

The University of Western Ontario
London, Canada

Department of Computer Science

CS4402/CS9635A -- Distributed and Parallel Systems

Course Outline -- Fall 2019

Course Description

The efficient usage of parallel and distributed systems (multi-processors and computer networks) is nowadays an essential task for computer scientists.

This course studies the fundamental aspects of parallel systems and aims at providing an integrated view of the various facets of software development on such systems: hardware architectures, programming languages and models, software development tools, software engineering concepts and design patterns, performance modelling and analysis, experimenting and measuring, application to scientific computing.

Course topics may include but are not limited to: hierarchical memory, cache complexity, multi-core architectures, fork-join parallelism, scheduling, scalability, GPU computing, data parallelism, pipelining, message passing (MPI), parallel and distributed data-structures, and applications of parallel and distributed computing.

Follow this link for various resources (software tools and tutorials, hardware documentation, conferences, other HPC course web sites, etc.) regarding [this course and HPC in general](#).

Prerequisites for undergraduate students

- Students **must be fluent in C or C++** ; they must also be **familiar with UNIX software tools** (shell scripts, makefiles, debuggers).

Instructor

Name: Marc Moreno-Maza
Office: MC 327
Office Hours: Tuesdays 13:30-15:15 in MC 327
Email: moreno@csd.uwo.ca
Phone: 661-2111 x3741

Lecture Notes and Textbook

Notes of each lecture will be available on the course website, approximately one or two days after the oral presentation. There is no textbook.

Course and OWL Websites

The course web site is accessible [here](#) For CS4402 and CS9635, the OWL web sites are respectively [here](#) and [there](#).

Please check the site often for updates on lecture notes and errata. Also be aware that the course website is not a substitute for actual classroom attendance!

Polices regarding email and contact

For all questions related to the course materials (lectures, assignments, and quizzes) students **must use the forum** of the OWL web sites (see above) instead of contacting the instructor or the TA by email. Indeed a question about the lectures or an assignment problem is likely to be of interest to many students in the class. Writing to the instructor or the TAs should only be done for handling a personal matter, like individual projects.

Lecture Topics

The list of topics will be something on the order of:

1. Overview of parallel computing
2. Hierarchical memories, cache complexity
3. The Cilk concurrency platform
4. Multithreading parallelism and performance
5. Scheduling and Synchronizing
6. Parallelism overheads
7. Parallel Random-Access Machines.
8. Many-core programming (GPGPUs)
9. Code optimization techniques for multi-cores and GPGPUs
10. High-Performance Computing with CUDA
11. Pipelining
12. Multiprocessed parallelism, message passing (MPI)
13. Other concurrency platforms (Open MP, Array Building Blocks, Threading Building Blocks)

Class Schedule

Lectures: 3 hours (Mondays 16:30 - 18:20 in **MC 17** and Wednesdays 14:30 - 15:20 in **MC-17**).

Each student is expected to attend the lectures. In particular, quizzes (short written tests) may take place without notice.

Student Evaluation

- Evaluation methods are quizzes, assignments and projects.
- Assignments and projects constitute 1/3 and 1/3 of the course mark, respectively. There is no midterm examination and no final examination. However, there will be at least three quizzes. Quizzes constitute the last 1/3 of the course mark.
- Assignments consist of theoretical and programming exercises. CS 4402 projects can be theoretical work (research article presentations), practical (programming, experimentation and analysis) or a combination of both. CS 9635 projects are more advanced and must deal with current research topics, see details below.
- A quiz is a series of short and simple exercises similar to the examples of the course notes, whereas assignments consist of more advanced exercises.
- In order to successfully complete the course, a student must achieve at least 50% on assignments, 50% on projects and 50% on quizzes. This is to prevent a serious lack of effort in either area. Thus, a student cannot get 100% on assignments and projects and barely pass the quizzes.
- A CS4402 project topic is chosen by the student from a list of topics proposed by the instructor. Project topics will be posted by October 15 and each student must choose a project topic by November 12 (at the very latest). The projects will be presented in class by the students during the last two weeks of class. Each presentation will consist of a 15 minute talk followed by questions for 10 minutes. A detailed project report will may be required and due by December 4.

- For CS9635, there is no Assignment Two, while the Project is of much larger scale and start during the Assignment Two period. CS9635 projects must deal with current research topics (in the scope of this course's contents) and can be related to the student thesis (in fact, this is recommended). The topic of each CS9635 project must be discussed individually with the instructor during the Assignment Two period. This implies a literature review to be done by the student and presented to the instructor during a face-to-face meeting. By March 14, (preferably earlier) the objectives of each CS9635 project must be well-defined by the student and approved by the instructor. Together with the literature review, this will give the mark for Assignment Two. Projects must then be implemented and will be presented in class during the last two weeks of class, as for CS4402. With this definition of the CS9635 project and CS9635 Assignment Two, the mark allotment is the same as for CS4402. That is, assignments, projects and quizzes constitute 1/3, 1/3 and 1/3 of the CS9635 mark, respectively.

Assignment/Project/Quiz Schedule

All dates are **tentative** and currently subject to change, although it is doubtful by any significant amount.

| Evaluation Technique | Weight | Posted Date <i>(tentative!)</i> | Due Date <i>(tentative!)</i> | Workload |
|-----------------------------|---------------|---|--|-----------------|
| Assignment One | 1/6 | Tu, Sept. 24 | Tu, Oct. 15 | regular |
| Assignment Two | 1/6 | Tu, Oct, 15 | Tu., Nov. 12 | regular |
| Project | 1/3 | Mon., Nov. 18 | Wed, Dec. 4 | heavy |
| Quizzes | 1/9 each | N/A | various | N/A |

If for any reason the schedule given above cannot be adhered to, the assignment, project and quiz marks will be pro-rated. For instance, if an assignment has to be cancelled for any reason, the remaining assignment weight will be prorated to add up to 1/3.)

Every effort will be made to have assignments, projects and quizzes marked and handed back within 3 weeks of the hand-in date, preferably sooner.

Quizzes

Quizzes may be held without being announced in advance.

Quizzes will be closed book.

No electronic devices may be in the possession of students during quizzes

Assignments

Assignments will be due on the (tentative) dates listed above.

Extensions will be granted only by the course instructor. If you have serious medical or compassionate grounds for an extension, you should take supporting documentation to the office of the Dean of your faculty, who will contact the instructor.

The submission of assignments is electronic using OWL.

Any changes, updates, and clarifications to assignments will also be posted on the website. It is your responsibility to monitor these pages closely.

Every effort will be made to have homework assignments and quizzes marked and handed back within 2 weeks of the hand-in date. If we are unable to comply with our intended return dates, revised dates will be posted on the course website.

When a student submits an assignment for evaluation, this student automatically certifies that the material she/he has handed in is exclusively her/his own work.

It is your responsibility to keep up-to-date backups of assignment disk files in case of system crashes or inadvertently erased files. Retain disk copies of all material handed in, as well as the actual graded assignment, to guard against the possibility of lost assignments or errors in recording marks. It is not safe to discard these materials until you are satisfied that your final mark for the course has been computed properly.

Lecture attendance

All students are expected to attend all classes. A student found to be missing a large number of classes without acceptable reasons risks being denied a passing grade.

Academic Accommodation for Medical Illness

If you are unable to meet a course requirement (assignment due date) due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible. This rule does not apply for quizzes; see below. The University Policy on Accommodation Consideration for Student Absences can be found [here](#).

If you are a science student, the Academic Counselling Office of the Faculty of Science can be contacted at 519-661-3040 or scibmsac@uwo.ca. See their [web site](#).

A student requiring academic accommodation due to illness must use the Student Medical [certificate](#) when visiting an off-campus medical facility.

For further information, please consult the [university's medical illness policy](#), and the [University' policy on academic accommodation for student with disabilities](#).

There are no make-up quizzes. If your faculty's Academic Counselling Office has approved your circumstances, the value of the missed test or quiz will be reallocated.

Accessibility Statement

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Mental Health

All students who are in emotional/mental distress should refer to [Mental Health@Western](#), for a complete list of options about how to obtain help.

Support Services

Learning-skills counsellors at the [Student Development Centre](#), are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling. See also the services provided by the [University Students' Council](#).

[The website](#) for Registrarial Services.

Ethical Conduct

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following [web site](#).

All assignments are individual assignments. You may discuss approaches to problems among yourselves. However, the actual details of the work (assignment coding, answers to concept questions, etc.) must be your individual effort. Assignments that are judged to be the result of academic dishonesty will, for the student's first offence. You are responsible for reading and respecting the Computer Science Department's policy on [Rules of Ethical Conduct](#) and [Scholastic Offenses](#).

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and [Turnitin.com](#).

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Computing Facilities

Each student will be given an account on the Computer Science Department senior undergraduate computing facility, GAUL. In accepting the GAUL account, a student agrees to abide by the department's [Rules of Ethical Conduct](#)

Note: After-hours access to certain Computer Science lab rooms is by student card. If a student card is lost, a replacement card will no longer open these lab rooms, and the student must bring the new card to a member of the Systems Group in Middlesex College Room 346.

[Marc Moreno Maza](#)

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