Boot Camp

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This Is a Hard Class

- Traditional hazards
  - 410 letter grade one lower than other classes
  - All ***other*** classes this semester: one grade lower
- Aim
  - If you aim for a B you might not get one
  - If you aim for a C you might not get one
  - “I'll drop if I can't get an A”
    - You ***must*** discuss this with your partner ***early***

This is a *Transformative* Class

- Genuine achievement, available to you
  - What is an OS, ***really?***
  - Mutual exclusion, synchronization, concurrency
  - Deadlock
- Design, planning
- Serious competence in debugging!

Work Flow – You may be used to...

- Assignment handout $\Rightarrow$ code outline
- Compilation implies correctness
- Graded by a script
- All done!
  - Never use it again
  - Delete it at end of semester
- ***Total opposite of real life***

Work Flow – 410 Additions

- Design
- Divide into parts
- Manage your partner
- Merge

Surprises

- “Code complete” means ***nothing***
  - Merge can take ***three days***
  - ***Then*** you find bugs.
- Code with “the right idea” will ***immediately*** crash
  - If you're lucky!

On Debugging

As soon as we started programming, we found to our surprise that it wasn't as easy to get programs right as we had thought. Debugging had to be discovered. I can remember the exact instant when I realized that a large part of my life from then on was going to be spent in finding mistakes in my own programs.

– Maurice Wilkes (1949)

Debugging

- Bugs aren't just last-minute glitches
- They are crucial learning experiences
  - Learning a lot can take a while

What Does A Bug Mean?

- “It tells me 'triple fault' – why??”
  - Research: 20 minutes
  - Think: 20 minutes
  - Debug: 2 hours.
  - ...three times.
- May need to ***write code*** to trap a bad bug
  - Asserts or more-targeted debug module
- Then you will find your design was wrong!
  - Don't be shocked – this is part of 410 / life

“All Done”?

- Finally, when you're done...
  - You will use your code for next assignment
  - We will read it (goal: every line)

Interlude

- What is source code “for”?
  - What do we do with it?

Interlude

- The purpose of code is for ***people to read***
  - By a reviewer / security auditor
  - By your group
  - By your manager
  - By your successor
  - By you six months later (6 hours later if no sleep)
- Oh, yeah, the compiler reads it too

Confront the Material

- We are doing printf() ***all the way down***
  - Subroutine linkage, how & why
  - Stub routine, IDT entry, trap handler wrapper
  - Output/input-echo interlock
  - Logical cursor vs. physical cursor
  - Video memory (what does scrolling mean?)
- Can't really gloss over ***anything***

On Investing

A week of coding can sometimes save an hour of thought.

– Josh Bloch

Confront Debugging

- Real life: you will debug other people's code
  - Any bug could be yours, partner's, ours, or simics; you need to ***find*** it.
- ***Can't*** debug with only printf()
  - Learn the Simics debugger
  - Assertions, consistency checks
  - Debugging code

Confront Debugging

- ½ hour of studying the debugger
  - vs. 2 days of thrashing
- Papering over a problem
  - Re-ordering object files to avoid crash

How to Have Trouble

- How to get an R
  - Arrive unprepared (barely escape 113, 213)
  - Do everything at the last minute
  - Don't read the book or come to class
  - Hide from course staff no matter what
- How to get a D
  - Don't get the core of the kernel project working
    - (There are other ways, but this one is popular)

Warning About 15-213

- It's an important class
- We expect you to ***know***
  - Byte, word, register, 1<<2
  - Thread, stack
  - malloc(), free() (when & why)
- Trouble with 213?
  - Expect to spend extra effort on 410

Warning to Graduate Students

- This is an undergraduate class
  - There is typically a diversity of grades
- Getting "average grades on every assignment" ***may*** mean a C, not a B

Doing Well – Invest in Good Code

- Mentally commit to writing ***good*** code
  - Not just something kinda-ok
  - You will ***depend*** on your code
- Anand Thakker
  - Remind yourself that you love yourself
  - So you should wrote good code for yourself

Doing Well – Start Early

- Starting a week late on a 2-week project can be bad
- Not making “just one” checkpoint can be bad

Doing Well – Read Partner's Code

- You will ***need*** to read everything your partner wrote
  - (and maybe answer test questions)
- Set up a mechanism
  - Daily meeting? Careful reading of merge logs?
- Do “one of each”
  - Partner does N-1 stub routines, you do hardest

Doing Well – Time for Design

- "Design" means you may need to think overnight

How to get an A

- Understand ***everything***
  - (consider 2-3 ways to do each thing, pick the best)
- Read ***all of*** your partner's code
- Work ***with*** your partner
  - (not: work alone for 4-5 weeks out of 6, then (fail to) merge)

How to get an A

- Write ***good code***
- Do things which ***help you***
  - asserts, good variable names, source control
- Document ***before*** coding
- Be “done” ***days*** early