CS 31: Intro to Systems
Course Introduction

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Swarthmore College
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What This Class Is About

1. How a program executes on the hardware

2. The systems costs of program execution

3. An introduction to operating systems

4. Foundations of parallel programming
Instructor: Kevin Webb


- Please call me Kevin (or Professor/Dr. Webb)

- Research: Control platforms for networks

- Making stuff (woodworking, electronics), cactus/fruit plants, PC games, weight lifting
Instructor: Kevin Webb


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- Research: Control platforms

- Making stuff (woodworking, cactus/fruit plants, PC games)
Office Hours

• Mondays 12:30 PM – 2:00 PM
• Thursdays 2:45 PM – 4:00 PM
• By appointment

• 255 Science Center
Ninjas!

• Sessions Sundays 7-11 PM in SCI 256

Greg

Jessica

Kei

Sally
Sara “Scout” Sinclair

• CS Department has a new lab lecturer!
Tonight

- Using Unix help session
  - 7:00 PM – 8:00 PM
  - Open to everyone
  - If this is your first CS course here, you should go!

- Location: SCI 256
Resources

• Piazza Q&A Forum
  – https://piazza.com/swarthmore/fall2018/cs31/home

• Slides & audio on course website

• Lab sections:
  – Clothier 016
  – Wednesdays 8:50-10:20, 1:15-2:45, 3:00-4:30
Email Policy

• Please use Piazza rather than email
  – Your classmates benefit from your questions
  – Your classmates can answer your questions
  – I will check the forum frequently

• I will attempt to respond to within 24 hours

• If you do email me, please use kwebb@cs...
How does this class work?

• This class is designed a bit differently from what you might normally be used to
  – Class will be centered around discussion
  – Requires your participation

• Ever considered why we have lectures?
Traditional Lectures:

• Roughly one millenium old
Traditional Lectures:

- Little opportunity for expert feedback
- Might as well skip class and watch video lectures!
  - (I am not actually suggesting this. Please attend your classes!)
Interactive Classes with Peer Instruction

- You do the “easy” part before class.

Class is reserved for interactive, customized experiences

Research on how people learn:
- Everyone constructs their own understanding
- To learn, YOU must actively work with a problem and construct your own understanding of it
Clickers!

- Lets you vote on questions in real time.
- Like pub trivia, except the subject is always systems.
Peer Instruction

• Short quiz at the beginning of class
• During class: pose carefully designed questions
  – Solo vote: Think for yourself and select answer
  – Discuss: Analyze problem in teams of 3
    • Practice analyzing, talking about challenging concepts
    • Reach consensus
    • If you have questions, raise your hand and I’ll come over
  – Group vote: Everyone in group votes
    • You must all vote the same to get your point
  – Class wide discussion:
    • Led by YOU (students) – tell us what you talked about in discussion that everyone should know!
Why Peer Instruction?

• You get a chance to think.
• I get feedback as to what you understand.
• It’s more engaging!
• Research shows it promotes more learning than traditional lecture.
Giving out Candy

• To people willing to
  – Ask a question
  – Share an explanation
  – Summarize what their group talked about

• Your explanations are CRITICAL for fellow students’ learning
Example Question

• Individual vote

• Group discussion / group vote
  – Room should be LOUD

• Class discussion
The best TV series is:

A  Arrested Development
B  Breaking Bad
C  Firefly
D  The Wire

E: Some other series (be prepared to discuss what and why!)
Grading

• 5% Reading Quizzes
• 5% Class participation
• 25% Midterm Exam
• 30% Final Exam
• 35% Lab Assignments
Grading

- 5% Reading Quizzes
- 5% Class participation
- 25% Midterm Exam
- 30% Final Exam
- 35% Lab Assignments

- I will drop your three lowest quizzes/no-shows.
Reading Quizzes

• Readings from online sources

• Target low difficulty: did you read?

• Goal: incentivize / reward preparation
  – Can be an easy 5%!
Supplemental Textbook

Policies

• Collaboration
  – You may discuss approaches, not solutions
  – You must submit your own work
  – Exams may include questions on programming

• Cheating
  – Zero tolerance for cheating, don’t do it!

• Lab Lateness
  – 48 hours of extra time for the semester
Tentative Schedule

• Midterm – Oct 24, 7:00 PM – 8:30 PM

• Final - TBD

• Labs
  – Out on Wednesdays (lab section)
  – Due on Tuesdays

If this time is known to be a problem for you, tell me TODAY!

Mark your calendar!
Administrative Questions?

• All of this info (should be) on class website

• Feel free to ask on Piazza discussion board
What is a computer system?

• Hardware and/or software that...
  – allows the user to interact with programs
  – allows programs to run and use machine’s resources
  – makes computer easier to use

• Improves the computer’s capabilities
  – performance
  – reliability
  – security
  – usability
Turn undesirable into desirable

• Turn undesirable inconveniences: reality
  – Complexity of hardware
  – Single processor
  – Limited memory

• Into desirable conveniences: illusions
  – Simple, easy-to-use resources
  – Multiple/unlimited number of processors
  – Large/unlimited amount of memory
Three big ideas

• Abstraction
  – What is the desired illusion?
  – How do we interact with it?

• Mechanism
  – How do we create the desired illusion?
  – How does it work?

• Policy
  – How do we make it work well, to meet a goal?
Why should you care?

• To know how your computer works
  – What may be wrong with your programs
  – How to enhance your computer, applications

• Systems programmers get respect
  – In high demand, get paid well

• Real-world impact
Pacman

- Pacman freaks out if you complete level 255

- Why?
Therac-25

• Anyone heard of this?

• Very similar to Pacman bug, only with tragic consequences.

• Radiation therapy machine, misdosed patients
Toyota Acceleration (2009-2011)

• Unintended acceleration

• ~9 million vehicles recalled

• “Stack overflow”
Mars Pathfinder (1997)

- Frequently locked up and stopped responding
  - (automatic reboot)

- “Priority inversion” in parallel software
Pokémon Yellow

- Cleverly “hacked”, game completed in 1:36
- “Buffer overflow” exploit
This Course

• How your programs *really* execute

• 1\textsuperscript{st} half: focus on hardware execution
• 2\textsuperscript{nd} half: focus on operating system
Clicker Registration

• [https://goo.gl/forms/BpOGDVSNpBI3JuXW2](https://goo.gl/forms/BpOGDVSNpBI3JuXW2)

• If you don’t register your clicker, I can’t give you credit for quizzes / participation!
Your TODO list

• Readings posted on course web page.

• Sign up for Piazza!

• Please let me know (emails ok) about:
  – Your preferred name, if different than roster name
  – Your preferred gender pronoun
  – Disability accommodations

• Register your clicker, if you didn’t already...

• Pick up account form if you’re new to CS department.
If you’re not officially enrolled...

• You should have gotten an email from me yesterday!

• If not, come talk to me now!

• Please fill out drop/add forms soon...