Course Syllabus
CMPT 398: Introduction to Concurrent Programming

Catalogue Description:
Theory and practice of concurrent programming. Process interaction using shared variables and message passing; parallel computing; development of correct programs; general problem-solving techniques; scientific computing; distributed programming.

<table>
<thead>
<tr>
<th>Prerequisite(s):</th>
<th>CMPT 215 (or EE 232); CMPT 260 (or CME 331); CMPT 280</th>
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<tbody>
<tr>
<td>Class Time &amp; Location:</td>
<td>TBD</td>
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<tr>
<td>Website:</td>
<td>TBD</td>
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Instructor Information

<table>
<thead>
<tr>
<th>Instructor:</th>
<th>Prof. Nadeem Jamali</th>
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<tbody>
<tr>
<td>Contact:</td>
<td>Email: <a href="mailto:jamali@cs.usask.ca">jamali@cs.usask.ca</a></td>
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<td></td>
<td>Office Phone: 306-966-2579</td>
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<tr>
<td>Office Hours:</td>
<td>Location: Thorvaldson 281.6</td>
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<td></td>
<td>Hours: TBD</td>
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Course Objectives

Concurrent Programming – also known as Parallel and Distributed Programming – is programming of multiple processes working together to solve problems. The topic has become more important in the last decade with the emergence of multi-core processors, and with the proliferation of distributed data centers.

This course aims to introduce students to key concepts and methods in concurrent programming. Students will learn both principles and practical aspects of concurrent programming.

- They will acquire the ability to identify inherent concurrency in problems, as well as opportunities for parallelization.
- They will learn a variety of concurrent programming abstractions and constructs, and learn about when to use which. These will include locks and barriers, semaphores, monitors, message passing, RPC and Rendezvous.
- They will learn about formal models for process interaction including CSP, Actors and Linda.
- They will learn a variety of paradigms for process interaction.
- They will learn to reason about safety and liveness properties of concurrent programs.
- They will gain experience using multiple languages and libraries for concurrent programming.
- They will learn general problem-solving techniques.

Textbook Information

Required Text

- Gregory Andrews, “Foundations of Multithreaded, Parallel, and Distributed Programming,” Addison-Wesley, 2000
Recommended Texts

- Ronald Kuhn, Brian Hanafee, Jamie Allen, “Reactive Design Patterns,” Manning, 2017

Student Evaluation

Grading Scheme

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<tr>
<td>Assignments</td>
<td>45%</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>25%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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Criteria that must be met to Pass

50% of the cumulative mark is required to pass.

Attendance Expectation

Students will be expected to know all information passed on during lectures and tutorials and through the webpage, Moodle and email. If they miss a lecture or tutorial, they are responsible for acquiring material covered in the session.

Final Exam Scheduling:

The Registrar schedules all final examinations, including deferred and supplemental examinations. Students are advised not to make travel arrangements for the exam period until the official exam schedule has been posted.

*Note: All students must be properly registered in order to attend lectures and receive credit for this course.*

Course Overview

**Lectures** The course material will be delivered in lecture style.

**Tutorials** There will be a total of 5 tutorials over the term, in weeks 2, 4, 5, 8 and 10, to introduce specific programming languages and libraries to be used in programming assignments.

**Assignments** There will be five (5) assignments, roughly one every two weeks. Four of these will be primarily programming assignments, and the fifth will primarily involve hand-written problem solving. Assignments could be made available in parts to help students with pacing. Assignment problems will be either chosen or adapted from problems appearing in the textbooks.

**Midterm Exam** The midterm exam will be scheduled in the latter half of February, with marks available by March 15, 2019. It will be an in-class 50-minute exam, with problems expecting students to demonstrate their understanding of topics covered. Typically, students will be asked questions about provided code; asked to identify errors in provided code and to propose how to correct it; asked to provide a few lines of pseudocode to solve a problem using a particular construct; or asked to answer factual questions.

**Final Exam** In the 3-hour final exam, the problems will be larger in number, and require more work. In addition to the types of problems described above, there will be a number of problems asking to provide several lines of code using particular constructs to solve toy problems.
Lecture Schedule

Topics to be covered and approximate amount of time devoted:

– Overview [1 week]
– Distributed Programming [5 weeks]
  * Message Passing [MPD Chapter 7]
  * RPC and Rendezvous [MPD Chapter 8]
  * Paradigms for process interaction [MPD Chapter 9]
  * Implementations [MPD Chapter 10]
– Shared-Variable Programming [5 weeks]
  * Processes and Synchronization [MPD Chapter 2]
  * Locks and Barriers [MPD Chapter 3]
  * Semaphores [MPD Chapter 4]
  * Monitors [MPD Chapter 5]
  * Implementations [MPD Chapter 6]
– Parallel Programming [2 weeks]
  * Scientific Computing [MPD Chapter 11]
  * Languages, Compilers, Libraries and Tools [MPD Chapter 12]

Policies

**Recording of Lectures**
Video or audio recording of lectures is not allowed, except with explicit permission of the instructor.

**Late Assignments**
Assignments must be turned in at the times and dates and locations they are due, unless you have received permission in advance for an extension.

**Missed Assignments**
Students should submit early versions of their programming solutions frequently to avoid the possibility of missing a deadline. Students will receive a zero for assignments missed without prior permission from the instructor. If there is a compelling reason why seeking prior permission is not possible, the student should contact the instructor at the earliest opportunity for consideration of alternative arrangements. The instructor will judge whether the reason is compelling.

**Missed Examinations**

1. Students who miss an exam should contact the instructor as soon as possible. If it is known in advance that an exam will be missed, the instructor should be contacted before the exam.

2. "A student who is absent from a final examination due to medical, compassionate, or other valid reasons, may apply to the College of Arts and Science Undergraduate Student's Office for a deferred exam. Application must be made within three business days of the missed examination and be accompanied by supporting documents." [(http://artsandscience.usask.ca/undergraduate/advising/strategies.php)]
Incomplete Course Work and Final Grades

"When a student has not completed the required course work, which includes any assignment or examination including the final examination, by the time of submission of the final grades, they may be granted an extension to permit completion of an assignment, or granted a deferred examination in the case of absence from a final examination.

Extensions past the final examination date for the completion of assignments must be approved by the Department Head, or Dean in non-departmentalized Colleges, and may exceed thirty days only in unusual circumstances. The student must apply to the instructor for such an extension and furnish satisfactory reasons for the deficiency. Deferred final examinations are granted as per College policy.

In the interim, the instructor will submit a computed percentile grade for the class which factors in the incomplete coursework as a zero, along with a grade comment of INF (Incomplete Failure) if a failing grade.

In the case where the student has a passing percentile grade but the instructor has indicated in the course outline that failure to complete the required coursework will result in failure in the course, a final grade of 49% will be submitted along with a grade comment of INF (Incomplete Failure).

If an extension is granted and the required assignment is submitted within the allotted time, or if a deferred examination is granted and written in the case of absence from the final examination, the instructor will submit a revised assigned final percentage grade. The grade change will replace the previous grade and any grade comment of INF (Incomplete Failure) will be removed.

A student can pass a course on the basis of work completed in the course provided that any incomplete course work has not been deemed mandatory by the instructor in the course outline and/or by College regulations for achieving a passing grade." (http://policies.usask.ca/policies/academic-affairs/academic-courses.php)

For policies governing examinations and grading, students are referred to the Assessment of Students section of the University policy "Academic courses: class delivery, examinations, and assessment of student learning" (http://policies.usask.ca/policies/academic-affairs/academic-courses.php)

Academic Honesty

The University of Saskatchewan is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Conduct & Appeals section of the University Secretary Website and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All students should read and be familiar with the Regulations on Academic Student Misconduct (http://www.usask.ca/secretariat/student-conduct-appeals/StudentAcademicMisconduct.pdf) as well as the Standard of Student Conduct in Non-Academic Matters and Procedures for Resolution of Complaints and Appeals (http://www.usask.ca/secretariat/student-conduct-appeals/StudentNon-AcademicMisconduct.pdf) Academic honesty is also defined and described in the Department of Computer Science statement on Academic Honesty (http://www.cs.usask.ca/students/academic-honesty/index.php).

For more information on what academic integrity means for students see the Student Conduct & Appeals section of the University Secretary Website at:
Examinations with Access and Equity Services (AES)
Students who have disabilities (learning, medical, physical, or mental health) are strongly encouraged to register with Access and Equity Services (AES) if they have not already done so. Students who suspect they may have disabilities should contact AES for advice and referrals. In order to access AES programs and supports, students must follow AES policy and procedures. For more information, contact AES at (306) 966-7273 or aes@usask.ca, or visit the AES website at https://students.usask.ca/aes.

Students registered with AES may request alternative arrangements for mid-term and final examinations. Students must arrange such accommodations through AES by the stated deadlines. Instructors shall provide the examinations for students who are being accommodated by the deadlines established by AES.

Student Supports
Student Learning Services (SLS) offers assistance to U of S undergrad and graduate students. For information on specific services, please see the SLS website at http://library.usask.ca/studentlearning/.

The Student and Enrolment Services Division (SESD) focuses on providing developmental and support services and programs to students and the university community. For more information, see the students’ website at https://students.usask.ca/.