Lecture 1:
Course Introduction

CSE 123: Computer Networks
Alex C. Snoeren
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:** Alex C. Snoeren
  - Office hours Thursdays 10-11am or by appointment
- **Project TAs:** Palash Chuan (P1) and Roger Cheng (P2)
  - P1 Office hours Wed/Fri 4-6pm
  - P2 Office hours TBA
- **Homework TA:** Hadi Givehchian
  - Office hours Mon 4-6pm (and Tue 6-8pm the day before HWs are due)
- **Tutors:** Jiachen Niu and Weifan Ou
  - Standing office hours Tue/Thu 4-6pm, Mon 3-5pm, and Fri 9-11am
  - Additional project hours Mon/Wed 9-11am, Tue 1-4pm and Wed 2-4pm
In-person COVID Requirements

- You must **wear a mask AT ALL TIMES**

- Please DO NOT MOVE the desks
  - Let me know if you can’t find a left-handed one

- Make sure you’ve got your “green thumb”!
  - If not yet, **DO IT NOW**

01/04/2021
Prereqs

- CSE30, CSE101, and CSE110
  - 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 *interactive* class lectures, textbook readings, and discussion sections
- Course assignments are
  - Homework questions (based on lecture)
  - Two substantial programming projects (in four parts)
- Discussion section (**Mon. 2pm Zoom**)
  - Help you get started on the projects
  - Lecture material and homework
  - Additional networking topics
- Discussion board (**Piazza**)
  - The place to ask questions about lecture, hw, projects, etc.
Peer Instruction

- Studies have shown it helps both with understanding and retention.

- Means you need to come to class prepared, have a clicker, and adhere to a slightly unusual class etiquette.

You must attend class
You must prepare for class
You must participate in class
iClickers: You must bring (only) yours

- Two options
  - Buy an iClicker at the Bookstore (or ebay), in person only
  - Download the iClicker REEF software (DO NOT PAY!)

- Register it following instructions in the Syllabus

- REGISTER iCLICKERs ON CANVAS.

- Classroom Frequency TBA, REEF CSE123
Test iClicker Question

- Are you:
  - A) Using an iClicker in person
  - B) Using REEF in person
  - C) Using REEF remote
  - - I can’t answer because none of the above apply!
Textbook


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

- There will be 4 homeworks throughout the quarter
  - Reinforce lecture material...no better practice

- 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 over Zoom, walk home hang up, and only afterwards 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 (really two, each split in half)
- You will have approximately two weeks to complete each
- The first will be assigned FRIDAY

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 TA and tutors 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

- You are welcome to ssh into ieng6
  - Linux running on Intel machines

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

- **Midterm**
  - Friday, February 5\(^{th}\)
  - Covers first half of class

- **Final**
  - Friday, March 19\(^{th}\) (11:30am-2:30pm)
  - Covers second half of class + selected material from first part
    - I will be explicit about the material covered

- **No makeup exams**
  - Unless dire circumstances (e.g., COVID)

- **Contact me regarding asynchronous exam options**
Grading

- Participation: 4%
  - Based on Clicker responses; you can miss up to three days w/o penalty
  - Contact me for asynchronous alternative

- Homeworks: 8%

- Midterm: 21%

- Final: 25%

- Projects: 42%
  - Divided evenly among the projects
A Few Class Policies

- Regardless of modality, this class is "live"
  - Asynchronous options for participation are available, but discouraged
  - Contact professor ASAP if you require them
  - No need to contact professor if you want to Zoom instead of attend in person

- Lecture is available live over Zoom, but archived via podcast
  - Participation is required via Clicker, questions are fine in person, over Zoom, in chat

- Discussion and office hours are NOT RECORDED
  - Please turn your camera on when interacting with TAs/Tutors

- No late assignments
  - HWs submitted via GradeScope, Projects via GitHub
How *Not* To Pass CSE 123

- Do not attend lecture / discussion
  - Class is online, podcast is available, and the material is in the book anyway
  - Lecture material is the basis for exams and directly relates to the projects
  - Besides, the professor thinks he’s funny

- Do not do the homework
  - It’s only 8% of the grade
  - Excellent practice for the exams, and some homework problems are exercises for helping with the project
  - 8% is actually a significant fraction of your grade (easily the difference between an A and a B)
How Not To Pass (2)

- Do not ask questions in lecture, office hours, or Piazza
  - 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
  - Office hours and Piazza will be invaluable for 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
### How *Not* To Pass (3)

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Class Web Page

- All Zoom links are on Canvas, everything else is here
  
  http://www.cs.ucsd.edu/classes/wi21/cse123-a/

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

- Class will be podcast
  
  - Lecture slides posted to website immediately after class
  - Podcast is for review, not intended as a substitute for lecture/Zoom
Before we start the material, any questions about the class structure, contents, etc.?
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 device

Internet

www.google.com

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Web request (HTTP)

- Turn click into HTTP request

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

...
Name resolution (DNS)

- Where is www.google.com?

My device (132.239.9.64)

Local DNS server (132.239.51.18)

What’s the address for www.google.com

Oh, you can find it at 66.102.7.104
Data transport (TCP)

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

```
GET http://www.google.com HTTP/1.1
Host: www.google.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 device (132.239.9.64) → www.google.com (66.102.7.104)

Destination: 66.102.7.104, Source: 132.239.9.64, Data: GET http...
Network Routing

- Each router forwards packet towards destination

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Link management (WiFi)

- Break message 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

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For Next Class…

- Browse the course website on Canvas
  - http://www.cs.ucsd.edu/classes/wi21/cse123-

- Read Chapter 1.3 and 2.3

- Wednesday: Layers and Framing

- Drop now or plan to stick it out!