Recent Announcements

Description

This course is an introduction to computer architecture and operating systems; it provides a view of how a processor works and how the operating system provides familiar abstractions such as processes and files.

Course Pre-requisites

- CPSC 213 and CPSC 221

Course Staff

Instructors

Patrice Belleville (pronouns he/him)

Reto Achermann (pronouns he/him)

Steve Wolfman (pronouns he/him)

- Contact:
    - Course administration issues (absence/illness, etc.): **cpsc313-admin@cs.ubc.ca (mailto:cpsc313-admin@cs.ubc.ca)**
    - Non-academic questions *of a personal nature* to an instructor: Patrice (**patrice@cs.ubc.ca (mailto:patrice@cs.ubc.ca)**), Reto (**achreto@cs.ubc.ca (mailto:achreto@cs.ubc.ca)**), or Steve (**wolf@mail.ubc.ca (mailto:wolf@mail.ubc.ca)**)
    - **All other issues: Piazza ⤷ (https://piazza.com/ubc.ca/winterterm12024/cpsc3131011022024w1/)** , please!
- Office Hours: See full list **Piazza ⤷ (https://piazza.com/class/m0cup2q4ff54h3/post/7)** !

Teaching Assistants

TA Office Hours listed on Piazza ⤷ (https://piazza.com/class/m0cup2q4ff54h3/post/7)

List of TAs:

- Alex Zhang
- Andrew Liu
- Asher Arya

- Chris Jung
- Gamma Huang
- Isabella Yang
- Jiayin Kralik
- Junhyeok Jang
- Ken Li
- Layla Zarins
- Louis Luo
- Ruthie Sun
- Taylor Foster
- Yifan Hao
- Yitan Li

Important Links

- **PrairieLearn** ⤤ **(https://us.prairielearn.com/pl/course_instance/161950)** (Please enroll in CPSC 313 2024w1 All Sections)
- **github repo (https://github.students.cs.ubc.ca/cpsc313/CPSC313-2024w1)** in which you will find code examples from the pre-class videos and class. This is now accessible only via **VPN (https://it.ubc.ca/services/email-voice-internet/myvpn)** or the UBCsecure network. (If you do not have access to github.students.cs.ubc.ca, please generate an account using **https://www.cs.ubc.ca/getacct (https://www.cs.ubc.ca/getacct)** .)

Overview

Modern computer systems are like onions, in that they consist of layers of hardware and software that interact to present a particular machine abstraction. As programmers we typically only see the outer layer of this "onion", however there are times when we need to peel back the layers of our system onion to be able to properly understand and modify the behaviour of programs and systems we are developing.

Consequently, this course focuses on the computer hardware, operating system, and other pieces of software that build these layers of abstraction that hide the hardware details and system complexities from programs and programmers. Although this resulting layering and abstraction simplifies programming, and allows us to reason about and build complex systems, there are times when it is important to strip away the layers to better understand the system's behaviour and improve its performance. In particular, the relationships and interactions between the various layers of abstraction can have profound effects on services and capabilities like performance, security, and correctness that span multiple layers.

Topics

Building on the material from CPSC 213, the course develops models of the various layers that comprise a computer system. In particular the course will explore topics concerning:

- CPU implementations and instruction execution
- Caches and memory systems
- Disks and file systems
- Virtual memory
- Operating systems and virtual machines

Course Learning Outcomes

Upon completion of this course students are expected to be able to:

- Explain the benefits of, and challenges associated with, instruction-level parallelism and its implementation.
- Describe at least one high-level architecture for a pipelined CPU. Correctly analyze examples of the timing of instructions passing through this architecture to identify dependencies and hazards.
- Explain why different types of memory need to be used in modern computers, and how the constraints on physical size, capacity and speed affect the performance of computer code. Correctly analyze examples of memory access patterns and locality to compute the steps required to retrieve the information and/or to update the memory state, while maintaining optimal performance for future accesses.
- Explain the issues that must be considered while designing file systems and some common solutions for these issues. Given a file system specification, correctly analyze examples of typical file system operations to identify how to retrieve necessary information or update the file system state.
- Explain how a modern operating system can share a computer's processing and memory resources among multiple untrusted and competing processes. Correctly analyze examples of virtual memory accesses in individual processes to (1) compute the steps required to retrieve the information and/or update the memory state, and to (2) identify when hardware can perform an operation autonomously and when the operating system has to be invoked.
- Optimize C code in order to make it run faster by refining its locality and use of processor and memory resources. Optimize at least one version of Assembly code to make it run faster by reducing the number of hazards in typical pipelined CPUs.

Textbook

Computer Systems: A programmer's Perspective ⬈ **(https://csapp.cs.cmu.edu/)** (3rd edition), by Randal Bryant and David O'Hallaron.

See the **Textbook and References page (https://canvas.ubc.ca/courses/146942/pages/textbook-and-references)** for more information.

Course Grading

Activities	Weight
Class Participation: Pre-class exercises (2%), in-class exercises (2%), tutorial (2%) For each of these three types, your lowest 3 grades will be dropped.	6%
Bi-weekly (roughly) quizzes (6) See below for more information on quiz logistics.	36%
Homework (Labs): There are 10 labs, each worth the same amount. Many labs must be completed independently; some can be completed with a partner (maximum 2 students per group); others will have parts that must be completed independently and parts that can be completed with a partner. In labs with both individual and group parts, 1/4 of the lab's grade comes from the individual part and 3/4 from the group part.	22%
Final Exam Self-scheduled by reservation. Exact dates TBA; rough expected dates are Dec 16-19.	36%
Total	100%

If you earn more than 0% on any in-class exercise, you will receive 100% for that exercise when we compute final grades, but PrairieLearn will show you the detailed grade for feedback purposes.

Students may receive in-term academic concessions for missed in-term work based on the University's policies on this matter. Typical concessions at the discretion of the course staff would be to shift the weight of individual assessments to other assessments in the same category (e.g., the weight of one assignment could be shifted to other assignments), or to the final exam or to compute an "effective grade" for the missed component from similar components (e.g., for a missed quiz from the final exam).

*Students must pass (earn 50% or more) on the weighted average of the Labs and also on the weighted average of the quizzes/exams to pass the course. (You can find **weighted average calculators** ⬈ **(https://www.google.com/search?q=weighted+average+calculator)** online if needed.)*

Quiz 0 is a review-focused quiz taken with an extended time limit and additional available resources; thus, no special grading rules apply. For each of quizzes 1 through 4, if you earn more than 0% on the quiz, you will have the opportunity later to review your quiz in an invigilated room and retake the (re-randomized and possibly moderately adjusted) quiz. If you opt not to retake, your original grade

*stands. Otherwise, your effective quiz grade is 80% of the retake grade plus 20% of the original grade. There is no time in the term to retake Quiz 5. Instead, the final exam will include slightly more emphasis on Quiz 5 material, and **if** it would improve your quiz 5 grade, we will also treat your final exam grade like a Quiz 5 retake grade.*

*The **CBTF (https://cbtf.ubc.ca/)** will let us know if this imposes too much demand on their facility. If so, we reserve the right to cap retake grades at a reasonably high threshold after that notification (e.g., if we imposed an 80% cap, your retake grade could not exceed 80%, and you would not be allowed to retake the quiz if you had already earned 80% or more). This would not impact already-completed quizzes or the Quiz 5 calculation described above.*

Additional details about the course's policies and administrative procedures can be found in the **Administration and Policies (https://canvas.ubc.ca/courses/146942/modules/985010)** module on Canvas.

Your personal health and wellness

University is a stressful time under the best of circumstances. If you are feeling overwhelmed, unable to work, or simply that you are not yourself and are not functioning, please ask for help. None of the course staff are health care professionals, but we will do our best to direct you to available resources. You may find the resources at **https://students.ubc.ca/health (https://students.ubc.ca/health)** helpful.

If you're sick, stay home – no matter what you think you may be sick with (e.g., Covid, cold, flu, other). Protect yourself *and* others!

- Our marking scheme provides flexibility so that you can prioritize your health and still be able to succeed:
  - You can earn 100% of the pre-class and in-class participation marks remotely, and we drop the lowest 3 marks of each of pre- and in-class exercises.
  - If you miss tutorial, recall that we drop the lowest 3 tutorial participation marks.
  - There is an opportunity to retake most quizzes.

Related: Masks are not required in class or tutorials, but **we welcome and encourage mask wearing** to reduce disease spread. Thanks!

If you do miss class because of illness:

- Talk to a classmate to figure out what you have missed; try to work through the in-class exercises on your own.
- Use Piazza for help.
- Come to office hours.
- See the marking scheme for reassurance about what flexibility you have.
- If you are concerned that you will need to miss a particular key activity due to illness, contact the course coordinator.

If you are sick on a final exam day, do not attend the exam. Contact the course coordinator ASAP and we may be able to schedule an alternate time for your exam, particularly if you scheduled before the last day of our exam period (so do so!). If not, you must apply for deferred standing (an academic concession) through Science Advising no later than 48 hours after the missed final exam. Students who are granted deferred standing write the final exam at a later date. Learn more and find the application online: **https://science.ubc.ca/students/advising/concession (https://science.ubc.ca/students/advising/concession)** (for BSc and BCS students).

For additional information about academic concessions, see the UBC policy here: **(http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0) http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0 (http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,329,0,0)**

Instructor health

If an instructor is sick: We will do our best to stay well, but if an instructor is ill, develops Covid symptoms, or tests positive for Covid, then they will not come to class. If that happens, here's what you can expect:

- We will find a substitute instructor.
- If that is not possible, we will lecture remotely using Zoom.
- If neither of these is possible, we will make a recording to replace the lecture and will try to staff lecture with TAs to take questions and help with the exercises.

Weather Contingency Plan for Class Sessions, Quizzes, and Exams

If in-person activities in our course are cancelled due to weather conditions (e.g., snow), please monitor **https://www.ubc.ca (https://www.ubc.ca/)** for information, the pinned posts section on Piazza for announcements on our course, and your UBC-registered e-mail. Specifically, in the event of such cancellations, we will:

- Make up missed lectures and tutorials via posted recordings or alternate exercises; follow Piazza for details.
- Adjust the deadline of labs, pre-class exercises, and in-class exercises during the affected period.
- Add new scheduling dates for quizzes/exams during the affected period and post instructions on how to re-register. (For the final exam, in the unlikely event that we run out of days available in the exam period, we will work with scheduling services and announce an alternate solution similar to "normal" exam rescheduling. Follow Piazza and your UBC-registered e-mail for more information.) This may involve removing retake options for quizzes; if so, we will review marking for affected quizzes.

If rescheduling causes problems for you that require academic concession, please reach out as usual to **cpsc313-admin@cs.ubc.ca (mailto:cpsc313-admin@cs.ubc.ca)** with details.

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.

Statement of Values and Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available **here (http://senate.ubc.ca/policies-resources-support-student-success)** .