Syllabus for UCLA Computer Science 35L
Software Construction Laboratory

Lectures

1. Introduction, files and editing

- Multiuser and multiprocess operating systems
- GUI basics (e.g., X, Wayland, GNOME, KDE)
- CLI basics (e.g., Bash, xterm)
- Unix file system layout
- Everything is a file — device files
- Unix permissions
- Basic commands: ls; pwd, cd, mkdir, rmdir; echo, cat; cp, mv, ln, rm; chmod, kill, ps
- Documentation and man pages
- Emacs basics: introduction, online tutorial (C-h t), help (C-h ?), basic editing, directory editing, running shell commands, building programs, Emacs Lisp.

2. Commands and basic scripting

- Unix wildcards, basic regular expressions
- More advanced commands (e.g., grep, find)
- Pipelines and redirection
- Simple shell scripting
- Idea of interpreted languages

3. More scripting, VMs, and construction tools

- Basics of Python
- Java as a compromise between interpreted and compiled languages
- Building from source
  - make
  - automake and autoconf

4. Change management

- diff and patch
- Basics of Makefiles
- Version control systems, e.g., Git, Subversion
  - retrieving a tree to build and install
  - committing a change
  - dealing with merge conflicts

5. Low-level construction and debugging

- The C compilation and linking process
- Introduction to C
- Debuggers and debugging tools, e.g., GDB, Valgrind, strace.

6. Systems programming

- C and system programming
- Library calls vs. system calls

7. Faults, failures, errors, and holes

- Ways in which a program can go wrong
- Buffer overruns, and techniques for avoiding them
- Ken Thompson, Reflections on Trusting Trust (1984). In 2003 Jon Hall was reported to have said that the paper is not a theoretical speculation.

8. Security basics

- Threats, including eavesdropping, tampering, forgery, and denial of service
- Authentication, authorization, and accounting
- Chains of trust
- Firewalls, kernels, and sandboxes
- Intrusion detection
- Backups
- Security policies

9. Parallelism

- SIMD versus vector processing versus MIMD
- Processes versus threads
- Synchronization
- POSIX threads
- OpenCL
- OpenMP
- Clusters, massive parallelism, grids, and clouds

10. The crystal ball

- Trends in computing research and development
- Things to increase your chances at grad school: research, 199's, etc
- Other general tips for excelling in upper division classes