Introduction to Operating Systems

CMPS 111, Winter 2014

Prof. Darrell Long
TA: Daniel Lipovetsky

Baskin Engineering
UC SANTA CRUZ

Welcome!

Prof. Darrell Long
E2–371
darrell@ucsc.edu

Daniel Lipovetsky
E2-380
danl@cs.ucsc.edu

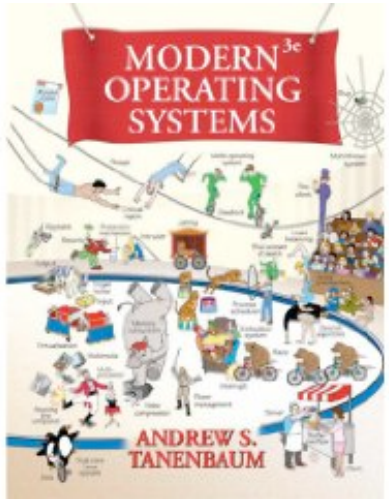
- Lab sections
  - TBA (Daniel)
  - TBA (Daniel)
- Office hours
  - Prof. Long: Wednesday 1400, and by appointment
  - Daniel: TBA
- Piazza: TBA

Introduction

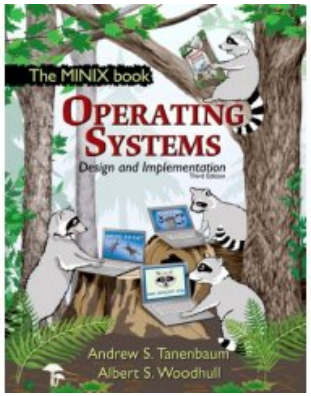
- Introduction, concepts, review & history
- Processes
  - Synchronization
  - Scheduling
  - Deadlock
- Memory management, address translation, and virtual memory
- Operating system management of I/O
- File systems
- Security & protection
- Case study: some of Unix (BSD), Linux, NT

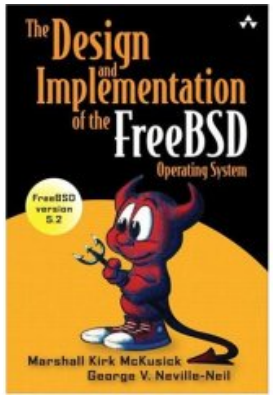
Textbooks

Required



Modern Operating Systems, ***3rd edition***
(Tanenbaum)





Optional

Operating Systems: Design & Implementation ***(3rd edition)***
The Design and Implementation of FreeBSD

Course requirements

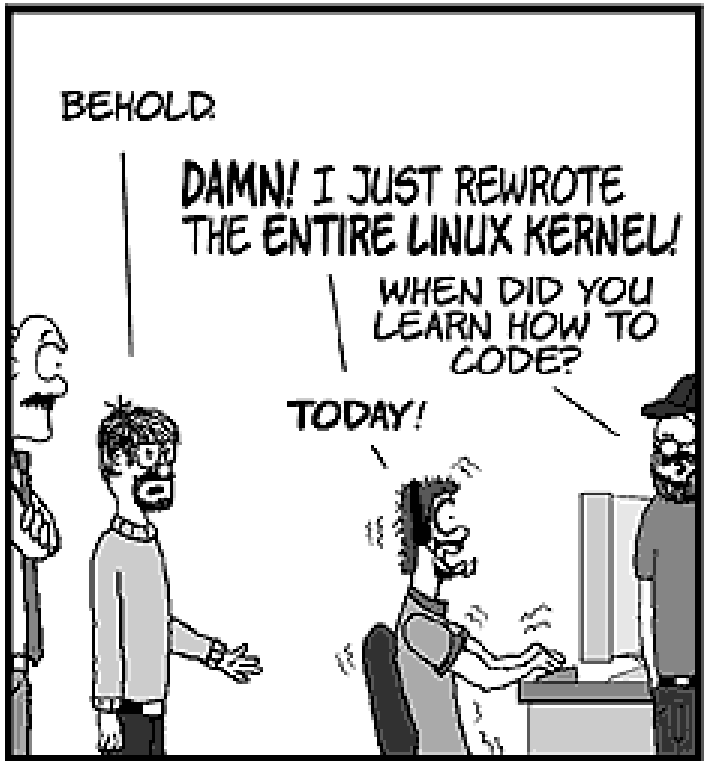
- Two exams
  - Midterm in the 5th–6th week
  - Final exam
- Projects
  - 4 projects during the quarter
  - About 2 weeks per project
- Homework
  - 5–6 homeworks during the quarter
  - 1 week per homework
  - Graded on a 0–5 scale
  - Need not do every homework to pass the class (but it certainly helps)
- Class participation

Grading

- Final grades based on:
  - Projects: 45% — all projects weighted equally
  - Homework: 8% — all homeworks weighted equally
  - Midterm: 17%
  - Final: 25%
  - Class participation: 5%
- Approximate grade ranges:
  - A: 89% – 100%
  - B: 79% – 88%
  - C: 69% – 78%
  - D: 60% – 68%
- To pass the class, you must
  - Complete all exams and projects (with non-zero grades)
  - Have at least a 50% average on exams and 50% average on projects
  - Satisfying both conditions does not guarantee a passing grade
    - Example: 51% on exams and 51% on projects ⇒ no pass

Programming projects

- Modify MINIX 3
  - Runs on x86 hardware
  - Virtual machine software runs on Mac OS X, Windows XP, Solaris
  - Tool set runs on MINIX
- Implement some of these:
  - Shell
  - Synchronization
  - Scheduling
  - System calls
  - Memory management
  - File system
- Learn about operating system structures
- Learn how to modify existing code
- Learn how an OS really works!



Project logistics

- For each project, hand in
  - Detailed design description
  - Code files & `Makefile` used to implement the project
  - Files used for testing your implementation
  - Documentation on how to build, run and test the project
- Submit code online
  - Work may be done on university-run systems or elsewhere
  - Probably better to use your own computer...
- MINIX install CD image available online
  - VirtualBox runs on some campus PCs
    - Free to anyone (open source)
  - VMware is free to students
  - Source code, tools included on install CD

Getting help

- This can be a tough class—get help if you need it!
  - The course staff (professor, TA) are here to help you learn the material
  - It's up to **you** to ask for help
- Don't wait too long!

- Ask questions in class
- Go to section
- Visit office hours (professor, TA)
- Ask general questions on the course newsgroup
- Ask specific questions by electronic mail to staff
  - Expect short answers, not long explanations

Academic honesty

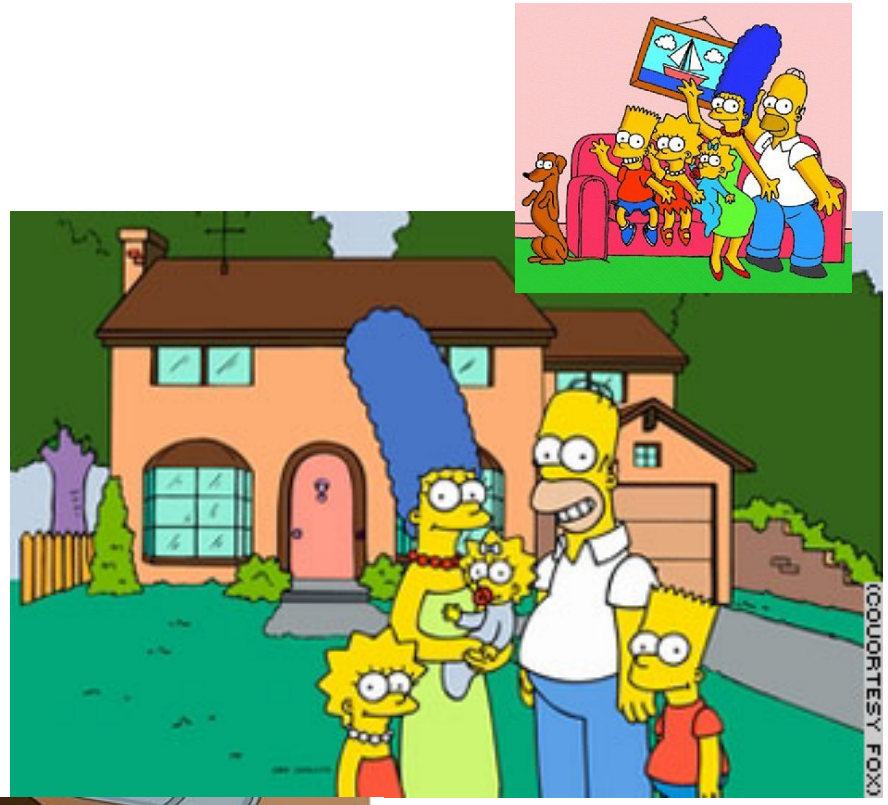
- You are expected to adhere to the highest ethical standards
  - All work you submit must be your own
  - You must give credit where it is due
- **Plagiarism of any form is unacceptable!**
- Consequences of dishonest conduct
  - A letter will be sent to your department, the School of Engineering, and the provost of your college
  - You **will** fail the course
- Bottom line: don't cheat!

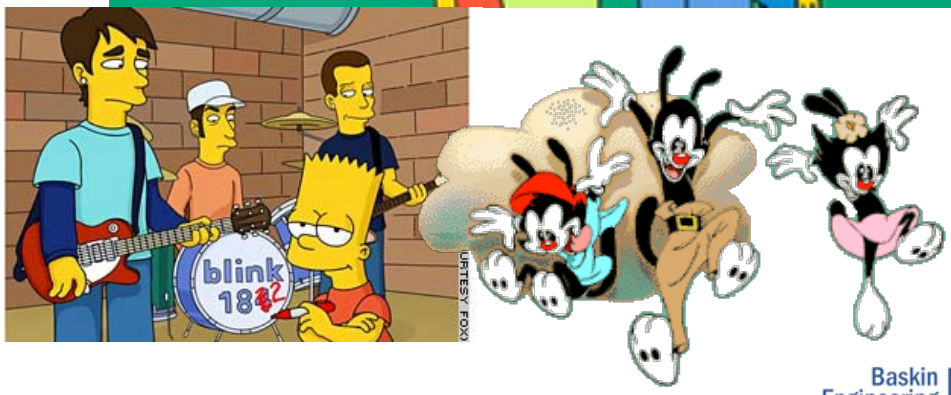
What is cheating?

- Homework
  - You may discuss general concepts with other students
  - You may not discuss answers to specific questions
- Projects
  - You may collaborate as part of a project group
    - All members of the group are graded equally
    - You must complete the first assignment on your own
  - Collaboration with anyone outside your group is limited
    - Follow the Simpsons rule…
    - Give credit to anyone from whom you get help
- Exams
  - You may not collaborate during an exam under any circumstances
  - Studying together before the exam is, of course, OK

The Simpsons rule (Gilligan's Island Rule)

- You may discuss the project or homework with others
  - General issues only
- You may not take notes
- You must take a 30 minute break before working on any 111 assignments
  - Watch The Simpsons or other (good) cartoons
  - Watch mindless TV
  - Work on other classes
  - Eat
  - Sleep





Secrets to success in CMPS 111

- Start projects early!
  - Write up your design document before writing code!
    - Spend less time writing code
    - Make it easier to get help from the professor and TA
  - Use the debugger
    - Details in lab section…
- Do the homework to test your own knowledge
  - If you don't understand something, ask
- The best time to get help is as soon as possible
  - Waiting until the last minute won't leave enough time for us to help you
  - You can always finish early and take the last day off….

What to do after graduation...

- Grad school vs. work?
  - Work: good if you want money *now*
    - Grad school typically covers expenses and tuition, but you won't get rich there...
  - Grad school: good if you like research (not being a code monkey)
  - Start now to apply for Fall 2012 (too late for Fall 2011)
    - Line up letter writers
    - Figure out where you want to go
    - Talk to faculty!
- Either way, join the ACM / IEEE / USENIX
  - Community of colleagues
  - Access to papers
  - Informative (and fun) conferences
  - Cheap to join as a student!

Getting numbers right

- Many problems in computer systems involve numbers
  - How many disk requests per second?
  - How much memory?
  - How many interrupts can each CPU handle?
- Estimation can be useful to check your answer
- Example: how many disk requests can your five disk system handle per second?
  - Estimate
    - Disk requests take about 10 ms each
    - Each disk can do about 100 per second
    - Five disks can do 500 per second
  - Actual (tentative) answer: 54,000 requests per second
    - Is this likely to be right?

Estimates can be helpful in other ways

- Question: how much water flows out of the Mississippi River in a year?
- You could look the answer up on-line, but is it right?
- Solution: estimate
  - Two possible ways to get the answer
  - If they both agree (or are close), you're probably right…
  - The solution may not be in useful units (in this case, I found one in cubic feet per second)
- What are the two ways to figure this out?

- To avoid gross errors, you should know
  - Metric prefixes (kilo, milli, giga, etc.)
  - How to estimate using powers of ten (scientific notation)
  - How to convert powers of two to powers of ten