Let’s get to know each other...

- Two minutes to know your neighbor... find out
  - Name
  - Year
  - Where were they born?
  - What will they be doing this summer for fun?
Why are you here?

- Curious about, or majoring in, Computer Science
- Major requirement
- Become a better programmer
- General interest in topic

Monday, June 27, 2011
What do you want to learn?

- Improve programming skills
- Learn Java
- Hone computational problem solving skills
- “Advanced” techniques to build programs to solve “real” problems
Your experience programming...

- “There are 2 fun parts of writing a computer program: the beginning and the ending.”
- “It is both fun and frustrating.”
- “debugging drives me crazy”
- “that moment when you finish debugging and everything works makes it worth it”
- “I think of each program like a logic puzzle to solve, which makes it fun!”
What will you do for fun?

- Nothing if this class takes over my life!
Concerns

- **Pace**
  - This *is* a demanding course, see syllabus for course expectations

- **Grades and curve**
  - See syllabus: no curve, lowest scores dropped/reduced

- **Only 6 assignments?**

- **Lack of Java experience**
What is this course about?

Programming?
/**
 * Given a File object representing a directory and a String
 * that represent a search term, this method finds all occurrences
 * of the search term in the files of this directory.
 */

public int findOccurrences(File directory, String searchString) {
(CODE DEMO)
## Performance comparison

<table>
<thead>
<tr>
<th></th>
<th>DirectorySearch.java</th>
<th>Google</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input size</strong></td>
<td>~ 5000 files</td>
<td>&gt; 40,000,000,000 web pages*</td>
</tr>
<tr>
<td><strong>Runtime</strong></td>
<td>&gt; 1 minute</td>
<td>&lt;1 second</td>
</tr>
</tbody>
</table>

What makes Google so fast?

- Faster machines?
- More machines?
- Caching?
- C instead of Java?
- A different algorithm?
Questions we’ll explore

- How do we represent “data” so that it accessed efficiently?
- How does the choice of representation depend on how we want to access it?
What’s this course about?

- **Data structures**
  - Ways of storing information ("data") for efficient access
## Performance comparison

<table>
<thead>
<tr>
<th></th>
<th>DirectorySearch.java</th>
<th>Google</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input size</strong></td>
<td>~ 5000 files</td>
<td>&gt; 40,000,000,000 web pages*</td>
</tr>
<tr>
<td><strong>Runtime</strong></td>
<td>&gt; 1 minute</td>
<td>&lt;1 second</td>
</tr>
</tbody>
</table>

How do we meaningfully compare software performance?
What’s this course about?

- **Data structures**
  - Ways of storing information ("data") for efficient access

- **Algorithm analysis**
  - Way of reasoning about efficiency of software
  - Allows us to make predictions about scalability
Sam Loyd’s 8 Puzzle

- **Goal**: Given an initial configuration of tiles, find a sequence of moves that will lead to the sorted configuration.
- How would you write a computer program that solves this puzzle?
Six degrees of separation

- Small-world phenomenon: we are all connected through a (short) chain of acquaintances

http://www.youtube.com/watch?v=afJRkbBEr2Q
Kevin-Bacon Game

- Find sequence of co-star relationship between given actor and Kevin Bacon:
  - Kevin Bacon
  - Tim Robbins
  - Fred Willard
  - Justin Bieber

Monday, June 27, 2011
Computational problem solving

- **Representation**
  - How do we represent the problem so that it is possible to perform computations on it?

- **Algorithm**
  - What sequence of computations will find the solution?

- **Implementation**
  - How do we structure the solution as a (Java) program?
Computational problem solving

Kevin Bacon Game

Different problems?

8 Puzzle
What’s this course about?

- Data structures
  - Ways of storing information ("data") for efficient access
- Algorithm analysis
  - Way of reasoning about efficiency of software
- Problem solving
  - Abstractions, algorithms, and implementations
Writing software

- What makes “good” software good? How do we write good software?

- Software design:
  - Principles of object-oriented design
  - Abstract data types
  - Design patterns
  - Powerful features of the Java language

- Programming methodology
  - Thinking (!), testing, debugging, documenting
What’s this course about?

- Data structures
  - Ways of storing information ("data") for efficient access
- Algorithm analysis
  - Way of reasoning about efficiency of software
- Problem solving
  - Abstractions, algorithms, and implementations
- Programming
  - Software design and programming methodology
Logistics
Course syllabus

- It is seven pages long.
- It is informative.
- Please read it.
  - Starting today, you are responsible for knowing the course schedule and policies, as outlined in the syllabus.

- Where to find it:
  - Online http://courses.cs.cornell.edu/cs2110
  - Emailed to you (Never got it? Send me email asap!)
Google group

- Join discussion group (you should get email today)
  
  http://groups.google.com/group/cs2110-2011/

- Post questions about lecture, assignments, exam, etc.
- Answer your peers’ questions! (Earns you karma.)
- Course staff will also monitor and answer questions.
Learning to think computationally

- Computational thinking is a different way of thinking
- Some students learn it quickly with little help from us
- Others find it more challenging
- If you are struggling... don’t despair!
  - Not being graded on a curve.
  - Try to learn from your peers
  - Seek help from course staff
- If you are excelling... earn karma!
  - Work on the bonus problems
  - Help your peers! (It will help you learn.)
Pretest

- Closed book, individual effort.
- **Does not** count towards your grade!
- To help you (and me) gauge your readiness for this course.

- **CS 1110 topics covered on pretest**
  - File I/O
  - Exceptions
  - You are expected to know these things for first homework assignment
Acknowledgments

- Slide material adapted from slides of previous CS 2110 instructors: Kozen, Birman, Joachims.