Computer Systems — Fall, 2015
CS 5600 — Professor G. Cooperman
http://www.ccs.neu.edu/course/cs5600/

Course Description:

Computer Systems discusses computers as an integrated whole, including: **hardware resources** (e.g., CPU cores, CPU cache, memory management unit (MMU), RAM); the **operating system**; and **systems languages** (assembly language, C (the low-level high-level language), POSIX threads, the shell (the original UNIX scripting language), and Python (the de facto scripting language of today)). This course will review the topics above (but including only an abridged "reading knowledge" of assembly). It will then apply this background to a real-world case study of importance today: Docker-style containers, the Cloud, and orchestration frameworks for clusters of servers. *NOTE: The CCIS faculty has voted for a strict cheating policy. Please ask, if you're not sure what's allowed.*

Faculty Information:

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Office Hours: Tues: 9:00 p.m. - 10:00 p.m. (after class); Fri: 5:30 p.m. - 6:30 p.m.; and by appointment.

Textbooks:

- *Operating Systems: Three Easy Pieces*, Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, `http://www.ostep.org` (version 0.90, free online textbook)
- *UNIX/XV6 source code:* `http://www.ccs.neu.edu/course/cs5600f15/unix-xv6/` `http://pdos.csail.mit.edu/6.828/2014/xv6/xv6-rev8.pdf`
- *Linux source code:* `http://www.tamacom.com/tour/kernel/linux/`
- *DMTCP source code:* `http://www.ccs.neu.edu/course/cs5600f15/dmtcp/`

Exams and Grades:

There will be a variety of homework assignments, plus a midterm and a final. They will be weighted 25% for the midterm, 35% for the final, 10% for all short homeworks combined, 15% for three regular assignments, and 15% for a team-based mini-project.

Syllabus:

Week	*Topics*	*Chapter*
Sept. 15	C/pointers/system calls, and models of linking	class lecture, xv6:syscall.c, xv6:sysproc
Sept. 22	Process startup, shell, file descriptors, and environment vars., I/O re-direction	Ch. 4–6, Ch. 2 (code), Ch. 5 (code), and xv6:file.c, xv6:sysfile.c, xv6:pipe.c
Sept. 29	Virtual Memory, static/dynamic linking, context switching, and mini-DMTCP	class lecture, xv6:memlayout.h, xv6:exec.c, and xv6:vm.c, xv6:kalloc.c, xv6:mmu.h
Oct. 6	Scheduling	Ch. 7, Ch. 8, Ch. 10, man getcontext, man setcontext, and xv6:swtch.S xv6:fs.c
Oct. 13	ELF dynamic libs: file/prog./sect. hdrs., GOT, PLT	class lecture
Oct. 20	Mid-term; Intro. to threads	Ch. 26–27
Oct. 27	POSIX Threads, Concurrency; a first look at Locks	Ch. 28–31, xv6:spinlock.c
Nov. 3	Virtual Memory, clock algo.; Cache/MMU/TLB	Ch. 13–15, Ch. 17–19, xv6:proc.{c,h}, vm.c
Nov. 10	ELF revisited; DMTCP plugins	class lecture, man dlopen,dlsym,ld.so
Nov. 17	Process synchronization, Signals revisited; and Locks (mutex, semaphore)	Ch. 27.3, Ch. 28, Ch. 31 (again)
Nov. 24	Filesystem; Python: high-level scripting	class lecture, xv6:fs.c,file.c,sysfile.c,exec.c
Dec. 1	Linux Containers, Docker, Cloud, Orchestration	class lecture
Dec. 8	Cloud, orchestration (cont.); review for final	class lecture
Dec. 15	Final Exam	