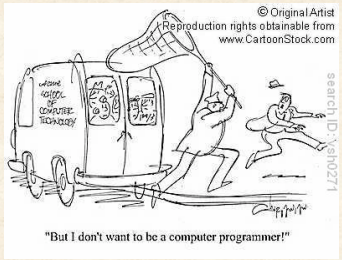
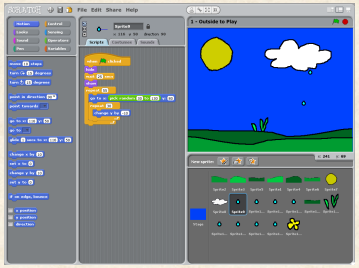
UNIVERSITY of WISCONSIN-MADISON
Computer Sciences Department

CS 202: Introduction to Computation — Professor Andrea Arpaci-Dusseau

CS 202: Introduction to Computation

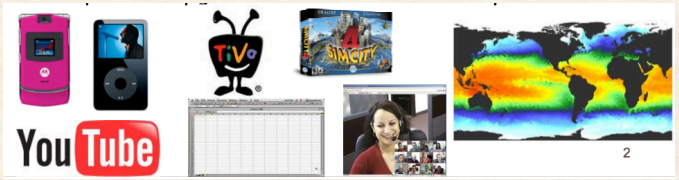




Motivation for CS 202

Computation is revolutionizing daily life

- Change how we live, work, learn, and communicate
- Increases productivity
- Drive advances in nearly all other fields



Goal: Understand how to think "computationally"

What will you learn in CS 202?

1. Design and implement creative applications
   - Scratch: programming environment for beginners
   - Animations, stories, art, games
2. Computation is powerful
   - Simple algorithms can solve complex problems quickly
   - Algorithm: Step-by-step method for accomplishing task
3. How modern computers work
   - Hardware:
     - How to go from bits (1s and 0s) to running anything and storing all information?
   - Software (Operating System):
     - How to run multiple apps? How to build Google?
4. Interesting frontiers of Computer Science
   - Artificial Intelligence, Robotics, Security, Education

What is NOT focus of CS 202?

NOT – How to use different applications

- Word, ppt, excel, databases, web searching
- Goal: Design and build our own applications

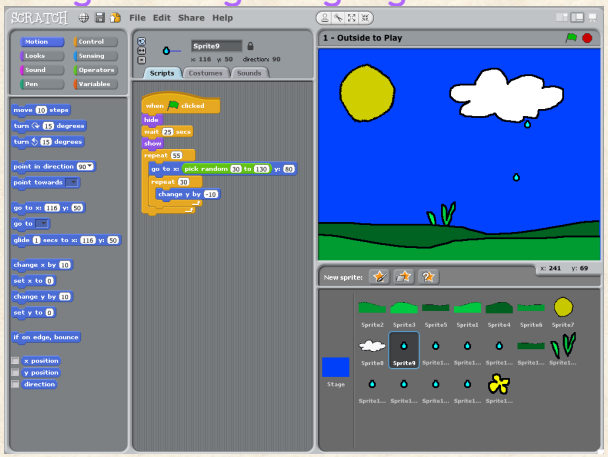
NOT – How to administer computers

- Reboot or install OS, configure firewall, printer
- Goal: Understand fundamentals behind operation

NOT – Implications of technology

- Impact of facebook or twitter on society
- Goal: Understand how they are designed and limits

Programming Language: Scratch



Scratch Demo

Easy to create many interesting programs

- Animations with Music
- Interesting Graphic Effects
- Logic and Strategy Games
- Simulations
- Video Games

What will you do in CS 202?

1. Create: Opportunity to implement your ideas
   - Art, stories, music, games, designs – All interactive!
   - Share your work with others in class
2. Explore: How good are current techniques? What is the frontier of CS?
   - Language translation, image recognition, search, visualization, web page creation
3. Understand: How does computation work?
   - Programming, logic, binary numbers

What will you do in CS 202?

Homework (~11 assignments): 50%

- Approximately 1/week
- Create, explore, and understand
- Programming in Scratch, short essays, pencil+paper analysis
- First one available today (see webpage), due in one week

Exams (3): 35%

- Two in-class exams 10% each
- Final exam: 15% (part cumulative, part not)
- Closed book, closed notes

Extra credit:

- Creative homeworks that you share with class
- Class attendance and participation (minor)

Scratch Design Project

Scratch Design Projects: 15% of total grade

- Prototype some new object

Details

- Open-ended show some creativity
- Work in small group (2 or 3)
- Expect significant effort: many, many hours
- Everyone demos to everyone else
- Instructor and TAs happy to give advice
- End of semester

Semester: Three Motivating Themes

Theme 1: Interacting with humans

- How can we create games that compete against humans? (play chess or jeopardy)

Theme 2: Big Data

- How does huge amounts of data change the problems we can solve?

Theme 3: Run any program

- How do computers work to solve these problems?

Resources: People

Instructor:

- Professor Andrea Arpaci-Dusseau
- dusseau@cs.wisc.edu
- Office: Computer Sciences 7375
- Office Hours: TBA

TAs: Help with homeworks and programming

- Weekly (optional) sessions in Computer Lab : 1370 CS
- Times posted soon
- cs202-tas@cs.wisc.edu to ask all of us

Classmates: Help okay (hw all have creative aspect)

Resources: Web Page

Course Web Page:
http://www.cs.wisc.edu/~cs202-1

Detailed syllabus

- Slides from lecture (after)
- Code samples from class

Recommended textbook: Attend lecture!

- Backup textbook: Invitation to Computer Science
- Not perfect match with 202 (does not use Scratch)
- Copy on reserve at library and available in Computer Lab

No laptops during lecture

- Occasional laptop days for experimentation

Homework 1: Due 1 week (Details on Course Webpage)

A) Investigate on-line Scratch projects

B) Explore Games with a Purpose
- Help humanity by playing 3 on-line games

C) Help CS Education with on-line survey

Before you leave…

Fill out and return paper survey

Get From Webpage…

What will you learn in CS 202?

How do computers…?	Answer
Interact with humans?	Artificial intelligence
Solve problems?	Algorithms
Know what to do?	Programming languages
Make art?	Control flow: Sequential and Repeat
Show animated stories?	Flowcharts and Abstraction
Make decisions?	Decision Trees and If statements
Remember what has happened?	Variables
Avoid race conditions?	Critical sections
Educational software?	Private vs. shared variables
Understand humans?	Natural language processing
Interact with humans?	Social robots
Guess what may happen?	Probability trials
Win games against you?	Game trees

What will you learn in CS 202?

How do computers…?	Answer
Solve societal problems?	Lots of data
Visualize data?	More abstraction
Find goal?	Optimization
Find stuff?	Search
Find stuff faster?	Binary search
Teach the world?	Digital StudyHall
Analyze text?	Histograms
Find web pages?	Search engines (Google)
Sort data?	Selection and insertion sort
Sort data faster?	Merge and quick sort
Predict the future?	Simulation
Share secrets?	Cryptography
Reach their limits?	P vs. NP

What will you learn in CS 202?

How do computers…?	Answer
Work???	
Represent information and integers?	Bits and binary
Represent words, pictures, sound?	Encode and compress
Act logically?	Boolean logic, gates, and truth tables
Calculate?	Combinational circuits
Remember?	Memory
Execute instructions?	CPUs
Run multiple applications?	Virtualization (Operating systems)
Share memory well?	Caching
Communicate with others?	Networking
Use other languages?	Compilers
Tolerate faulty computers?	Logic with random information