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

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

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?

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?

<table>
<thead>
<tr>
<th>How do computers...?</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interact with humans?</td>
<td>Artificial intelligence</td>
</tr>
<tr>
<td>Solve problems?</td>
<td>Algorithms</td>
</tr>
<tr>
<td>Know what to do?</td>
<td>Programming languages</td>
</tr>
<tr>
<td>Make art?</td>
<td>Control flow: Sequential and Repeat</td>
</tr>
<tr>
<td>Show animated stories?</td>
<td>Flowcharts and Abstraction</td>
</tr>
<tr>
<td>Make decisions?</td>
<td>Decision Trees and If statements</td>
</tr>
<tr>
<td>Remember what has happened?</td>
<td>Variables</td>
</tr>
<tr>
<td>Avoid race conditions?</td>
<td>Critical sections</td>
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<tr>
<td>Educational software?</td>
<td>Private vs. shared variables</td>
</tr>
<tr>
<td>Understand humans?</td>
<td>Natural language processing</td>
</tr>
<tr>
<td>Interact with humans?</td>
<td>Social robots</td>
</tr>
<tr>
<td>Guess what may happen?</td>
<td>Probability trials</td>
</tr>
<tr>
<td>Win games against you?</td>
<td>Game trees</td>
</tr>
</tbody>
</table>
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</thead>
<tbody>
<tr>
<td>Solve societal problems?</td>
<td>Lots of data</td>
</tr>
<tr>
<td>Visualize data?</td>
<td>More abstraction</td>
</tr>
<tr>
<td>Find goal?</td>
<td>Optimization</td>
</tr>
<tr>
<td>Find stuff?</td>
<td>Search</td>
</tr>
<tr>
<td>Find stuff faster?</td>
<td>Binary search</td>
</tr>
<tr>
<td>Teach the world?</td>
<td>Digital StudyHall</td>
</tr>
<tr>
<td>Analyze text?</td>
<td>Histograms</td>
</tr>
<tr>
<td>Find web pages?</td>
<td>Search engines (Google)</td>
</tr>
<tr>
<td>Sort data?</td>
<td>Selection and insertion sort</td>
</tr>
<tr>
<td>Sort data faster?</td>
<td>Merge and quick sort</td>
</tr>
<tr>
<td>Predict the future?</td>
<td>Simulation</td>
</tr>
<tr>
<td>Share secrets?</td>
<td>Cryptography</td>
</tr>
<tr>
<td>Reach their limits?</td>
<td>P vs. NP</td>
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</tbody>
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<th>Answer</th>
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<tr>
<td>Work????</td>
<td>Bits and binary</td>
</tr>
<tr>
<td>Represent information and integers?</td>
<td>Encode and compress</td>
</tr>
<tr>
<td>Represent words, pictures, sound?</td>
<td>Boolean logic, gates, and truth tables</td>
</tr>
<tr>
<td>Act logically?</td>
<td>Combinational circuits</td>
</tr>
<tr>
<td>Calculate?</td>
<td>Memory</td>
</tr>
<tr>
<td>Remember?</td>
<td>CPUs</td>
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<tr>
<td>Execute instructions?</td>
<td>Virtualization (Operating systems)</td>
</tr>
<tr>
<td>Run multiple applications?</td>
<td>Caching</td>
</tr>
<tr>
<td>Share memory well?</td>
<td>Networking</td>
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<tr>
<td>Communicate with others?</td>
<td>Compilers</td>
</tr>
<tr>
<td>Use other languages?</td>
<td>Logic with random information</td>
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