What is this class about?

1. To understand how systems work when you execute a program.

2. The systems costs of program execution

3. An introduction to operating systems

4. Foundations of parallel programming
Instructor: Vasanta Chaganti

http://www.cs.swarthmore.edu/~chaganti/

Please call me Vasanta (or if you prefer, Professor Chaganti)

Office Hours
Office: SCI Center 252D

- Mondays 3-4:30 PM
- Thursdays 2:30-4:00 PM
- By Appointment

Research: Network Architecture

- Future Internet Architectures: Seamless device and content mobility
- Differential privacy for Network data: What does your network data reveal about you?
CS 31 Lab Instruction

Sara “Scout” Sinclair
Office SCI 262A
• Thursdays: 11:15 - 12:15 PM,
• Fridays: 3:00 - 4:00 PM
• By Appointment

Rich Wicentowski
Office: SCI 251
• Mondays: 9:15 - 10:15 AM,
  Mondays: 1:30 - 2:30 PM
• By Appointment
Ninjas!

• Sessions Sundays 7-11 PM in SCI 256
• Ninjas: Greg, Sally, Kevin and Shayne
Tonight: Unix help session!

- **When?** 7:00 PM – 8:00 PM
- **Where?** SCI 256
- **Who is it for?**
  - Open to everyone!
  - **If this is your first CS course here, you should go!**
Resources

• Piazza Q&A Forum

• Slides & audio on course website

• Lab sections:
  – SCI Center 240
  – 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 chaganti@cs.swat...
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

One person lecturing to an audience that passively listens.
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
- To learn, YOU must actively work with a problem and construct your own understanding of it
Peer Instruction

• **Short quiz, at the beginning of class**
  – Based on readings for that day
  – Ensure you are familiar with the terminology
Peer Instruction

• Discussion questions during class: question that introduces a new idea

1. **Solo vote**: Think for yourself and select answer

2. **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
Peer Instruction

• **Discussion questions** during class: question that introduces a new idea

1. **Solo vote**: Think for yourself and select answer
2. **Discuss**: Analyze problem in teams of 3
3. **Group vote**: Everyone in group votes
4. **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.
Clickers!

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

https://goo.gl/forms/iJZNjs4KSSagfAKh2

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

Quiz scores count from week 2
Locating your Clicker ID

Will only have numbers 0-9 and letters A – F

A hexadecimal number
- More on this next week!

ID is also visible when you turn your clicker on.
Example Question

1. Individual vote (votes with Clicker)

2. Group discussion / group vote
   – Room should be LOUD

3. Class discussion
The most useful super power for a college student would be:

A. Invisibility
B. Lots of $$$
C. Telepathy
D. Weather
E. Some other power (be prepared to discuss!)
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

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%!
Readings

Suzanne J. Matthews, Tia Newhall, Kevin C. Webb

Dive into Systems
A Gentle Introduction to C and the Architectural Reef Below

Authors: Suzanne J. Matthews, Ph.D. - West Point suzanne.matthews@westpoint.edu
Tia Newhall, Ph.D. - Swarthmore College newhall@cs.swarthmore.edu
Kevin C. Webb, Ph.D. - Swarthmore College kwebb@cs.swarthmore.edu

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Supplemental Textbook

Policies

• Lab Lateness
  – 48 hours of extra time for the semester
  – Email AFTER you are done!
  – No Email: Grade whatever is present at the deadline.
Policies: academic dishonesty

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

• Cheating
  – We take this very seriously. It can have a negative impact on your course grade, your GPA and your record at Swarthmore and beyond.
  – Don’t do it!
Schedule

• Midterm: **March 07, In-class.**
  – **Mark your calendar!**
  – **Let me know if this is a problem today!**

• FINAL – TBA

• Labs:
  – Labs are held on Wednesday
  – Out (usually) on Monday nights
  – Due on Tuesdays
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
What is a computer system?

• GOAL: Improve 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
Pac-Man

- 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
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 Jeff!

• If not, come talk to me now!

• Please fill out drop/add forms soon…
Next Class

- Data representation!