# CPSC 313: Computer Hardware and Operating Systems

Unit 0: Introduction

# Meet Patrice

Pronouns: He/Him

Office: ICICS 343

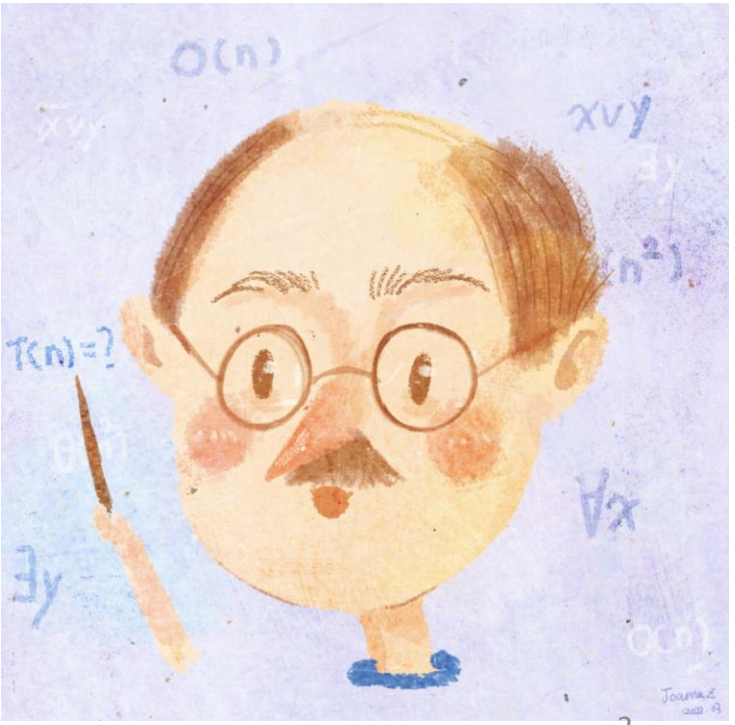
Email: patrice@cs.ubc.ca


Joined UBC in 1995

- Has mostly taught CPSC 121, 313, and 320 recently.
- Somehow convinced to be an Associate Head this year

Office Hours --

- TBD



# Meet Steve

Pronouns: he/him

Office: ICICS 239

Office Hours:
- TBD

Joined UBC 2004
- Have taught CPSC 110, 121, 221, 311, 312, 320, …
- Taught CPSC 210 and 221 over the last couple years
- Taught CPSC 313 last year; learned so much!! ☺

Extremely amateur parody singer!


# Meet Reto

Pronouns: he/him

Office: ICICS 341

On a hike

Office Hours:

- TBD

Attempts to bake by times

Joined UBC 2020 as a Postdoctoral Research Fellow
"Re-joined" UBC 2024 as an Assistant Professor

**Teaching:**

- I have TA-ed Computer Architecture and Systems Programming for 9ish years at ETH Zurich
- I have taught CPSC 508 (Graduate Operating Systems)
- Created 436A (Operating Systems Design and Implementation)

**Research:**

- Operating Systems with focus on memory management.
- Applied formal methods / verification

**If you like this course:**

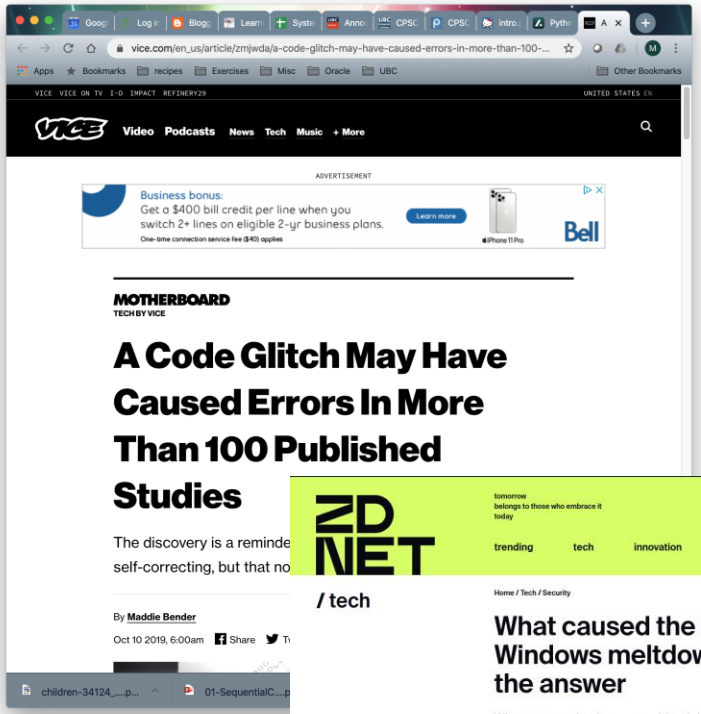
- take 436A next.
- Reach out to me or other Systopians for summer research internships, Honor's Thesis or Directed Studies :)

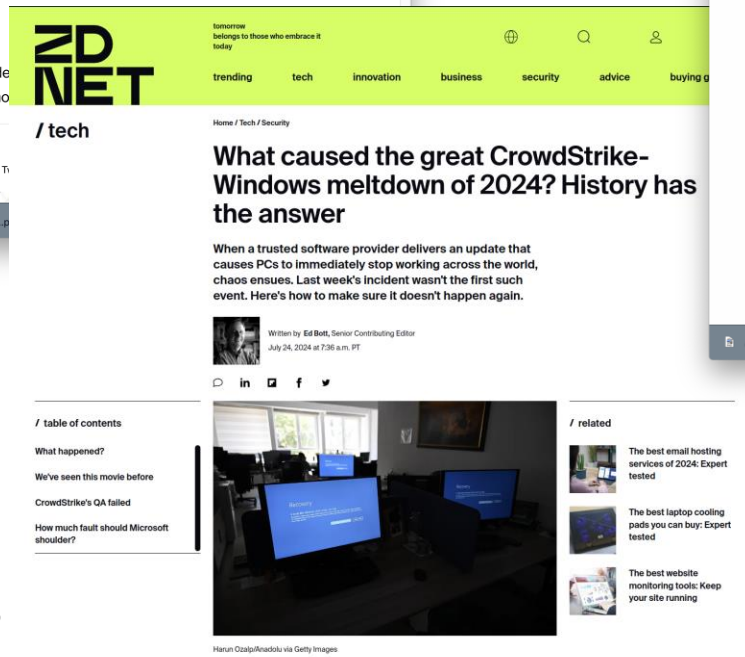
# The rest of the teaching staff

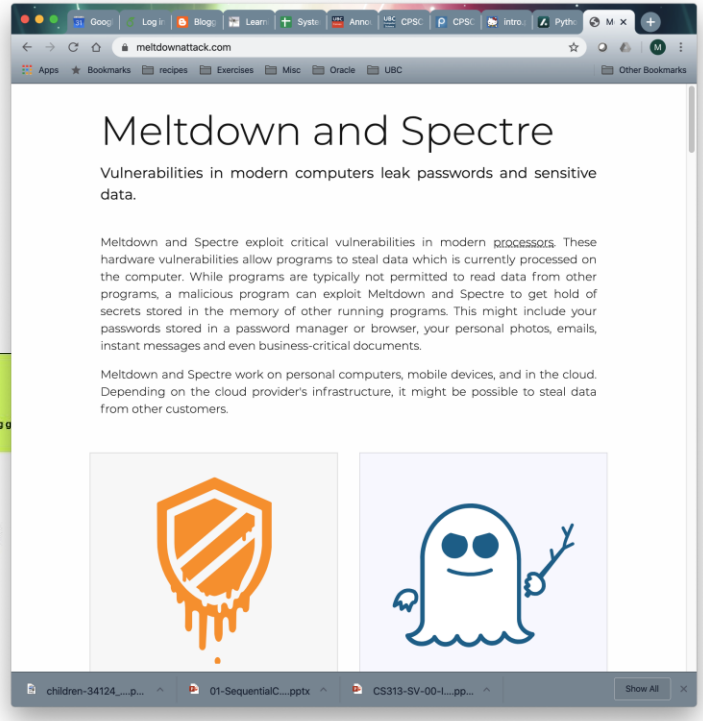
- We have an all-star cast of Teaching Assistants.
- We are all here to facilitate your **learning**
- You'll meet TAs in lecture, in tutorial, in office hours, and on Piazza
- So far, we have:

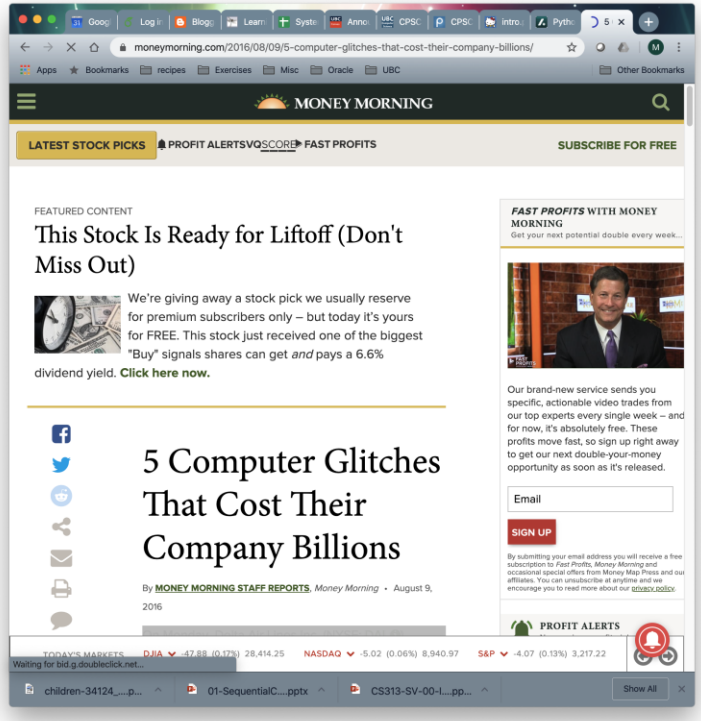
  Alex, Andrew, Asher, Chris, Gamma, Isabella , Jiayin, Junhyeok, Ken, Layla, Louis, Ruthie, Taylor, Yifan, and Yitan!

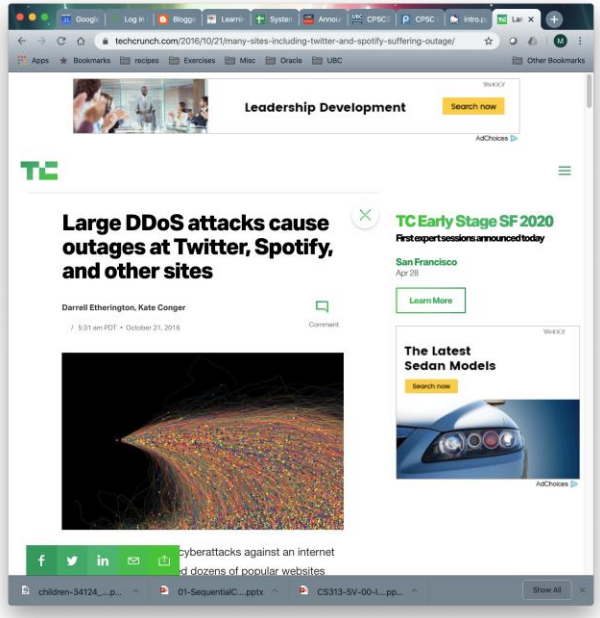
# Why We Love Systems



# Our Agenda for Today

- A meta-discussion about **how** we will be teaching this course, **what** we expect of you, and **what** you can expect of us.
- Hands-on exercises to understand what this course is about.
- Hands-on exercises to give you an idea of how this course will be taught.

# But first:
# CPSC 313 and Health

- Your (and our) health and well-being are a priority! Please do not wait until the last minute to communicate with us if you are ill, struggling, or encountering any unusual difficulties.
- If one of us becomes ill, we will fill in for each other.
- We are posting class recordings (see Piazza for more information). **However**, research suggests that synchronous class attendance is beneficial. Do **NOT** be "trapped" by the videos into bad habits!
- Please read the Canvas Home page and Syllabus, if you have not already done so.

# Course Objectives

- Explore how hardware and OS's enable, exploit, and limit parallelism, and what that means for performance and communication.
- Explain why modern computers have several different kinds of memory that differ in their size, performance, and persistence.
- Exploit your understanding of *the memory hierarchy* to make programs run faster.
- Explain how operating systems provide the abstractions that programmers use for things like:
  - Accessing persistent data
  - Creating the illusion of processes
  - Supporting virtual address spaces
- Analyze the tradeoffs between implementing features in hardware and software.

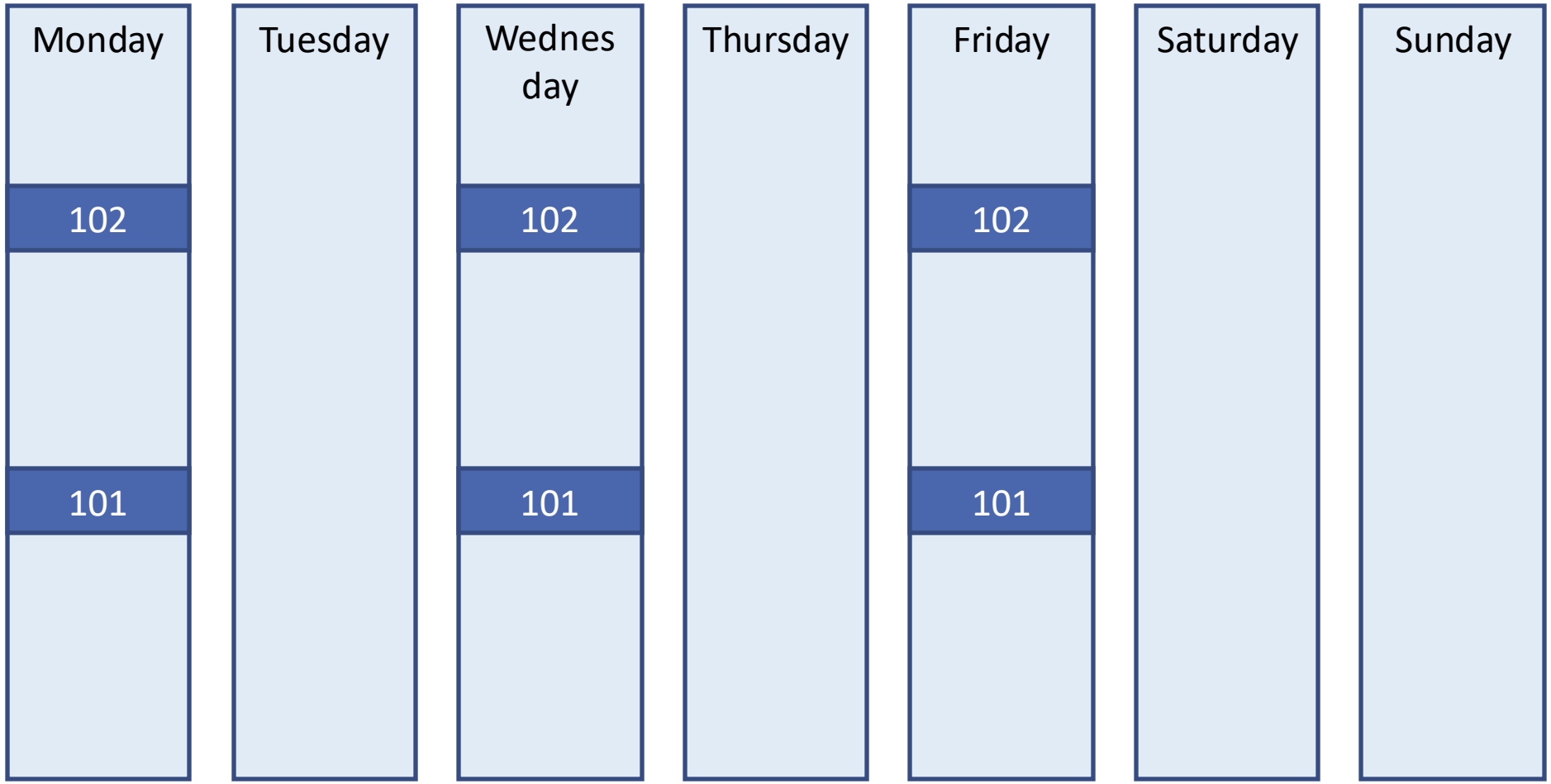
# Our Contract with You

We expect a lot of you:

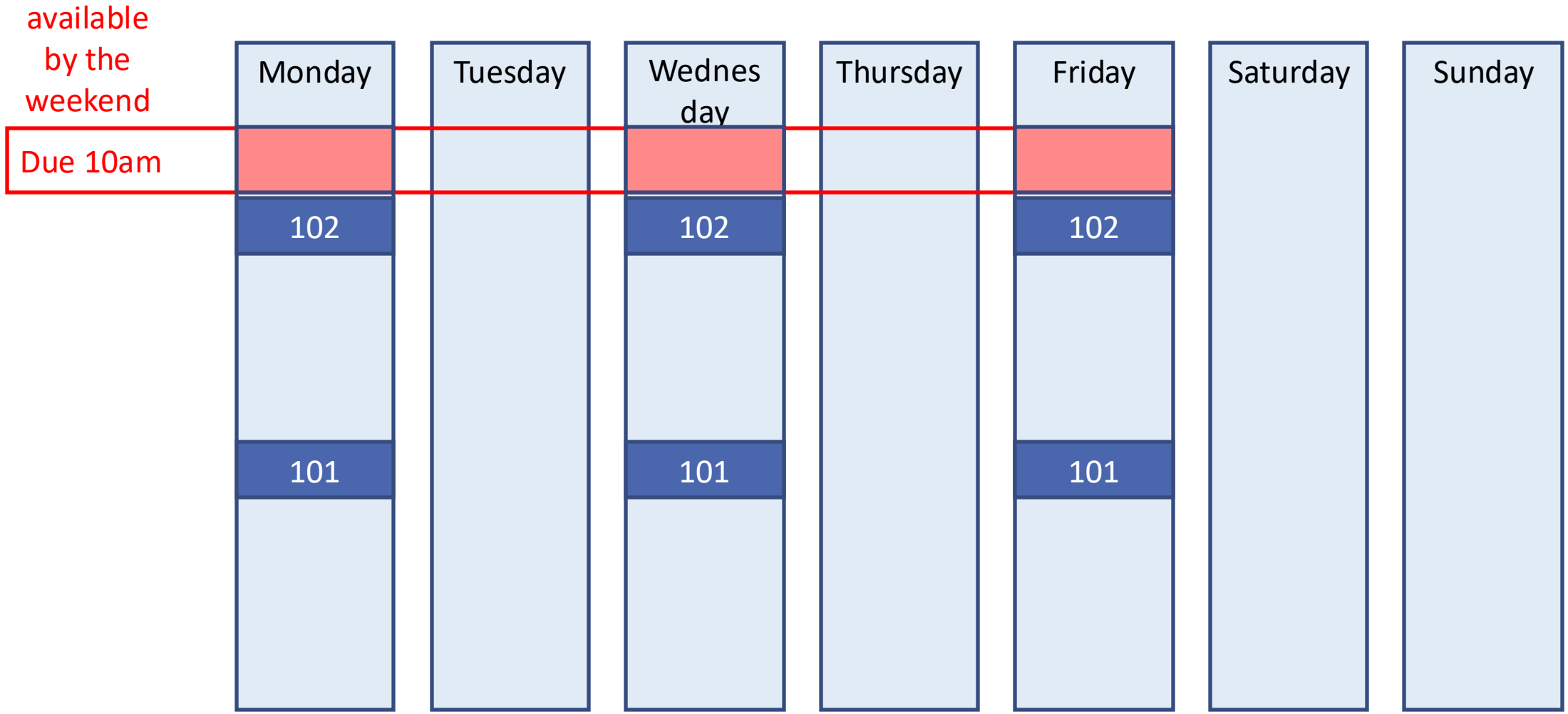
- Come to class.
- **Do the reading/viewing/pre-class work in advance.**
- Participate in class.
- Provide feedback.

- In return, we promise to:
  - Provide concrete reasons for why we cover material.
  - Keep pre-class work short and focused.
  - **Take advantage of the time we have together to help you think deeply rather than reciting to you what is in the book.**
  - Be available to support you in your learning the course material.
  - Be receptive and responsive to feedback.

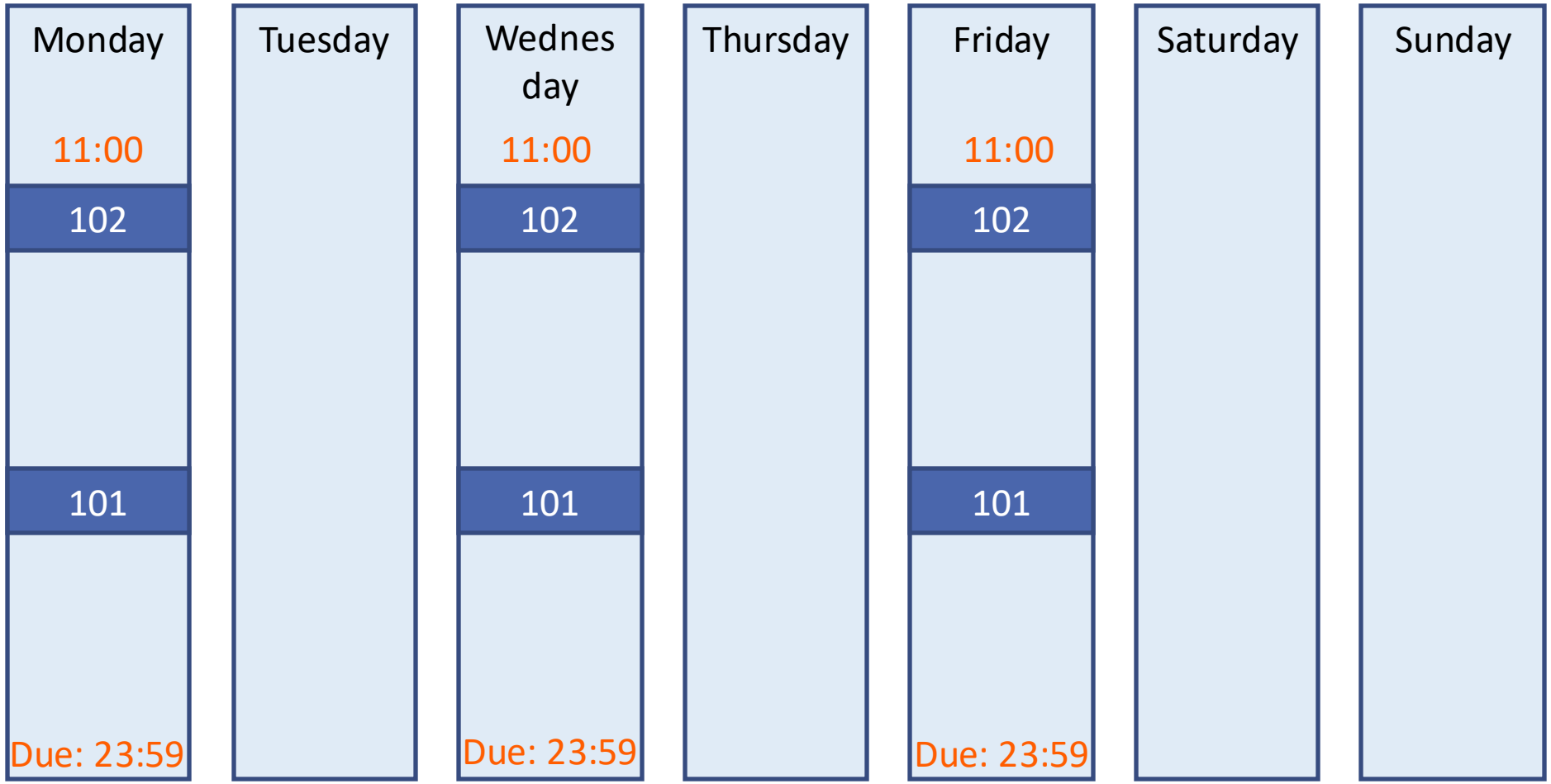
# A Week in the life of CPSC 313: Lecture



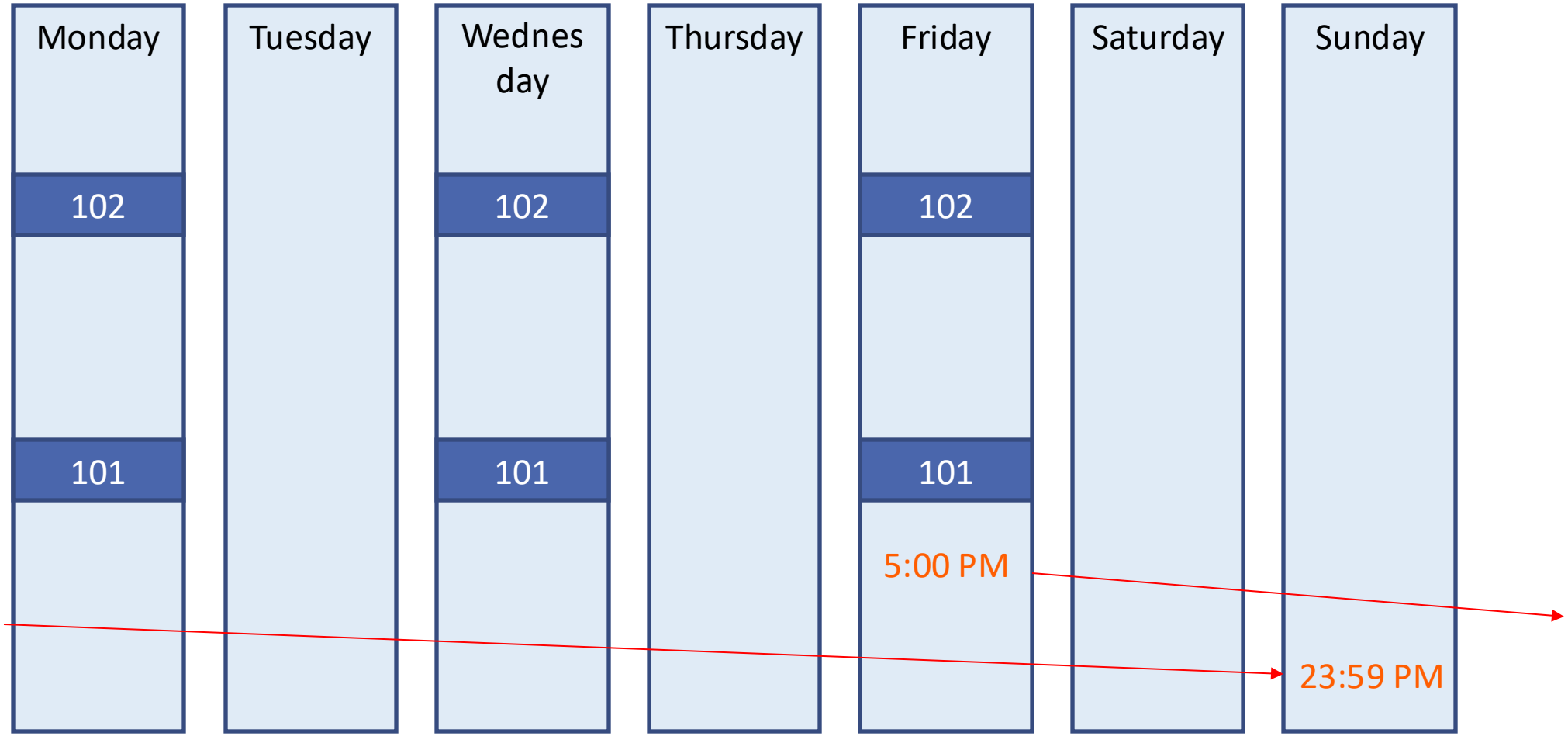
# A Week in the life of CPSC 313: Pre-Class



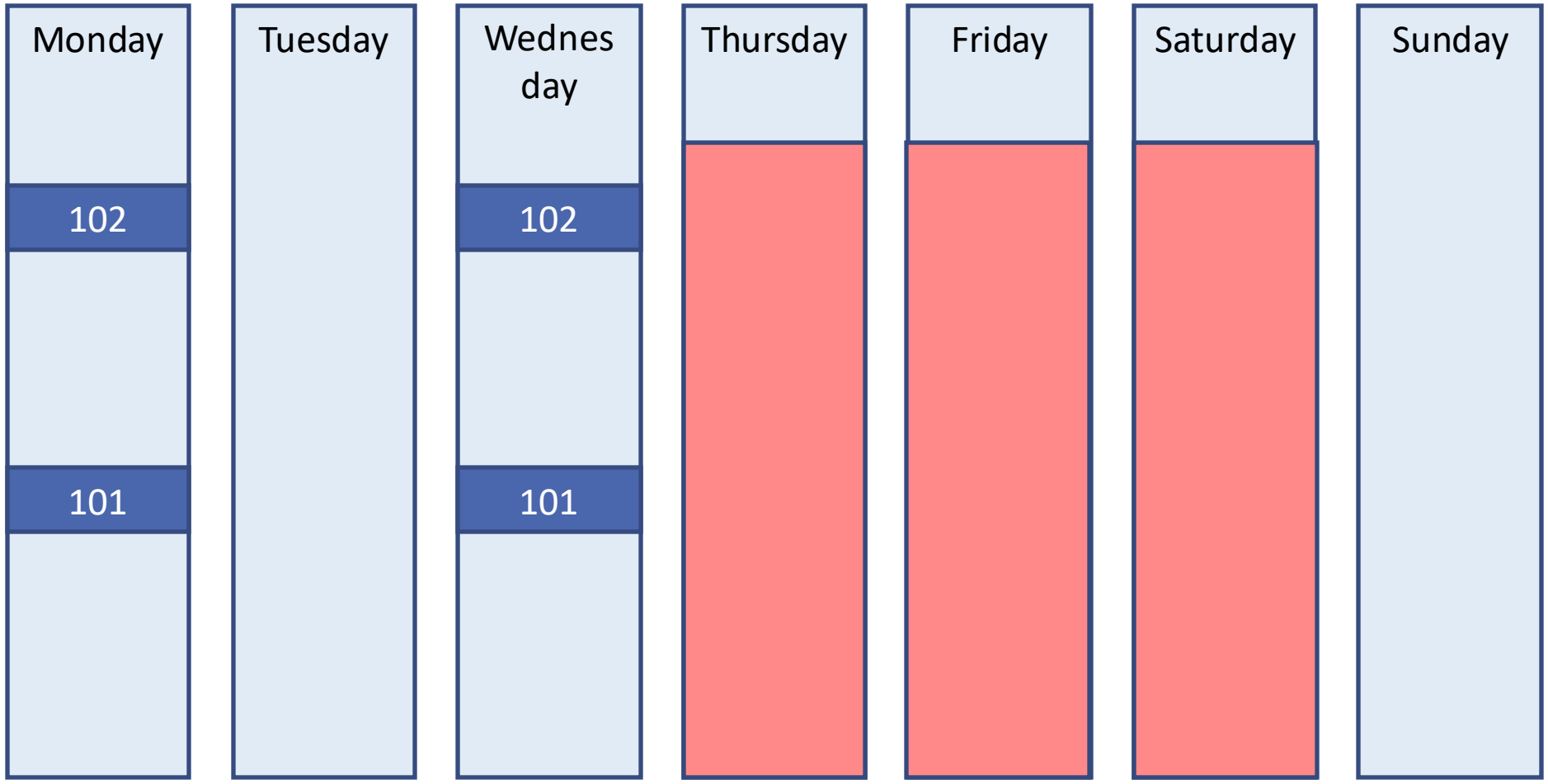
# A Week in the life of CPSC 313: Inclass



# A Week in the life of CPSC 313: Labs



# A Week in the life of CPSC 313: Quizzes (not #0)




Self-scheduled Thu, Fri, Sat in the "CBTF"
(and maybe Wed; more info coming on Piazza)

# Quiz #0 (and Lab #1)

Quiz #0 is a review quiz and so runs differently:

1. Unlike all other quizzes:
   - you do it “at home” on your own time (vs. in the Computer-Based Testing Facility)
   - it has a 100 minute time limit (vs. 50 minutes)
   - you may use: a compiler/run your code, a calculator, and any non-interactive resource like Wikipedia, i.e., not another person or an AI agent (vs. only what is enabled in the CBTF, which includes a calculator, scratch paper, and our key reference sheets)
2. Finishing Lab #1 (see PrairieLearn soon) helps with Quiz #0
3. Quiz #0 is due Sep 18, after Lab 1’s deadline

# Course Logistics: Grading

- Final exam: 36%
- Quizzes: 36%
  - There will be 6 quizzes.
  - Quiz #0 (only) is *soon*, for review, at-home, and has a longer time-limit
  - Quiz #1-5 will be in the CBTF. Other than Quiz #5, you'll have the chance to *retake* each of these quizzes to improve your score.
- Labs (homework assignments): Total of 22%
  - There will be 10 Labs, each worth the same amount
- Participation: 6%: this includes:
  - Pre-class work (videos + questions; lowest 3 dropped): 2%
  - In-class exercises (> 0% earns full marks; lowest 3 dropped): 2%
  - Tutorials (attendance, up to 3 absences dropped): 2%

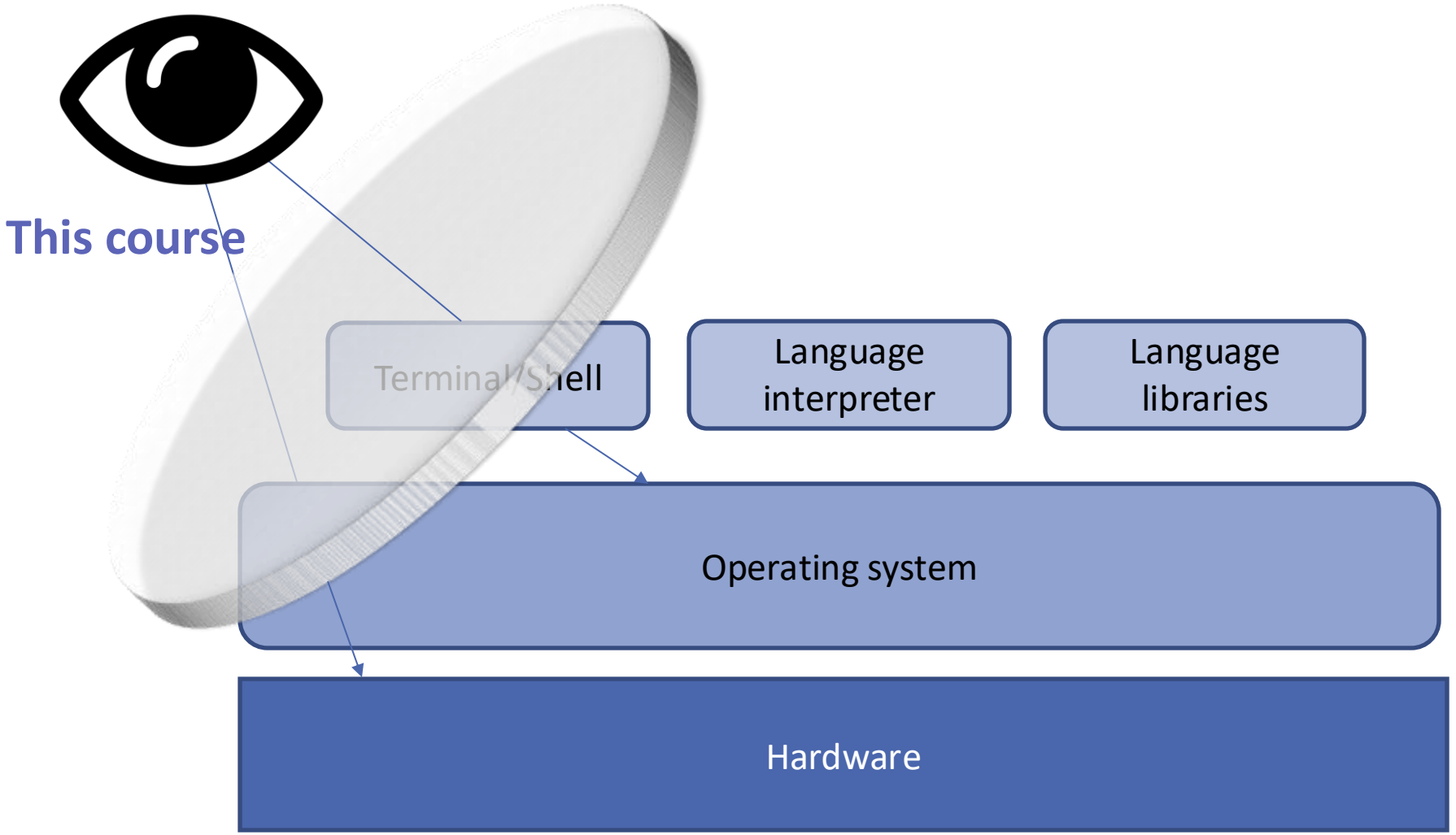
# Academic Honesty

- We take this really seriously (and personally)
- Read the web site
- Collaboration is fine, but turn in your own work
- Use what you learn in this class for good, not to do harm

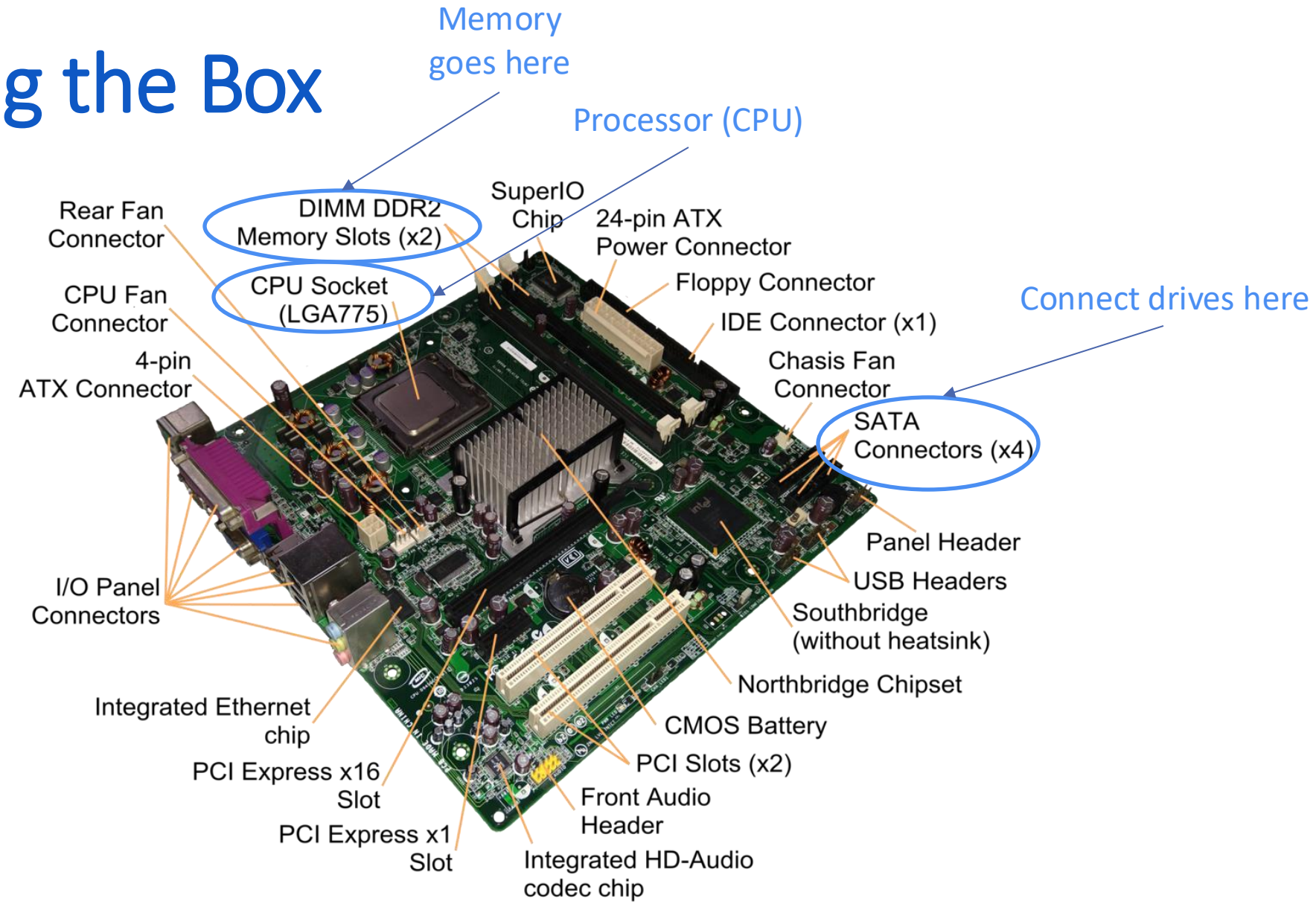
# Course Logistics (Tools)

- Official course information: Canvas
  - The Canvas site will have links to everything else that we do, so this is the place to check first.
  - **The Syllabus has links to all pre-class work, in-class work, labs, and quizzes -- this is your 'goto' page!**
  - **If you can't find something there, ask.**
- Classes (i.e., Combination of Lecture and In-class Work (Links on Canvas)
  - Section 102 11:00–11:50
  - Section 101 4:00–4:50
- Pre-class work: PrairieLearn
- Labs (assignments): PrairieLearn
- Quizzes/Exam: PrairieTest in CBTF (except Quiz #0, which is on PrairieLearn)
- Questions: Piazza
- Tutorials: In person
- Office Hours: In person and/or on Zoom (check the schedule on Piazza)

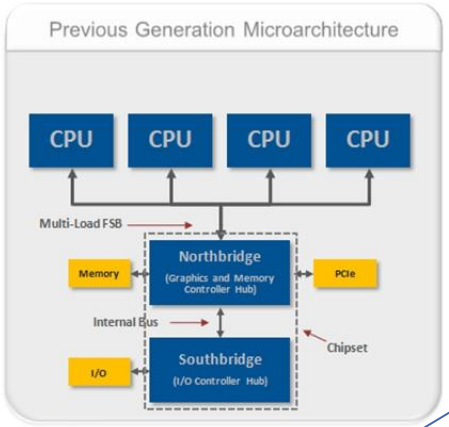
# Computers through Different Lenses

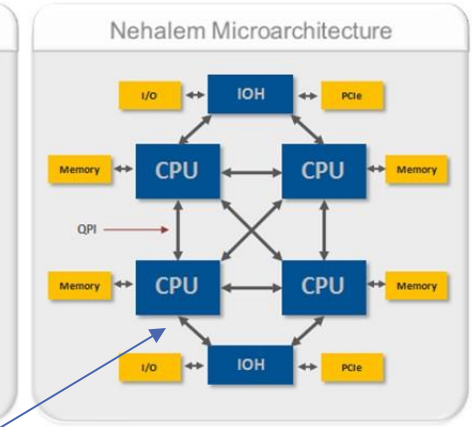


# Opening the Box



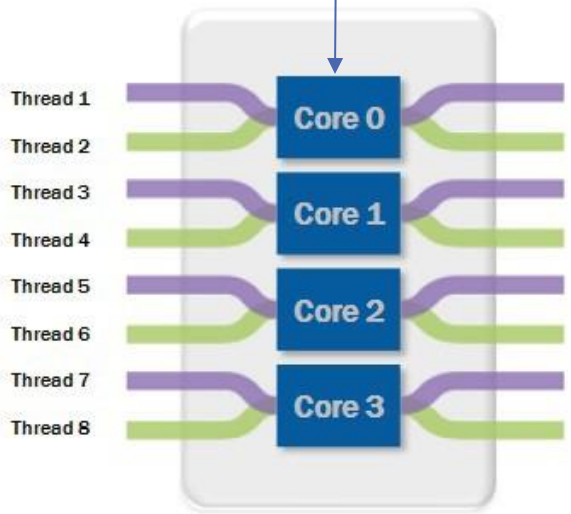
# The Processor

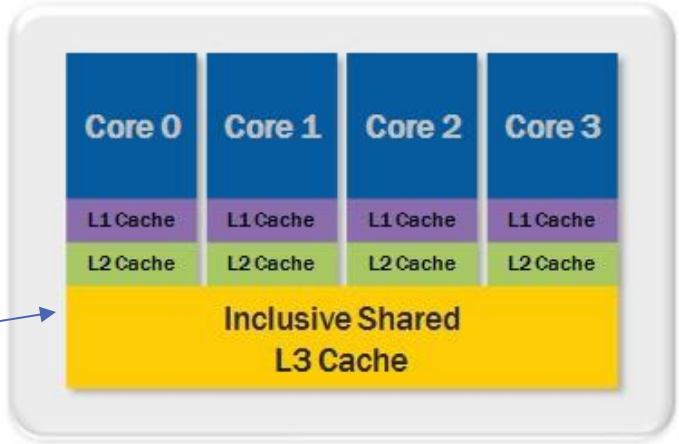




Module 5

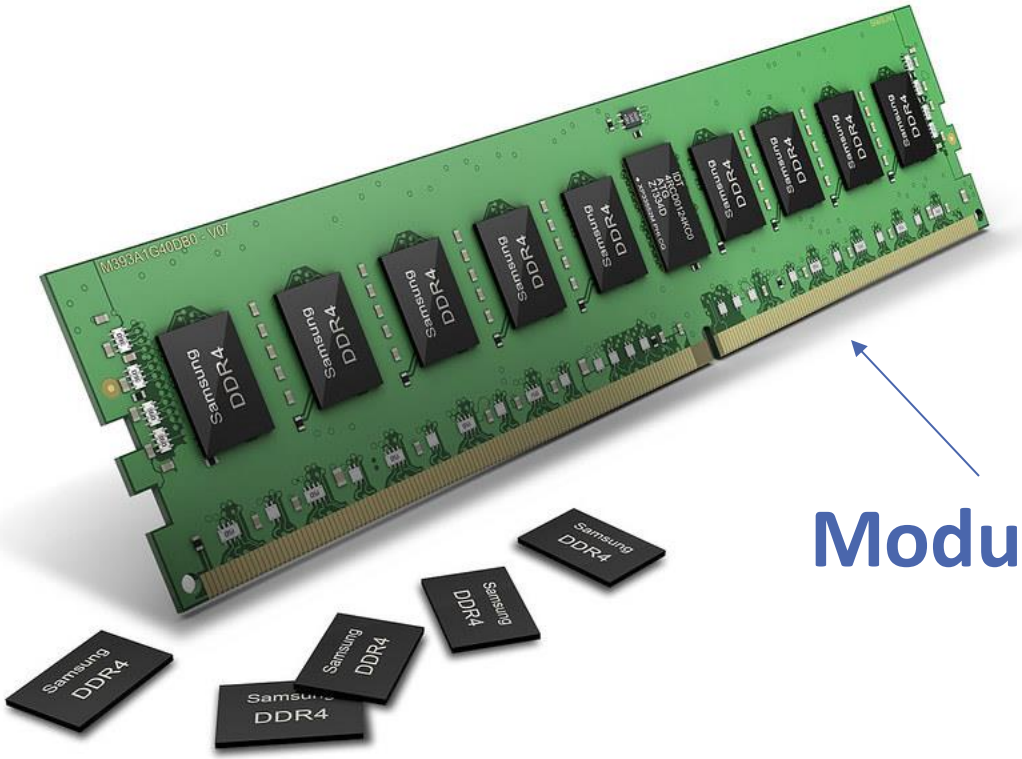
Modules 1 & 2




Module 3



# Memory




DRAM

Module 3


NVRAM

Flash Drive

Spinning Disk

Module 4

# Cross Cutting Theme


**Optional C Refresher Tutorials this week!**

**Times TO BE POSTED shortly on Piazza**

**(we'll post a video for those who cannot attend)**

# In-Class Exercise: Part 0

*We will be using small group gatherings regularly this semester. In a moment, we are going to ask you to make a small group a few of your neighbours …*

Get to know your teammates!

- Each person gets 30 seconds to introduce themselves with their name, the program they are in, and when they took 213.
- Now, go around once more and give everyone 30-60 seconds to identify something they think is unique about themselves. This can be something fun/silly (e.g., I color coordinate my socks and shirts) or something serious (e.g., I'm really worried about 313 because …).

# In-Class Exercise: Part 1
# NOT FOR CREDIT, not submitted (today only)

- Have someone in your group navigate to the course Canvas site (this will work best if someone has a laptop or tablet, but a phone should work in a pinch).
- Go to the syllabus and click on the link for today's in-class work (the following QR code also works).
- Discuss the problems in your groups (answers will be posted tomorrow).
- The link on the Syllabus

# Wrapping Up

- You will find this course significantly more accessible if you are comfortable programming in C!
- If you are not comfortable, you should:
  - Review the links from the in-class exercise
  - Attend/watch our C Refresher tutorial
  - Become familiar with the C resources we posted on Piazza
  - Attend office hours and ask questions

# Coming Up

- Check the Canvas Syllabus and PrairieLearn to know what's coming!
- In the short-term:
  - First pre-class exercise due for next class,
    first graded in-class exercise happening next class
    - Check the pre-class exercise video/slides for textbook readings
  - Lab 1 will release shortly
  - More pre- and in-class exercises and Quiz 0 *coming soon*!