CS246 Object-Oriented Software Development Winter 2019

Course Description

Introduction to object-oriented programming and to tools and techniques for software development. Designing, coding, debugging, testing, and documenting medium-sized programs: reading specifications and designing software to implement them; selecting appropriate data structures and control structures; writing reusable code; reusing existing code; basic performance issues; debuggers; test suites.

Course Objectives

- Design, implement, test, and debug C++ programs to solve problems requiring hundreds of lines of code, making appropriate use of
    - types, variables, arrays, strings, and dynamic memory; loops, conditionals, and other control structures; structures and enumerations; procedures and functions; the preprocessor; formatted I/O;
    - classes, objects, overloading, and single inheritance;
    - a subset of the STL, including vector and map;
    - exceptions and exception safety;
    - basic software development tools, including makefiles, a shell, a revision control system, and a debugger;
    - test suites for unit testing, white and black box testing;
    - structured programming, incremental development;
    - interface design, abstractions, information hiding, cohesion and coupling;
    - a subset of UML to specify classes, objects and relationships between them; and
    - a selection of design patterns.
- Explain the following properties of the memory model used in C++, including their impact on time and space efficiency when designing code: memory as an array, run-time stack and stack frames, memory allocation on the heap vs. automatic allocation on the stack, pointers as memory addresses, the representation of objects in memory.
- Define and explain at an elementary level basic software-engineering concepts.

Course Personnel

Instructor's Name	Office Location	Contact	Office Hours
Rob Hackman	DC 2128	r2hackma@uwaterloo.ca	Tuesday 1:00pm - 3:00pm
Gustavo Tondello	DC 2129	gfortestondello@uwaterloo.ca	Thursday 10:00am - 12:00pm

ISA	Office Location	Contact	Office Hours
Kris Frasheri	MC 4065	cs246@uwaterloo.ca	Monday 12:30pm to 2:00pm Friday 3:30pm to 5:00pm

ISA (Part Time)	Office Location	Contact	Office Hours
Spencer Whitehead	MC 4065	cs246@uwaterloo.ca	TBD
Jonas Yu	MC 4065	cs246@uwaterloo.ca	TBD

ISC	Office Location	Contact
Olga Zorin	MC 4005	ozorin@uwaterloo.ca

Lecture and Tutorial Schedule

Lecture Section	Time/Date	Building/Room	Instructor Name
LEC 001	11:30am-12:50pm TTh	PHY 145	Rob Hackman
LEC 002	8:30am-9:50am TTh	MC 4059	Gustavo Tondello

Tutorial Section	Time/Date	Building/Room	Leading ISA
TUT 101	4:30pm-5:20pm W	MC 4063	Jonas Yu
TUT 102	1:30pm-2:20pm W	MC 4060	Kris Frasheri
TUT 103	2:30am-3:20pm W	MC 4063	Kris Frasheri

Resources

- Course website: http://www.student.cs.uwaterloo.ca/~cs246; discussion forum hosted by Piazza, https://piazza.com/uwaterloo.ca/winter2019/cs246/home
- Recommended textbook: *Lippman, Lajoie, and Moo. C++ Primer, 5th edition, Addison-Wesley Professional*.

Course Topics

All timings are approximate.

- The shell (4 hours)
  - file system, pattern matching, quoting, shell/system commands, file permission, redirection, shell programming.
- C++ (16 hours)
  - declarations, expressions, control structures, structured programming, preprocessor, I/O, dynamic allocation, objects, overloading, inheritance, templates, STL, separate compilation.
- Unix tools (8 hours)
  - compiler, debugging and the debugger (e.g., GDB), code management (e.g., make), version control (e.g., git).
- Software engineering (8 hours)
  - development process, design (UML), language selection, patterns, testing

Student Assessment

Assignments	Number	Tentative Due Date	Marks	Totals
	0	Jan. 14th	0*	
	1	Due Date 1: Jan. 18th Due Date 2: Jan. 25th	5	
	2	Due Date 1: Feb. 1st Due Date 2: Feb. 8th	7	

	3	Due Date 1: Feb. 15th Due Date 2: Mar. 1st	7	
	4	Due Date 1: Mar. 8th Due Date 2: Mar. 15th	9	
	5	Due Date 1: Mar. 22nd Due Date 2: Apr. 5th	12	
			40	40
Tests	**Midterm**	Mar. 5th (Tue), 04:30-06:20pm TBD	20	20
	Final	TBA, scheduled by the registrar	40	40
				100

Note (*): you cannot get credit for assignments 1-5 until you have achieved 100% on assignment 0.

Note: The weight of the final exam will be increased by 1/3 of the value of the marks lost on the midterm. This provides a "second chance" to earn up to one third of those lost marks back, with good final exam performance. This is the only adjustment to grades that will be made in the middle of the term. All other grade adjustments (if any) will be applied at the discretion of the instructors, at the end of the term.

Note: Most assignments are expected to be due on Friday 5:00pm. However, the listed due dates are **tentative**, and are subject to change.

Note: The final assignment is a project to be done in groups of at most three. You may do the project in pairs or individually, but you will be expected to produce the same output as a group of three. Be sure to work with people whom you trust; we will not arbitrate disagreements. Part of the evaluation of your project will consist of a live demo in front of a TA. This is mandatory.

- **A passing mark in the weighted test portion of the final grade AND at least 45% in the average of assignments 1-4 must be achieved to pass the course.** The final grade is calculated using the following formula:

```
if ( testing_average < 50% or a1-a4_average < 45% ) then
    final_grade = MIN( weighted_testing_average, a1-a4_average, normally_calc_grades )
else
    final_grade = normally_calc_grades
```

  In other words, good assignment marks alone cannot get you a passing mark in this course. Neither can good exam or project marks alone.

Tests

Both the midterm test and the final exam are closed book.

A missed test/exam receives a mark of 0, unless there is a documented reason. If a documented reason is provided for missing the midterm, its weight is applied to the final exam. If a documented reason is provided for missing the final exam, a grade of INC MIGHT be given, and the final exam must be written at the end of the next term the course is offered. A copy of the documented reason must be given to and approved by the instructor.

Assignments

All assignments must be done individually, unless the assignment is explicitly designated as a group assignment. All members of a group receive the same grade (no exceptions). The instructors/staff do not arbitrate group disputes; group members must handle any and all problems. A group assignment may be done individually, but it must be understood that the amount of work is significantly greater and no extra marks are given for this additional work.

Note: Marmoset is not a compiler! Do not submit C++ code to Marmoset, without first attempting to compile it yourself. For each problem on Marmoset where the deliverable is C++ code, if you have three or more submissions marked "Did not compile", **a mark will permanently be deducted** from your score on that problem.

Assignment Submissions

Assignments must be submitted using the Marmoset Submission and Testing Server.

The release test for a problem gives you the result of running your program on one basic test case (usually a case that appears in the assignment specification). The remaining test cases are secret tests, the results of which are revealed after the assignment is due. So be sure to test your code thoroughly, so that you pass as many of our secret tests as possible.

Lates

- Assignments are due on the due-date at the time specified on the top of the assignment.
- Late assignments **are not accepted**.
- **An assignment not handed in receives a mark of 0, unless there is a documented reason.**
- If a documented reason is supplied, and instructors decide that accommodation is warranted, the weight of the missing assignment is distributed across future assignments (assignments 1-4 only) and/or exams (instructors will decide on the appropriate distribution). A copy of the documented reason must be given to and approved by the instructors (submit it to Olga Zorin).

Marking

- Assignments are marked on some or all of the following criteria:
    1. testing
    2. correctness
    3. hand-marking
- Note that correctly-working code is only *one* component of an assignment mark.

Remarking Policy

- Make a written request clearly stating the questions you want remarked.
- Include any supporting evidence for your case.
- No more than two weeks after the assignment or test is handed back, return your assignment or test with the remark page to the ISA during a tutorial or an office hour.
- All requests are processed after the deadline to ensure fairness and consistency in marking.
- Changes to your code are not permitted as part of a remark request.

Note: The entire assignment or test is examined when remarking; therefore, the grade could decrease.

Course Communication

The primary form of communication of information outside of lectures will be through Piazza. **It is thus very important that you read it daily!** Since it is very common for the number of posts to get very large, very quickly, we have posted some guidelines to using Piazza in Piazza to help make everybody's lives easier. **Please make sure that you read the guidelines before you post.**

Mental Health Resources

Mental Health: If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support.

On-campus Resources

- Campus Wellness https://uwaterloo.ca/campus-wellness/
- Counselling Services: counselling.services@uwaterloo.ca / 519-888-4567 ext 32655 / Needles Hall North 2nd floor, (NH 2401)
- MATES: one-to-one peer support program offered by Federation of Students (FEDS) and Counselling Services: mates@uwaterloo.ca
- Health Services service: located across the creek from Student Life Centre, 519-888-4096.

Off-campus Resources

- Good2Talk (24/7): Free confidential help line for post-secondary students. Phone: 1-866-925-5454
- Here 24/7: Mental Health and Crisis Service Team. Phone: 1-844-437-3247
- OK2BME: set of support services for lesbian, gay, bisexual, transgender or questioning teens in Waterloo. Phone: 519-884-0000 extension 213

Diversity: It is our intent that students from all diverse backgrounds and perspectives be well served by this course, and that students' learning needs be addressed both in and out of class. We recognize the immense value of the diversity in identities, perspectives, and contributions that students bring, and the benefit it has on our educational environment. Your suggestions are encouraged and appreciated. Please let us know ways to improve the effectiveness of the course for you personally or for other students or student groups. In particular:

- We will gladly honour your request to address you by an alternate/preferred name or gender pronoun. Please advise us of this preference early in the semester so we may make appropriate changes to our records.
- We will honour your religious holidays and celebrations. Please inform of us these at the start of the course.
- We will follow AccessAbility Services guidelines and protocols on how to best support students with different learning needs.

Academic Integrity

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. Check the Office of Academic Integrity's website for more information.

All members of the UW community are expected to hold to the highest standard of academic integrity in their studies, teaching, and research. This site explains why academic integrity is important and how students can avoid academic misconduct. It also identifies resources available on campus for students and faculty to help achieve academic integrity in — and out — of the classroom.

MOSS(Measure of Software Similarities) is used in this course as a means of comparing students' assignments to ensure academic integrity.

Excessive collaboration defined

Students in CS 246 are permitted to discuss the assignments with each other **in generalities only**. Students may not look at each other's code or show their code to others. Any discussions about assignments must take place away from a computer, and without any written (or typed) record of the conversation. Similarities between students' code submissions, if they lie beyond what the instructors feel may be reasonably explained by chance, will be taken as evidence of excessive collaboration and will be forwarded to the Math Faculty integrity officer.

Special Note on test cases: Sharing test cases, created as part of an assignment submission, is not permitted even after the due date for these test cases has passed.

Please note that if you gain access to someone else's solution to a problem, you have already committed an offence, even if you never actually use that solution. Please protect your work from being seen by others, and please do not put your friends in difficult situations by asking to see their code. Any evidence that you had knowledge of someone else's solution while writing your own solution will be reported as an offence.

Publishing your code online

Posting assignment, project, midterm, and final exam solutions in publicly-accessible locations is not permitted in this course. For more information, and for information on alternatives to posting publicly, see here.

Intellectual Property

Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

Grievance

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 — Student Petitions and Grievances, Section 4. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline

A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. For information on categories of offenses and types of penalties, students should refer to Policy 71 — Student Discipline. For typical penalties, check the Guidelines for the Assessment of Penalties.

Avoiding Academic Offenses

Most students are unaware of the line between acceptable and unacceptable academic behaviour, especially when discussing assignments with classmates and using the work of other students. For information on commonly misunderstood academic offenses and how to avoid them, students should refer to the Faculty of Mathematics Cheating and Student Academic Discipline Policy.

Appeals

A decision made or a penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 — Student Appeals.

Note for students with disabilities

The AccessAbility Services Office (AAS), located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AAS at the beginning of each academic term.