	**Parallel Programs** -Examples of Parallel Applications -Parallelization Process	LAB1: Submit report LAB2:- Running application using MPI -download and Install
Week 4	**Parallel Programs** -Examples of Parallel Applications -Parallelization Process	LAB2: -Install MPI
Week 5	**Parallel Programs** -Example Program	LAB2: -Compile and run application

Week 6	**-Programming for Performance** -partitioning	LAB2: submit report LAB3: GPU
Week 7	**-Programming for Performance** -partitioning -Communication-Programming for Performance	LAB3: Compile and run application
Week 8	**Shared Memory Multiprocessors** -Cache Coherence -Memory Consistency	LAB3: Submit report Project: Select application and parallel Model
Week 9	**Shared Memory Multiprocessors** -Design Snooping Protocol - Synchronization	Project: Compile, Running application
Week 10	**GPU** -Introduction and Concept -Applications	Project: Optimization of Performance
Week 11	**Parallel Computer Design** **-Test**	Evaluate system Scalability and define bottleneck
Week 12	**Projects Presentation**	Final Presentation

Evaluation

No.	Title	Individual/group	Value	Detail / general description
1	Labs and Participation	Individual	30%	LAB1,LAB2,LAB3
2	Project	Group	50%	Implement parallel processor and run useful application
3	Test	individual	20%	Final Exam

Late work submission
Deduction of 20% every week

Unscheduled evaluations
NA
Feedback and grades
An indication of when the first assessment results will be returned to students (this should be before the last date to drop the class).

Other expectations and requirements
Discussion and presentation of projects

Variations within a course
NA

Turnitin.com (if used in the course)
Turnitin is a plagiarism prevention and detection service to which Ryerson subscribes. It is a tool to assist instructors in determining the similarity between a student's work and the work of other students who have submitted papers to the site (at any university), internet sources, and a wide range of journals and other publications. While it does not contain all possible sources, it gives instructors some assurance that a student's work is their own. No decisions are made by the service; it generates an "originality report," which instructors must evaluate to judge if something is plagiarized. Turnitin is integrated into D2L, the instructions for which are available here.

If Turnitin.com is to be used in a course, the following wording is required in a course outline: "Students who do not want their work submitted to this plagiarism detection service must, by the end of the second week of class, consult with the instructor to make alternate arrangements."

University Academic Policies

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on the following URL: http://ryerson.ca/senate/course-outline-policies
It is student's responsibility to familiarise themselves with all relevant University academic policies.

The most relevant policies
(faculty members may choose to exclude the following part from the course outline, up to the Important Resources, and leave it to students to familiarize themselves with policies from the link above. However, it is strongly suggested that every instructor goes over the most crucial requirements such as Student accommodation, Academic integrity and Ryerson e-mail, during the 1st class, regardless if they leave it in the course outline or not).

For information on academic policies pertaining to issues such as course management, grading practices, and appeals, students are to refer to the Ryerson Senate Policies: Policy 164 – Graduate Status, Enrolment, and Evaluation, Policy 166 – Course Management Policy , and Policy 152 – Graduate Student Academic Considerations and Appeals

Student Accommodations
Students are required to immediately inform their instructors of any situation which arises during the semester, which may have an adverse effect upon their academic performance, and must request any considerations and accommodations according to the relevant policies and well in advance. Failure to do so will jeopardize any academic appeals.

- *Health certificates* – If a student misses the deadline for submitting an assignment, or the date of an exam or other evaluation component because of illness, he/she must immediately inform the instructor and submit a Ryerson Student Medical Certificate AND an Academic Consideration form within 3 working days of the missed date. Both documents are available at www.ryerson.ca/senate/forms/medical.pdf
- *Religious observance* – If a student needs accommodation because of religious observance, he or she must submit a Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance AND an Academic Consideration form within the first 2 weeks of the class or, for a final examination, within 2 weeks of the posting of the examination schedule. If the required absence occurs within the first 2 weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these forms should be submitted with as much lead time as possible in advance of the required absence. Both documents are available at https://www.ryerson.ca/senate/forms/relobservforminstr.pdf
- *Students who need academic accommodation support* should register with the Academic Accommodation Support office (AAS, formerly called the Access Centre). Before the first graded work is due, registered students should inform their instructors through an "Accommodation Form for Professors" that they are registered with Academic Accommodation Support and what accommodations are required.

Academic Integrity and Plagiarism

Ryerson's Policy 60 - Academic Integrity policy, applies to all students at the University. Forms of academic misconduct include plagiarism, cheating, supplying false information to the University, and other acts. The most common form of academic misconduct is plagiarism. Plagiarism is a serious academic offence and penalties can be severe. In any academic exercise, plagiarism occurs when one offers as one's own work the words, data, ideas, arguments, calculations, designs or productions of another without appropriate attribution or when one allows one's work to be copied.

All academic work must be submitted using the citation style approved by the instructor. Students may refer to the Ryerson Library's list of Citations and Style Guides for more information.

It is assumed that all examinations and work submitted for evaluation and course credit will be the product of individual effort, except in the case of group projects arranged for and approved by the course instructor. Submitting the same work to more than one course, without instructor approval, is also considered a form of plagiarism.

Furthermore, the unauthorized use of intellectual property of others, including your professor, for distribution, sale, or profit is expressly prohibited. Intellectual property includes, but is not limited to: slides, lecture notes, presentation materials used in and outside of class, lab manuals, course packs, exams, etc.

Students are advised that suspicions of academic misconduct may be referred to the Academic Integrity Office (AIO). Graduate students who are found to have committed academic misconduct will have a Disciplinary Notation (DN) placed and remain on their academic record, **which will exclude them to be eligible for any scholarships and/or awards**. In addition, they could be assigned one or more of the penalties ranging from a **grade of "zero" (0) on the work, a grade of "F" in the course, to DA (Disciplinary action), DA-S (Disciplinary action with suspension), (DW) Disciplinary withdrawal, up to an expulsion or even revocation of a degree.**

For more detailed information on these issues, please refer to the full online text for the Ryerson Senate Policy 60: Academic Integrity. For more information on how to avoid academic misconduct situations, for clues and tips, visit the Academic Integrity website.

Student Email Accounts

All students in full and part-time graduate degree programs are required to activate and maintain their Ryerson online identity in order to regularly access Ryerson's e-mail, RAMSS, my.ryerson.ca portal and learning system, and other systems by which they will receive official University communications. Students are required to monitor and retrieve messages and information issued to them by the University via Ryerson online systems on a frequent and consistent basis. Students have the responsibility to recognize that certain communications may be time-critical. (Policy 157 on Ryerson Student E-mail Account)

Important Resources Available at Ryerson

- **The Library** provides research workshops and individual assistance. Inquire at the Reference Desk on the second floor of the library, or go to www.ryerson.ca/library/info/workshops.html
- **Student Learning Support** offers group-based and individual help with writing, math, study skills and transition support.

Date of Issue

The date of issue of this Course outline is….
Sept 3, 2019