W4118
Operating Systems I

Spring 2024

https://cs4118.github.io/www/2024-1/

Teaching Staff

Instructor:

[Kostis Kaffes](#)

6+ TAs:

Alex Xu – Chelsea Soemitro – Jake Torres

Ryan Wee – Jyothi Gandi – Abhinav Gupta

…names, photos, and emails available on Courseworks

Credits to Jae, Jason, and all previous class TAs that set up the course

Who am I?

Kostis Kaffes kkaffes@cs.columbia.edu

Assistant Professor in Computer Science

Just call me Kostis

Background

Undergrad in Electrical and Computer Engineering in Greece

Ph.D. in Electrical Engineering at Stanford

Spent some time at Google

Research focuses on systems – particularly scheduling, networking, and cloud

Course Homepage

https://cs4118.github.io/www/2024-1/

Please see the course page for:

- Lecture schedule, notes, and assignments

- Office hours calendar

- Exam dates and assignment deadlines

- Other course material

EdStem

https://edstem.org/us/courses/50753

!!Check that you have access to Ed!! It will be used for:

- Announcements
- Q&A (more on the next slide)
  - Post general interest questions as regular threads
  - Post team-specific questions as private threads

EdStem Etiquette

Do:

- Ask and answer questions. 1st place to go for non-personal questions
- Provide helpful tips and links for classmates
- Be considerate and friendly

Don't:

- Ask questions without first trying to solve it yourself
- Post code/critical info that leads directly to the solution
- Be impatient and rude

- Use private threads for questions specific to you or your team. We may ask you to make the post public (unless you ask us not to)
- Strongly prefer posting to EdStem over emailing the TAs (or me) directly

Courseworks

Courseworks will be used for:

- Distributing assignment-related files

- Some assignment submissions

Course Prerequisites

1. Solid C experience
   DON'T TAKE THIS CLASS IF YOU DON'T KNOW C

2. UNIX environment
   Must be comfortable with command line interface

3. Computer Architecture
   Basic knowledge of hardware: *registers, cache, etc.*
   Able to read basic assembly: *load, store, add, jump, etc.*

4. Data Structures
   Solid on the basics: *list, tree, stack, queue, etc.*

Columbia Courses:

For #1 and #2:
W3157 Advanced Programming

For #3:
W3827 Fundamentals of Computer Systems

For #4:
W3134, W3136, W3137 Data Structures

Hardware Requirements

You need a computer with:
- 64-bit multi-core CPU (you most likely have one)
- At least 8GB RAM

You must run one of the following platforms:
- Windows on x86 CPU (Intel or AMD)
- MacOS on x86 CPU
- MacOS on Apple M1/M2 chip
- Linux on x86 CPU

You will receive VMWare for your platform

Textbooks

1. Advanced Programming in the Unix Environments (APUE)
   - 3rd Edition, 2013, Addison-Wesley

2. Operating Systems: Three Easy Pieces (OSTEP)
   - Version 1.00, 2018
   - Free in PDF: https://pages.cs.wisc.edu/~remzi/OSTEP/

3. Linux Kernel Development (LKD)
   - 3rd Edition, 2010, Addison-Wesley

Exams

Two **synchronous** and **in-person** exams for all sections:

- Midterm: Thursday March 7, 4:10pm
- Final: Tuesday May 7, 4:10pm

No make-up and no alternative exams
Please take OS next semester if you can't make these times

If you receive extended time accommodation, you can't have a class after this class

Homework

(probably) **7 assignments** (without HW0)

Some are individual, some group assignments
Some are short and light, some are long & heavy

Assignments can carry different weights
Some assignments may not be graded (you won't know which ones)

Late policy: 20% penalty up to 24h; zero afterwards
HWs picked for grading will be 40% of the grade

Grading Policy

Homework (40%) + Midterm (30%) + Final (30%)

Letter grades are curved – no predetermined grade cutoffs

(Grading policy may change)

Zero Tolerance on Cheating

REQUIRED READING: http://www.cs.columbia.edu/~jae/honesty.html

You are cheating if you:
- Take code from friends, or search for code on the internet
- Look at solutions from previous semesters
- Upload any class materials to a public repository (e.g., Github) during or after the semester

We can detect cheating cases:
- We compare your submissions to **CURRENT** and **PREVIOUS** ones
- You submit work history – **minimum 5 commits required**

Part 1: Advanced Unix Programming

First four weeks: UNIX from the outside

- Advanced systems programming

Use basic **OS abstractions**:
processes, threads, concurrency, signals, networking, non-blocking & async I/O

hw3-multi-server:
add complex functionality to a provided basic web server

Part 2: Operating System Internals

OS theory reinforced by Linux kernel hacking

- Work with real-world C code implementing OS theory from the lecture

Implement basic **OS components**:
    system calls, synchronization, scheduling, memory management, file systems

Linux kernel hacking assignments (hw4-hw8)

Let's get started!!!

- Make sure that you have access to Ed

- Read the following two documents:
    - http://www.cs.columbia.edu/education/honesty
    - http://www.cs.columbia.edu/~jae/honesty.html

- See course page for **HW0** and **reading assignments**

- Start forming groups of 3 – feel free to use Ed