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

- **Instructor:** Aaron Schulman (aka Aaron Shalev)
  - Office hours Monday & Wednesday 3pm-4pm
- **Project TA:**
  - Sam Crow (TBD)
- **Discussion TA:**
  - Alex Gamero-Garrido (Office hours Thursdays 10-11:30am)
- **Homework/Lecture TA:**
  - Hadi Givehchian (TBD)
- **Project Tutors:**
  - Sammy Gill (Office hours Wednesday 10-1pm)
  - Jingsong Chen (12-3pm)
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 will help, but you need to learn it on your own if you don’t already know it.
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 view a Web page

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

- Similarly, we will not cover Internet apps/services
  - CSE124 covers application layer protocols, Web, etc.
  - You *will be able to* pick this up on your own with Google
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


Homeworks

- There will be four homeworks throughout the quarter
  - 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 in library, walk home, and write up answers independently
  - Cheating is copying from other student’s homeworks or solution sets, searching for answers on the Web, etc.
  - Suspicious homeworks will be flagged for review
Projects

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

- 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 Labs (COVID)

- You are welcome to use ieng6 machines over ssh
- You can also use your home machine
  - The project source will work on Windows/OS X (with caveats)
  - Graders will test on ieng6 machines
  - Be sure to test your projects on ieng6 as well
Exams

- **Midterm**
  - Monday, May 4th
  - Covers first third to half of class

- **Final**
  - Wednesday, June 10th (08:00am-11:00am)
  - Covers second half of class + selected material from first part
    » I will be explicit about the material covered

- **No makeup exams**
  - Unless dire circumstances (or contracting COVID)

- **All exams online and open book (COVID)**
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 Not To Pass CSE 123

- Do not come to or watch recorded lecture / discussion
  - Material is in the book anyway…
  - Lecture material is the primary basis for exams and directly relates to the projects
  - Besides, the professor is home alone with his family and needs social interaction

- Do not do the homework
  - It’s only 20% of the grade
  - 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)
How *Not* To Pass (2)

- Do not ask questions in lecture, office hours, or email
  - Professor is scary, I don’t want to embarrass myself
  - 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 email will help with homeworks, projects

- Wait until the last couple of days to start a project
  - We’ll have to do the crunch anyways, why do it 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

- Course announcements
- Links to all relevant course materials and services
  - Zoom – Lecture and Discussion
  - Piazza – Project Discussion
  - Github – Project Submission
  - Gradescope – Project/Homework/Exam Grades
  - Course Homepage…
Serves many roles…

- Course syllabus and schedule (updated as quarter progresses)
  - Lecture slides
- Homework handouts
- Project information

http://www.cs.ucsd.edu/classes/sp20/cse123-a/
Questions

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

- Note that this is “emergency teaching” (COVID)
  - I will do my best to give you the best education possible
  - You may hear my kids having “fun”
  - Zoom may fail, 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 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?

My iPhone  

www.muirskate.com
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)

Where is www.muirskate.com?

Many hosts have it, one is 104.20.86.126

Local DNS server (132.239.51.18)
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)
Network Routing

- 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

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

Ethernet switch/router

To campus
backbone

100 Gbps Ethernet

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

- Browse the course web
  - http://www.cs.ucsd.edu/classes/sp20/cse123-a/

- Read Chapter 1.3 and 2.3

- Next class: Layers and Framing