COSC 407-001: Introduction to Parallel Computing
2022W Term 1

UBC OKANAGAN

Instructor   Dr. Abdallah Mohamed

abdallah.mohamed@ubc.ca (write the course number in the email subject, i.e. COSC407: *subject*)

Office hours

Mon, 13:00-14:00, 15:30-16:00	In-person, SCI-108
Thu, 10:00-11:00	In-person, SCI-108
or by appointment	

Lectures   Tue, Thu   11:00-12:30   ~~Zoom (7562761523) or~~ In-person (L305) (see schedule below)

Labs

L01	Thu	14:00-16:00	SCI-234	TA: Congsong Zhang
L02	Mon	14:00-16:00	SCI-234	TA: Isha Shah
L03	Wed	16:00-18:00	SCI-234	TA: Congsong Zhang
L04	Mon	08:00-10:00	SCI-234	TA: Isha Shah

All TA's can be contacted on Canvas.

Course Description

Academic Calendar Entry*:* Design and implementation of parallel programs including theoretical computer models, parallel architectures (distributed, multicore, GPU), and standard parallel libraries. Credit will be granted for only one of COSC 407 or COSC 507. [3-2-0]

More details: The course will provide 3rd and 4th year students with an introduction to parallel computing. Upon completion of the course students will be able to understand parallel computing architectures and their limitations, create and implement parallel programs using various standard libraries, explain the limitation of the IEEE 754 floating point model, determine whether an undesirable output is due to floating point errors, and write parallel code.

Prerequisites: 3rd year standing and either COSC 111 or APSC 177.

Students who lack the prerequisites should not be registered for this course and will receive a failing grade if they remain in it. Any exceptions must be brought to the attention of the instructor immediately.

Course URL   https://canvas.ubc.ca
https://people.ok.ubc.ca/abdalmoh/teaching/407

Assessment

- Lecture Quizzes   10 % (**clickers + canvas quizzes**. full mark if you get 80% or more)
- Lab Assignments   20 %
- Two Midterm Exams   10 % - 30 % (75 minutes each, in-person during scheduled lecture time)
- Final Exam   40 % - 60 % (cumulative, in-person)

Midterms are used to improve your mark, not to penalize. There is **70%** of the course grade for all exams. The exams mark is calculated based on the **best** of the following options:

	Option 1	Option 2	Option 3	Option 4
Midterm 1	15 %	15 %	5 %	5 %
Midterm 2	15 %	5 %	15 %	5 %
Final	40 %	50 %	50 %	60 %

Final grades will be based on the evaluations listed above and the final grade will be assigned according to the standardized grading system outlined in the UBC Okanagan Calendar.

Passing criteria**:** to pass the course, a student must receive: (1) an overall course grade of at least 50%, and (2) a combined grade of at least 50% on the exams (midterms and final). **Failure to do so will result in a 45% grade, or the resulting grade, whichever is the lowest.** Students will not be able to receive a passing grade if they are not registered to the required lab section.

Final grades will be based on the evaluations listed above, and the final grade will be assigned according to the standardized grading system outlined in the UBC Okanagan Calendar.

Final Examinations: The examination period for this term will be announced at https://students.ok.ubc.ca/courses-money-enrolment/exams. Students will be permitted to apply for out-of-time final examinations only if they are representing the University, the province, or the country in a competition or performance; serving in the Canadian military; observing a religious rite; working to support themselves or their family; or caring for a family member. Unforeseen events include (but may not be limited to) the following: ill health or other personal challenges that arise during a term and changes in the requirements of an ongoing job.   An examination hardship is defined as the occurrence of an examination candidate being faced with three (3) or more formal examinations scheduled within a 27-hour (inclusive) period.

Further information on Academic Concession can be found under Policies and Regulation in the Okanagan Academic Calendar: http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,48,0,0

Grading Practices: Faculties, departments, and schools reserve the right to scale grades in order to maintain equity among sections and conformity to university, faculty, department, or school norms. Students should therefore note that an unofficial grade given by an instructor might be changed by the faculty, department, or school. Grades are not official until they appear on a student's academic record.
http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,41,90,1014

Grievances and Complaints: A student who has a complaint related to this course should follow this procedure: The student should attempt to resolve the matter with the instructor first. Students may talk first to someone other than the instructor if they do not feel, for whatever reason, that they can directly approach the instructor. If the complaint is not resolved to the student's satisfaction, the student should e-mail the Associate Head of Subject Dr. Yves Lucet at yves.lucet@ubc.ca or the Department Head Dr. John Braun at cmps.depthead@ubc.ca

Textbook and Reference Materials

- Course website and discussion forum on Canvas**,** Lecture Notes (available electronically).
- *Recommended Textbooks***:**
  - Pacheco, P. S. An introduction to Parallel Programming, 2nd Ed., Morgan Kaufmann., 2022 (1st Ed is fine too)
  - Kirk, D. B. & Hwu, W.-m. W. Programming Massively Parallel Processors: A Hands-on Approach, 3rd Ed., Morgan Kaufmann Publishers Inc., 2016 (*earlier editions are ok*)
  - Sanders, J. & Kandrot, E. CUDA by Example: An Introduction to General-Purpose GPU Programming, Addison-Wesley Professional, 2010, ISBN: 0131387685.
- *More references***:**
  - Rauber, T. & Rünger, G., Parallel Programming: for Multicore and Cluster Systems, Springer Publishing Company Inc. , 2015, ISBN: 3642438067
  - Cheng, J, Grossman, M, &McKercher, T, Professional CUDA C Programming, Wrox, 2014.
  - Eijkhout, V., Intro to High-Performance Scientific Computing, 2015, ISBN: 9781257992546.

Required Equipment

- For the online portion of the course**:** all students must have access to **computers** with **reliable internet** + **microphone** + **webcam**. Students are encouraged to check out this link: https://keeplearning.ubc.ca/setting-up.
  - As indicated above, we may be required to switch to fully online teaching. Therefore, make sure you have access to (a computer + reliable internet + webcam + mic + quite room) as soon as possible.
- *For class exercises***:** all students are expected to have an **iClicker Cloud** account (instructions here).

Expectations

It is my best day when all my students pass the course, receive good grades, and feel the course was useful. For that to happen, help me by putting enough effort for the course. I expect that you will attend **all classes** and participate in class discussions, read the lecture notes **before** the lecture, attend **all labs**, finish all your assignments on time, and practice on the course materials. I also expect that you will spend (in average) **at least 7 hours per week** in out-of-class relevant activities (homework, preparation, practicing).

Course Format

Lectures*:* This course uses a blended form of learning. There are **two lectures every week** (*see the course schedule*):

1) **Regular, in-person lecture** (Thursday and a ~~few~~ most Tuesdays)
   - In-person lecture where I teach and discuss new material.

   ~~2) Flipped, online lecture (Most Tuesdays)~~
   - ~~Based on a pre-recorded video which you can watch at any time **before** the lecture.~~
   - ~~We will use the scheduled lecture time to go over the practice questions and do exercises related to the lecture, discuss issues related to the lecture, and answer questions or doubts related to the recording. **I will not repeat the lecture during this time**.~~

Lecture Quizzes: We will have MCQs questions in almost every lecture:

- ~~**For flipped lectures**:~~
  - ~~Embedded questions in the videos; these questions do *not* count towards your grade.~~
  - ~~Same questions will be discussed during the lecture time and posted as Canvas quizzes that **will be counted** towards your grade. You must finish this quiz **before the posted deadline**.~~

- **For regular lectures**:
  - Questions displayed **during the lecture, and they can only be answered using iClickers.**
  - Your iClicker responses will be counted towards your grade.
  - **Create an iClicker Cloud account** using these Instructions: https://lthub.ubc.ca/guides/iclicker-cloud-student-guide. You **must link your iClicker account to Canvas**.
  - You can submit your responses using web interface (must sign-in to your iClicker account) or phone app (search for iClicker Reef on our play/app store). Whether you use the web interface or phone app, you must "join" class on the clickers system after the class starts.

Labs

- Labs will be offered in-person as indicated on page 1 of this syllabus.
- A student **must be registered in one lab** for his/her assignments to be accepted.

Exams

- *Platform*: Exams will be held **in-person:** Midterms in the same classroom used for the lectures, during the scheduled lecture times. Location for final exam will be announced later.
- *Format*: The examinations in this course are all *closed-book*, so you are NOT permitted to access any of the course materials, including your notes, during the exam. You are also NOT to communicate with anyone about the exam during the scheduled write time or after the examination – you are to work independently. Communication with other students (written, text, verbal, etc.) is not permitted and will constitute Academic Misconduct.

Tentative Course Schedule and Required Readings

The course schedule contains the most up-to-date information and important dates for main events such as assignments due dates and tests. These dates and topics are subject to change. Any change will be announced to students. **The due dates of each assignment is one *or* two weeks after the lab (as indicated below) at 11:59 pm.** All assignments should be done on **INDIVIDUAL** basis (NO GROUP WORK).

W	L	Date		Topics	Regular	Flipped	Labs
1	L1	Tue	6 / 9	Introduction to the course	x		*No lab in the first week*
	L2	Thu	8 / 9	Intro to C (basics, arrays, functions)	x		
2	L3	Tue	13 / 9	Intro to C (pointers, struct, directives)		x	**A1:** Intro to C, *due Friday, **Sep 23***
	L4	Thu	15 / 9	Basic Concepts of Parallelism OpenMP (A): Intro	x		
3	L5	Tue	20 / 9	OpenMP (B, C): Mutual Exclusion, Reduction, Sync		x	**A2:** C-pointers, OpenMP(A), *due Fri, **Sep 30***
	L6	Thu	22 / 9	OpenMP (D): Work Sharing 1	x		
4	L7	Tue	27 / 9	OpenMP (E): Work Sharing 2		x	**A3:** OpenMP (B,C,D), *due Fri, **Oct 7***
	L8	Thu	29 / 9	OpenMP (F,G): Example Applications, Misc.	x		
5	L9	Tue	4 / 10	Speed/Efficiency		x	**A4:** OpenMP (E,F), *due Fri, **Oct 14***
	L10	Thu	6 / 10	Midterm Overview OpenMP(I): Exercises (with iClicker questions)	X		
6	L11	Tue	11/10	**Midterm 1** (during lecture time, L1 to L8 + L10)	x		*Review*
	L12	Thu	13/10	Midterm discussion CUDA (A) : Introduction	x		*Students in Monday labs are welcome to join other lab sessions.*
7	L13	Tue	18/10	CUDA (B): Programming model	x	*	*Midterm 1 discussion with the TA*
	L14	Thu	20/10	CUDA (C): Threads Organization	x		**A5:** CUDA (A,B), *due Fri, **Nov 4***
8	L15	Tue	25/10	CUDA (C): Threads Organization, cont'd	x	*	*Continue A5*
	L16	Thu	27/10	CUDA (D,E): Thread Sched, Mem and Performance	x		
9	L17	Tue	1 / 11	CUDA (E): Mem and Performance, cont'd CUDA (F): Thread Sync	x	*	**A6:** CUDA (C), *due **Mon, Nov 14*** **A7:** CUDA (D,E,F), *due Fri, **Nov 18***
	L18	Thu	3 / 11	CUDA (G): Best Practices	x		
10		Tue	8 / 11	**No class – Remembrance Day + Midterm break**			**No Labs during this week**
		Thu	10/11				
11	L19	Tue	15/11	CUDA (H): Practice Questions	x	*	**A8:** CUDA (E,F,G), *due **Tue, Nov 29***
	L20	Thu	17/11	Distributed Memory Concurrency (part A)	x		
12	Lx1	Tue	22/11	Midterm Revision (with iClicker questions)		*	*Q/A session with your TA*
	L21	Thu	24/11	**Midterm 2** (in-class, L9 + L12 to L19)	x		
13	L22	Tue	29/11	Midterm discussion Distributed Memory Concurrency (part B)		*	*Midterm 2 discussion with the TA*
	L23	Thu	1 / 12	Distributed Memory Concurrency (part C)	x		
14	Lx2	Tue	6 / 12	*COSC507 project presentations – Attendance not required; but feel free to attend if interested)*	x		**No lab in the last week**
	Lx3	Thu	8 / 12	*COSC507 project presentations (cont'd)* Java Concurrency (tentative) Final discussion	x		

The letter "W" in the header refers to the week number, and "L" to lecture number.

Missed Graded Work

Students who, because of unforeseen events, are absent during the term and are unable to complete tests or other graded work should generally discuss with their instructors how they can make up for missed work, according to written guidelines given to them at the start of the course (see Grading Practices). Instructors are not required to make allowance for missed tests or incomplete work not satisfactorily accounted for. If ill-health is an issue, students are encouraged to seek attention from a health professional. Campus Health and Counselling will usually provide the documentation only to students who have been seen previously at these offices for treatment or counselling specific to conditions associated with their academic difficulties. Students who feel that requests for consideration have not been dealt with fairly by their instructors may take their concerns first to the Head of the discipline and, if not resolved, to the Office of the Dean. Further information can be found at: http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,48,0,0. There will be no make-up midterm exams. If the absence is satisfactory, the student's final exam will be worth more than the final grade.

Generally speaking, if a student misses an exam without an acceptable excuse according to the UBC Okanagan's policy on excused absences from examinations, the mark received will be zero. If an acceptable excuse is provided to the instructor, then for:

- Midterm Examinations: the grade will be combined with the marks of the final exam so that the exams are still worth **70%** of the total grade. If a student misses both midterms with acceptable excuse, a make-up exam *might be* arranged for the second midterm. Note that a make-up exam may have a question format different from the regular exam.

- Final Examination: all requests for changes to final exams must be sent to the office of the Associate Dean of Students (fos.students.ubco@ubc.ca).   Further information on Academic Concession can be found under Policies and Regulation in the Okanagan Academic Calendar http://www.calendar.ubc.ca/okanagan/index.cfm?tree=3,48,0,0. A make-up exam may have a question format different from the regular exam

- Missed clicker questions*: no answers will be accepted except those provided during the lecture time using your own clicker account

Late Assignments/project

 Except for extreme situations (e.g., illness, childbirth, or bereavement supported by a written proof such as a doctor's note), the following policy is applied to late assignments or project:

- 0 to 24 hours late: 25%-mark deduction (e.g., if an assignment is worth 20 marks, then 5 marks will be deducted from the assignment mark; no negative marks will be given.).
- 24 to 48 hours late: 50%-mark deduction
- More than 48 hours: no mark.

One-time Extension Policy

- Everyone can get a one-time extension for **3 days** for any assignment of their choice. Use this extension wisely as I will give no additional extensions unless in very very extreme situations (e.g. admission to hospital, death in family). If you used this extension then asked for another one due to having too many exams/assignments, travelling, etc. you will not get a second extension.

- This policy only applies to assignments A1, A2, etc., and it **does *not* apply to the last assignment or the Project.**

- **You do not have to ask for permission to use the 3-day extension**. Just inform your TA directly (no need to email the professor, but you must inform your TA)

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise, and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences. A more detailed description of academic integrity, including the University's policies and procedures, may be found in the Academic Calendar at: http://okanagan.students.ubc.ca/calendar/index.cfm?tree=3,54,111,0.

Cooperation vs. Cheating

Working with others on assignments is a good way to learn the material and we encourage it. However, there are limits to the degree of cooperation that we will permit. Any level of cooperation beyond what is permitted is considered cheating.

When working on programming assignments, you must work only with others whose understanding of the material is approximately equal to yours. In this situation, working together to find a good approach for solving a programming problem is cooperation; listening while someone dictates a solution is cheating. You must limit collaboration to a high-level discussion of solution strategies and stop short of writing down a group answer. Anything that you hand in, whether it is a written problem or a computer program, must be written by you, from scratch, in your own words. If you base your solution on any other written solution, you are cheating. If you provide your solution for others to use, you are also cheating.

Copyright Disclaimer

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Student Service Resources

Disability Resource Centre: The Disability Resource Centre ensures educational equity for students with disabilities and chronic medical conditions. If you are disabled, have an injury or illness and require academic accommodations to meet the course objectives, please contact Earllene Roberts, the Diversity Advisor for the Disability Resource Centre located in the University Centre building (UNC 215).

> **UNC 215** 250.807.9263
> email: earllene.roberts@ubc.ca
> Web: www.students.ok.ubc.ca/drc

Equity and Inclusion Office: Through leadership, vision, and collaborative action, the Equity & Inclusion Office (EIO) develops action strategies in support of efforts to embed equity and inclusion in the daily operations across the campus. The EIO provides education and training from cultivating respectful, inclusive spaces and communities to understanding unconscious/implicit bias and its operation within in campus environments. UBC Policy 3 prohibits discrimination and

harassment on the basis of BC's Human Rights Code. If you require assistance related to an issue of equity, educational programs, discrimination or harassment please contact the EIO.

UNC 325H 250.807.9291
email: equity.ubco@ubc.ca
Web: www.equity.ok.ubc.ca

Office of the Ombudsperson for Students: The Office of the Ombudsperson for Students is an independent, confidential and impartial resource to ensure students are treated fairly. The Ombuds Office helps students navigate campus-related fairness concerns. They work with UBC community members individually and at the systemic level to ensure students are treated fairly and can learn, work and live in a fair, equitable and respectful environment. Ombuds helps students gain clarity on UBC policies and procedures, explore options, identify next steps, recommend resources, plan strategies and receive objective feedback to promote constructive problem solving. If you require assistance, please feel free to reach out for more information or to arrange an appointment.

UNC 328 250.807.9818
email: ombuds.office.ok@ubc.ca
Web: www.ombudsoffice.ubc.ca

Sexual Violence Prevention and Response Office (SVPRO): A safe and confidential place for UBC students, staff and faculty who have experienced sexual violence regardless of when or where it took place. Just want to talk? We are here to listen and help you explore your options. We can help you find a safe place to stay, explain your reporting options (UBC or police), accompany you to the hospital, or support you with academic accommodations. You have the right to choose what happens next. We support your decision, whatever you decide.
Visit svpro.ok.ubc.ca or call us at 250-807-9640.

Independent Investigations Office (IIO): If you or someone you know has experienced sexual assault or some other form of sexual misconduct by a UBC community member and you want the Independent Investigations Office (IIO) at UBC to investigate, please contact the **IIO**. Investigations are conducted in a trauma informed, confidential and respectful manner in accordance with the principles of procedural fairness. You can report your experience directly to the **IIO by** calling 604-827-2060.

Web: https://investigationsoffice.ubc.ca/
E-mail: director.of.investigations@ubc.ca

Student Learning Hub: The Student Learning Hub (LIB 237) is your go-to resource for free math, science, writing, and language learning support. The Hub welcomes undergraduate students from all disciplines and year levels to access a range of supports that include **tutoring in math, sciences, languages, and writing, as well as help with study skills and learning strategies**. For more information, please visit the Hub's website (https://students.ok.ubc.ca/student-learning-hub/) or call 250-807-9185.

Student Wellness: At UBC Okanagan health services to students are provided by Student Wellness. Nurses, physicians and counsellors provide health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. As well, health promotion, education and research activities are provided to the campus community. If you require assistance with your health, please contact Student Wellness for more information or to book an appointment.

UNC 337 250.807.9270
email: healthwellness.okanagan@ubc.ca
Web: www.students.ok.ubc.ca/health-wellness

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SAFEWALK

Don't want to walk alone at night? Not too sure how to get somewhere on campus? Call Safewalk at
250-807-8076.
For more information, see: www.security.ok.ubc.ca

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