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
- Project 1:
  - Xuyang Cao (Tue. and Thur. 11am-12pm)
- Project 2:
  - Aritra Basu (Wed. and Fri 3-4pm)
- Homeworks/Exams:
  - Harsh Gondaliya (Mon. and Tue. 5-6pm)
- Discussion/Project 1/Exams:
  - Shreyas Anantha-Ramaprasad (Wed. and Thur. 5-6pm)
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: (Wednesday 2pm in Center 115)
  - 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


Homeworks

- There will be four homeworks throughout the quarter
  - All will be made available under “Homework” tab
  - 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 prove 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 try to accommodate them
Exams

- Midterm
  - Monday, May 2\textsuperscript{nd}
  - Covers first third to half of class

- Final
  - Thursday, June 9\textsuperscript{th}
  - Covers second half of class + selected material from first part
    » I will be explicit about the material covered

- No makeup exams, all exams held in person
  - Unless dire circumstances

- You can bring a 1-page cheat sheet to the Exam
Grading

- Homeworks: 20%
  - Think of these collectively as practice exams

- 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

- Start the project early
  - 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

- Links to all relevant course materials and cloud services
  - Course Homepage – Syllabus, Project specs, Homeworks and Announcements
  - Zoom – Remote Office Hours
  - Piazza – Project Discussion
  - Gradescope – Project/Homework/Exam Grades
  - Github – Project Submission
Class Web Page

http://www.cs.ucsd.edu/classes/sp22/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.?
This Class in One Slide

- **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

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

![Diagram of a smartphone communicating with the internet and a server]
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 across different organizations
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

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

Ethernet switch/router

To campus backbone

100 Gbps Ethernet
For Next Class...

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