W4118
Operating Systems I

Spring 2025

columbia-os.github.io

Teaching Staff

Instructor:

Kostis Kaffes

7 TAs:

Alex Xu – Chelsea Soemitro – Denzel Farmer

Richie Fu – Brennan McManus - Prabh Sodhi

Nicholas Zhe Kai Yap

…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

(and some LLM stuff…)

Who are you?

Course Homepage

columbia-os.github.io

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/74294/

!!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.*
5. Unix Programming
   Must know the basics or be able to pick them up quickly: *processes, threads, I/O, etc.*

Columbia Courses:

For #1 and #2:
W3157 Advanced Programming

For #3:
W3827 Fundamentals of Computer Systems

For #4:
W3134, W3136, W3137 Data Structures

For #5:
W4995 Advanced **Systems** Programming

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 use VMWare Fusion/Workstation on 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 13, 4:10pm
- Final: Tuesday May 13, 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 carry the same weight
Some assignments may not be graded (you won't know which ones)

Late policy: No late days
We will just drop the assignment with the lowest score
(almost) no other exceptions

Grading Policy

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

Letter grades are curved – no predetermined grade cutoffs

(Grading policy may change)

Zero Tolerance on Cheating I

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**

Zero Tolerance on Cheating II

If you use an LLM like ChatGPT, the citation provided must include the full set of prompts used.

If you submit a homework that violates the collaboration rules:

- First offence: 0 grade in the respective homework
- Second offence: F in class and you are reported to the Dean’s office

For serious cases of cheating (copying someone's work without their knowledge or cheating on exams):

- F in class and you are reported to the Dean’s office

Do not let your your files lie around!!

Part 1: Advanced Unix Programming

First 3 weeks: UNIX from the outside

- Advanced systems programming

Use basic **OS abstractions**:

processes, threads, concurrency, signals, networking, non-blocking & async I/O

hw2-shell:

build a basic UNIX shell

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

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**
- Fill in the form we will post on Ed with your Github ID
- Start forming groups of 3 – feel free to use Ed