CS/SE 4F03 DISTRIBUTED COMPUTER SYSTEMS

NED NEDIALKOV
DEPARTMENT OF COMPUTING AND SOFTWARE
MCMASTER UNIVERSITY
WINTER 2016

1. Lectures, Tutorials, TAs

Lectures:	Monday, Thursday	9:30–10:20	TSH B105
	Tuesday	10:30–11:20	TSH B105
Tutorials:	Wednesday	9:30–10:20	JHE 326H
	Thursday	10:30–11:20	BSB 104
Office hours	Tuesday	11:45–13:00	ITB 123

Instructor

Ned Nedialkov, email nedialk
ITB 123, x 24161

Teaching assistants

Thomas Gwosdz, email gwosdzto
Natalie Perna, email pernanm

2. Introduction

This course is devoted to studying parallel architectures and parallel algorithms and programming. In addition to the theory that will be covered, there is a substantial programming component, which involves distributed computing using MPI (Message Passing Interface), shared-memory computing using OpenMP, and GPU computing using OpenACC.

The course web page is http://www.cas.mcmaster.ca/~nedialk/COURSES/4f03/.

3. Text

Peter Pacheco, *An Introduction to Parallel Programming*

4. Schedule

The following schedule is tentative; it may change depending on how we progress with the material.

Week		Topic	Reading
Jan	4	Introduction to parallel computing and parallel hardware	Chapter 1, 2.1, 2.2, 2.3.1–2.3.3, 2.4, 2.5
Jan	11	Introduction to MPI, collective communications	3.1–3.4
Jan	18	Caching, performance issues	Lecture notes
Jan	25	Communication cost, scalability. Parallel program design, tasks, critical path	Lecture notes, 2.6
Feb	1	Nonblocking communications, understanding communications	Lecture notes
Feb	8	Introduction to parallel program analysis	Lecture notes
Feb	15	Midterm recess	
Feb	22	GPU programming	Youtube: OpenACC 1 OpenACC 2, lecture notes
Feb	29	OpenMP	
March	7	Data decomposition techniques	
March	14	Advanced MPI	
March	21	Parallel algorithms: matrix multiplication, communicators and topologies, parallel N-body	
March	28	Parallel algorithms: the traveling salesman problem, tree search	
April	4	Review	

5. Grading scheme

Assignment 1 Code 1	8%	19 Jan – 28 Jan
Assignment 2, Problem 2	12%	28 Jan – 8 Feb
Assignment 3, solution code by Xiao Li	15%	22 Feb – 8 March
Test 1	10%	11 February, 9:30-10:20 T28
Test 2	15%	29 March
Project	40%	10 March – 5 April

6. Lecture notes

This list and corresponding content will be updated as we progress with the material.

(1) Introduction, mpi-greetings.c, openmp-hello.c
(2) Introduction to MPI Code
(3) Collective communications I Code
(4) Caching Code
(5) Interconnection networks
(6) Communication cost
(7) Scalability
(8) Collective communications II
(9) Nonblocking communications Code
(10) Understanding communications Code
(11) Parallel program design. Tasks, critical path
(12) Introduction to parallel program analysis

(13) Example: odd-even transposition sort
(14) CudaCast: Your First OpenACC Program
(15) Youtube: OpenACC 1, OpenACC 2
(16) OpenACC. Part I, code
(17) OpenACC. Part II
(18) Parallel quicksort
(19) Data decomposition techniques
(20) Array distribution schemes
(21) Parallel N body
(22) Topologies Code
(23) Communicators and topologies: Fox's Algorithm
(24) Traveling salesman problem. Parallel distributed tree search
(25) Distributed shortest paths
(26) Advanced point-to-point communications Code
(27) OpenMP
(28) Recursive doubling

7. Resources

Tutorial March 30
Tutorial slides 25 February by N. Perna
Midterm 2015

MPI on CAS machines. You can login to `mpihost01` and run your MPI programs there. See `http://www.cas.mcmaster.ca//support/index.php/Mpi`

MPI resources.

- MPI standard
- MPI: The Complete Reference
- MPI tutorial
- MPI exercises

Makefiles
Unix
Shell programmng
Code from the tutorial of the week of the 18th of Jan

8. Course Policy

Course-related announcements will be at the course web site. You are responsible for checking it regularly.

Assignments.

- The assignments will be due at the beginning of the lectures.
- A late assignment will receive 10% penalty per day.
- You are allowed to discuss the problems from the assignments. However, you must submit your own work.
- Assignments that are very similar may lose half of their marks. Identical solutions to the same problem will receive zero marks.

Missed work.

- An MSAF form must be submitted for the following items to apply. Without an MSAF form, missed work receives zero.

- The weight of a missed assignment will be moved to the weight of the tests. For example, if Assignment 1 is missed, Test 1 will contribute 14% and Test 2 will contributed 19% to the final grade.
- If a test is missed, its weight will be moved to the weight of the other test.
- If both tests are missed, then 25% will be lost from the final grade.

Remarking.

- Requests for remarking of an assignment or a test must be made within one week after the marked assignment/test is returned.
- Requests that are later than a week will not be accommodated.

Changes.

- The instructor reserves the right to modify elements of this course and will notify students accordingly (in class and post any changes to the course website).

9. Academic Dishonesty

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: Grade of F assigned for academic dishonesty), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not ones own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

10. Academic Accommodation of Students with Disabilities

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140, ext. 2865 or e-mail sas@mcmaster.ca. For further information, consult McMaster Universitys Policy for Academic Accommodation of Students with Disabilities.

11. Faculty Notices

"The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as the problem occurs."