Lecture 1:
Course Introduction

CSE 123: Computer Networks
Aaron Schulman (aka Aaron Shalev)
Lecture 1 Overview

- Class overview
  - Expected outcomes
  - Structure of the course
  - Policies and procedures

- A brief overview of Computer Networking
  - High-level concepts
  - An end-to-end example
Personnel and office hours

- **Instructor:** Aaron Schulman (aka Aaron Shalev)
  - Office hours Monday & Wednesday 4pm-5pm
    - [7-8am in many countries in East Asia]

- **Project 1 / Homework / Discussion TA:**
  - Zesen ”Jason” Zhang (8-9pm Wednesday and 4-5pm Friday)

- **Project 2 / Homework / Discussion TA:**
  - Aritra Basu (8-9pm Monday and 2-3pm Thursday)

- **Project Tutors:**
  - Xuyang Cao (3-4pm Monday and Thursday, and 7-8pm Friday)
  - Rohith Kasar (TBD)
  - Pramith Reddy (12:30-1:30pm Monday, Wednesday, Friday)
Prereqs

- CSE30, CSE101, and CSE110 – *not* CSE120
  - Undergrads can’t enroll without them
  - We expect it (or equivalent) even for grad students

- Programming experience
  - We will be assigning programming projects in C/C++
  - This course will not teach you C. The TAs/Tutors will help, but you need to learn it on your own if you don’t already know.
Expected Outcomes

- This course *will* teach you the *fundamentals* of computer networks:
  - Layering, signaling, framing, MAC, switching, routing, naming, Internetworking, congestion control, router design, etc.
  - At the end of this course you should completely understand what’s actually happening when you use the web or even Zoom

- This course *will not* teach you signals and coding
  - Take an EE course to learn about physical layer modulation, encoding, etc. on different hardware technologies

- Similarly, we will not cover Internet apps/services
  - CSE124 covers application layer protocols, Web, etc.
CSE 123 Class Overview

- Course material taught through class lectures, textbook readings, and discussion sections
- Course assignments are
  - Homework questions (based on lecture)
  - Four substantial programming projects
- Discussion section: (Friday 2pm on Zoom)
  - Help you get started on the projects
  - Lecture material and homework
  - Additional networking topics
- Discussion board (Piazza.com)
  - The place to ask questions about lecture, hw, projects, etc.
Textbook


PDF, eBook, HTML, and source! available at:
Homeworks

- There will be four homeworks throughout the quarter
  - All will be made available on GradeScope
  - Reinforce lecture material...no better practice
  - One week to complete each

- Collaboration vs. cheating
  - You should discuss homework problems with others
    » You can learn a lot from each other
  - But there is a distinction between collaboration and cheating
  - Rule of thumb: Discuss together on Piazza and Discord (or whatever you use), and write up answers independently
  - Cheating is copying from other student’s homeworks or solution sets, searching for answers on the Web, etc.
Projects

- There will be four programming projects
  - You will have [1.5 – 2] weeks to complete each
  - The first will be assigned THIS WEEK, yay!

- The projects must be completed in C/C++
  - We will provide skeleton code for you to use
  - Your job is to fill in the interesting/hard parts
  - The TAs will be available to help with coding

- The projects are INDIVIDUAL assignments
  - All code must be your own (not copied from GitHub!)
  - OK to discuss design ideas, NOT OK to share/look at code
  - Projects assigned AND SUBMITTED via private GitHub repo
Computer Facilities for Projects

- You can also use your home machine
  - The project source will work on Windows/OS X/Linux
    - Windows folks should install Windows Subsystem for Linux (WSL)
  - Graders will test on GradeScope machines
  - If there are discrepancies between your machine and GradeScope we will accommodate them (as you can demo working code over Zoom)
Exams

- **Midterm**
  - Monday, May 3\(^{rd}\)
  - Covers first third to half of class

- **Final**
  - Wednesday, June 11\(^{th}\)
  - Covers second half of class + selected material from first part
    - I will be explicit about the material covered

- No makeup exams (24 hours to complete)
  - Unless dire circumstances

- All exams on GradeScope for 24 hours, and open book
Grading

- Homeworks: 20%
  - Think of these collectively as a take-home midterm

- Midterm: 20%

- Final: 20%

- Projects: 40%
  - Divided evenly among the four projects
How to *Succeed in CSE 123*

- Come to or watch recorded lecture / discussion
  - Lecture material is the primary basis for exams and directly relates to the projects

- Do the homework
  - Excellent practice for the exams, and some homework problems are exercises for helping with the project
  - 20% is actually a significant fraction of your grade (easily the difference between an A and a C)

- Read the book
  - Reinforces concepts we talk about in lecture, helps with homework
How to Succeed (2)

- Ask questions in lecture, office hours, or email
  - Asking questions is the best way to clarify lecture material at the time it is being presented
  - Bring your concerns to the professor early (avoid snowball)
  - Office hours and Piazza will help with homeworks, projects

- Wait until the last couple of days to start a project
  - The projects cannot be done in the last couple of days
  - Repeat: The projects cannot be done in the last couple of days
Canvas is your one-stop shop

- Course announcements
- Links to all relevant course materials and cloud services
  - Course Homepage – Syllabus and Project specs
  - Zoom – Lecture and Discussion
  - Piazza – Project Discussion
  - Gradescope – Project/Homework/Exam Grades
  - Github – Project Submission
Class Web Page

http://www.cs.ucsd.edu/classes/sp21/cse123-a/

- Serves many roles…
  - Course syllabus and schedule (updated as quarter progresses)
    » Lecture slides
  - Project information
Questions

- Before we start the material, any questions about the class structure, contents, etc.?

- Note that this is “remote teaching” (COVID)
  - We will do the best to give you the best experience possible
  - You may hear my kids having fun
  - Zoom may fail, (but we will learn about why in this course!)
  - Pass/Fail is a perfectly reasonable option
    » Pass will be a C- or better
Protocols & Layering
- Manage complexity of comm. by decomposing the tasks
- Standardizing syntax and semantics to support interoperability

Naming
- Agreeing on how to describe a host, application, network, etc.

Switching & Routing
- Deciding how to get from here to there
- Forwarding messages across multiple physical components

Resource Allocation
- Figuring out how to share finite bandwidth, memory, etc.
A “Simple” Task

- Send information from one computer to another
  - Endpoints are called hosts
    - Could be computer, iPhone, laptop, etc.
  - The plumbing is called a link
    - We don’t care what the physical technology is: Ethernet, wireless, cellular, etc.
Actually Quite Complicated

- **ROUHGLY**, what happens when I click on a Web page from UCSD?

![Diagram showing a connection between My iPhone and www.muirskate.com through the Internet.]

*Image of My iPhone on the left and the UCSD website on the right connected by the Internet.*
Web request (HTTP)

- Turn click into HTTP request

```
GET https://www.muirskate.com/ HTTP/1.1
Host: www.muirskate.com
Connection: keep-alive
...
```
Name resolution (DNS)

- Where is www.muirskate.com?

My computer
(132.239.9.64)

Local DNS server
(132.239.51.18)

Where is www.muirskate.com?

Many hosts have it, one is 104.20.86.126
Data transport (TCP)

- Break message into packets (TCP segments)
- Should be delivered reliably & in-order

GET http://www.muirskate.com HTTP/1.1
Host: www.muirskate.com
Connection: keep-alive
...

“and let me know when they got there”
Global Network Addressing

- Address each packet so it can traverse network and arrive at host

My computer (132.239.9.64)

www.muirskate.com (104.20.86.126)
Each router forwards packet towards destination
Link management (WiFi)

- Break stream of bits into frames
- Media Access Control (MAC)
  - Can I send now? Can I send now?
- Send frame
Physical layer

802.11ac Wireless Access Point

5.8 Ghz Radio
OFDM/MIMO 4x4
1 - 1,300 Mbps

Ethernet switch/router

Cat 6 Cable (4 pairs)
NBase-T Ethernet
10 Gbps

To campus backbone

100 Gbps Ethernet

CSE 123 – Lecture 1: Course Introduction
For Next Class…

- Browse the course page on Canvas
- Read Chapter 1.3 and 2.3
- Next class: Layers and Framing