CS/ENGRD 2110 (FORMERLY CS 211) FALL 2010

Lecture 1: Overview

http://courses.cs.cornell.edu/cs2110

Welcome to CS2110!

- We'll be learning about…
  - Abstract data types and generics and reflection and other cool Java features
  - Reasoning about complex problems, analysis of the algorithms we create to solve them, and implementing those tricky algorithms with elegant, easy to understand, correct code
  - Recursion on graphs and other linked structures
  - Algorithmic complexity
  - (+ a lecture or two on quantum computing)

Is CS2110 right for you?

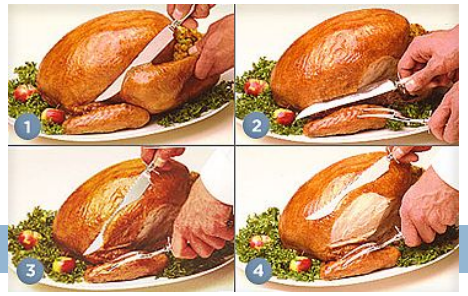
- CS32110 assumes you know Java
  - For example, you took cs111x at Cornell
  - Or took a high school course and got a 4 or 5 on the CS AP exam
- Don’t take cs1110 just because you are worried that your high school Java experience won’t do
- *We recommend against trying to skip directly into cs3110. Doing so requires permission from both Professor Birman and Professor Joachims!*

Lectures

- TR 10:10-11am, Olin 155
  - Attendance is mandatory

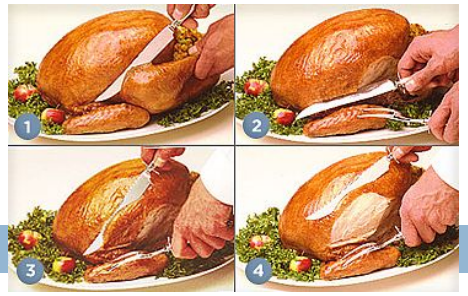
- ENGRD 2110 or CS 2110?
  - **Same course! We call it CS 2110**
  - **Non-engineers sign up for CS 2110**
  - **Engineers sign up for ENGRD 2110**

Sections



- Like lecture, attendance is mandatory
- Usually review, help on homework
- Sometimes new material
- Section numbers are different for CS and ENGRD
- Each section will be led by a member of the teaching staff
- No permission needed to switch sections
- You may attend more than one section if you wish

Sections



Sections Start Next Week!

Non-Eng	Eng	Day	Time	Room
4943	DIS 201	T	12:20PM - 01:10PM	OLH 245
4945	DIS 202	T	01:25PM - 02:15PM	OLH 165
4947	DIS 203	T	02:30PM - 03:20PM	BRD 140
4949	DIS 204	W	12:20PM - 01:10PM	PHL 219
4951	DIS 205	W	01:25PM - 02:15PM	HLS 306
4953	DIS 206	W	02:30PM - 03:20PM	PHL 219
4955	DIS 207	T	12:20PM - 01:10PM	HLS 401

Resources

- Course web site
  - **http://courses.cs.cornell.edu/cs2110**
  - Watch for announcements

- Course discussion forum
  - Currently setting this up on Google groups
  - Good place to ask questions
  - Once we have it running, we do expect you to check *daily* for updates on homeworks!

Academic Excellence Workshops

- Two-hour labs in which students work together in cooperative setting
- *One credit S/U course based on attendance*
- Time and location TBA
- See the website for more info

www.engineering.cornell.edu/student-services/learning/academic-excellence-workshops/

Resources

- Book: Frank M. Carrano, *Data Structures and Abstractions with Java, 2nd ed., Prentice Hall*
  - *Note: The 1st edition is seriously obsolete*
  - Sharing the textbook is a fantastic idea. You won't need a personal copy but you do need access to a copy from time to time
  - Copies of 2nd Edition on reserve in Engr Library
- Additional material on Prentice Hall website

- Great Java resource: the online materials at the Sun JDK web site. Google has it indexed.

Obtaining Java

- See Resources on website
- We recommend that you work with Java 6
- Need Java Development Kit (JDK), not just Java Runtime Environment (JRE)
- Many production releases… latest is usually best

Eclipse IDE

- IDE: Interactive Development Environment
  - Helps you write your code
  - Protects against many common mistakes
  - At runtime, helps with debugging
- Follow “Resources” link to download

“In my country of Kazakhstan everyone is use Eclipse! Excellent for hack American web site and steal credit card.

Java Help

- CS 2110 assumes basic Java knowledge
  - classes, objects, fields, methods, constructors, static and instance variables, control structures, arrays, strings, exposure to inheritance
- Need a refresher? Consider CS 1130
  - Transition to Object-Oriented Programming.
  - (self-guided tutorial, material on website)

Coursework

- 5 assignments involving both programming and written answers (45%)
- Two prelims (15% each)
- Final exam (20%)
- Course evaluation (1%)
- Occasional quizzes in class (4%)

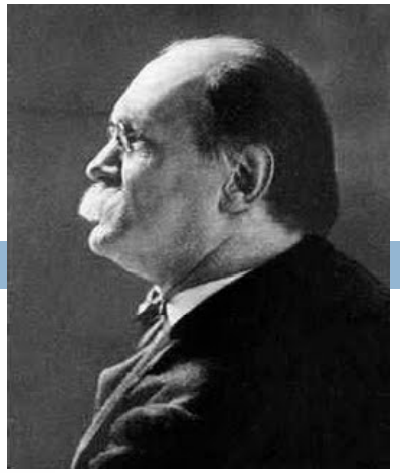
Assignments

- Except for assignment A1, assignments may be done by teams of two students
  - A1 is already posted on CMS
  - Just the same, we encourage you to do them by yourself and have considered making this the rule
  - Finding a partner: choose your own or contact your TA. Newsgroup may be helpful.

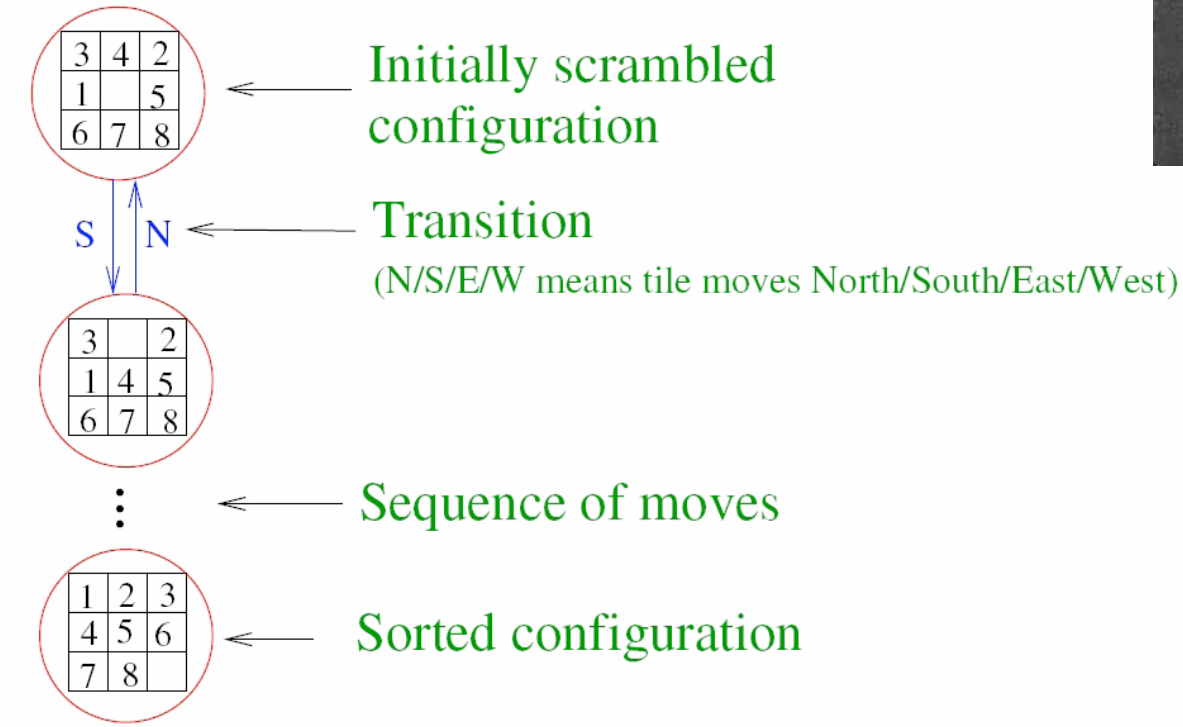
Academic Integrity… Trust but verify!

- We use artificial intelligence tools to check each homework assignment
  - The software is very accurate!
  - It tests your code and also notices similarities between code written by different people
- Sure, you can fool this software
  - … but it's easier to just do the assignments
  - … and if you try to fool it and screw up, you might fail the assignment or even the whole course.

Sam Loyd's 8 Puzzle

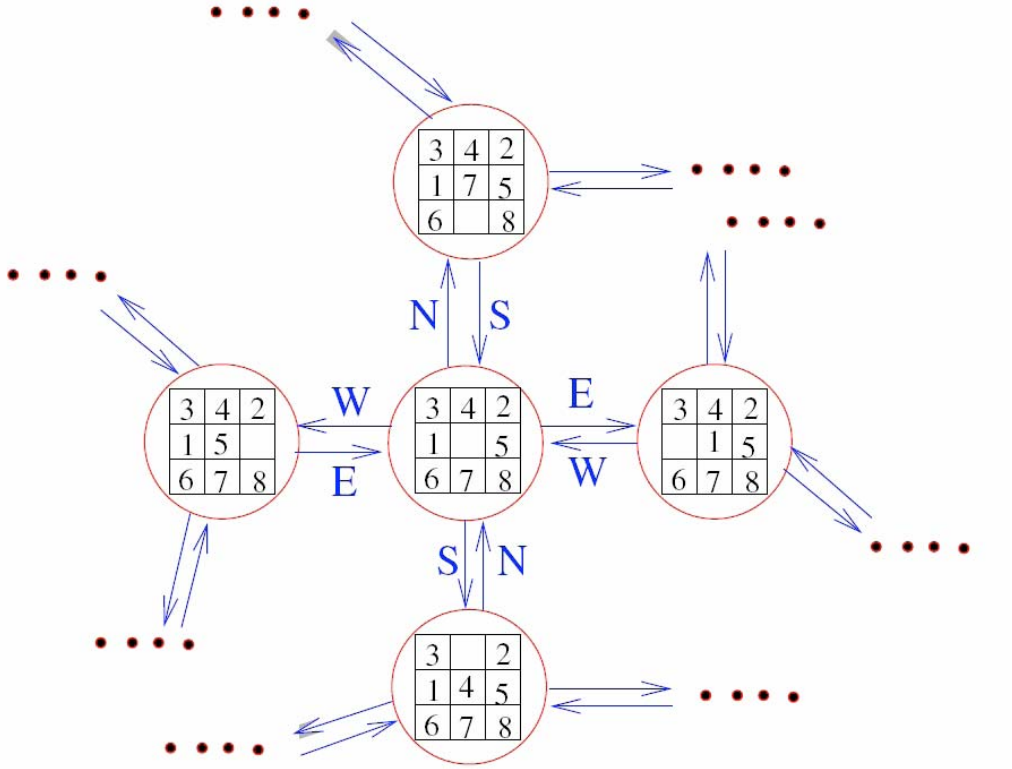


Sam Loyd



- Goal: Given an initial configuration of tiles, find a sequence of moves that will lead to the sorted configuration.
- A particular configuration is called a ***state of the puzzle.***

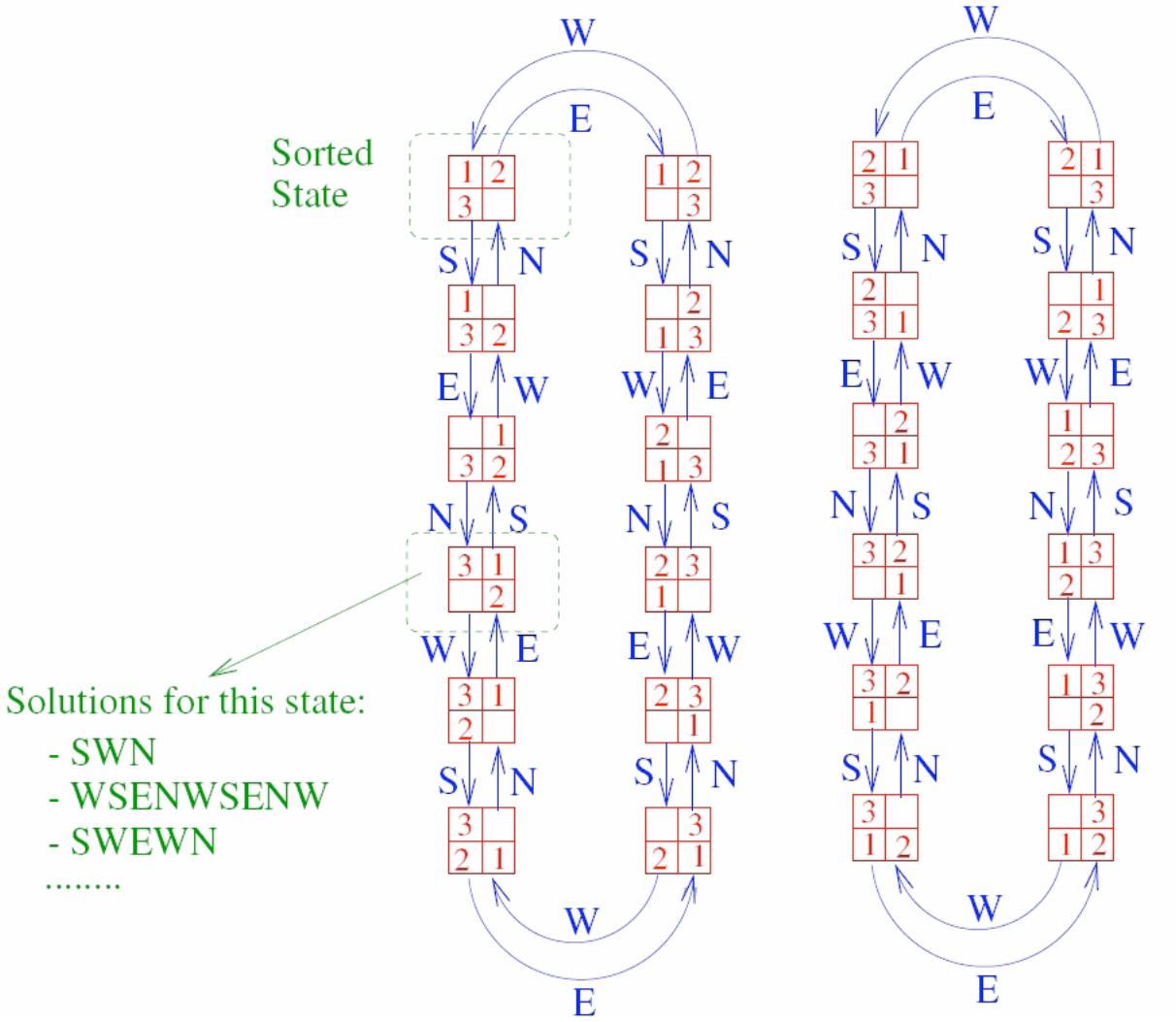
State Transition Diagram of 8-Puzzle



State Transition Diagram: *picture of adjacent states.*

A state Y is ***adjacent*** *to state X if Y can be reached from X in one move*

State Transition Diagram for a 2x2 Puzzle



« Simulating » the 8-puzzle

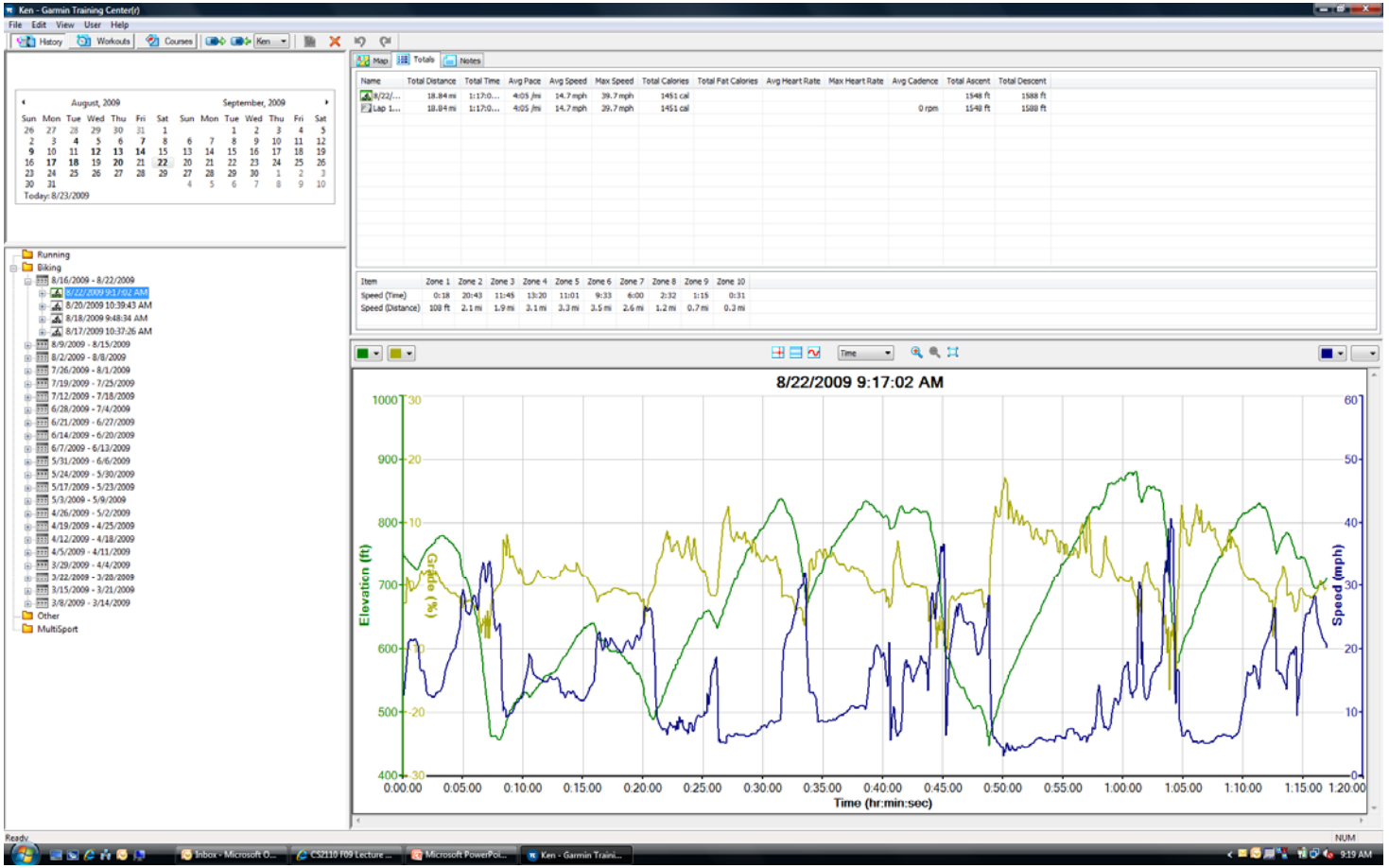
- What operations should puzzle objects support?
- How do we represent states?
- How do we specify an initial state?
- What algorithm do we use to solve a given initial configuration?
- How should we present information to the user? (GUI design)
- How to structure the program so it can be understood, maintained, upgraded?

Graphs

- State Transition Diagram in previous slide is an example of a ***graph:*** a mathematical abstraction
  - ***vertices*** (or ***nodes***): (e.g., the puzzle states)
  - ***edges*** (or ***arcs***): connections between pairs of vertices
  - vertices and edges may be labeled with some information (name, direction, weight, cost, …)
- Other examples of graphs: roadmaps, airline routes,. . .
  - A common vocabulary for problems

A very different example of a graph

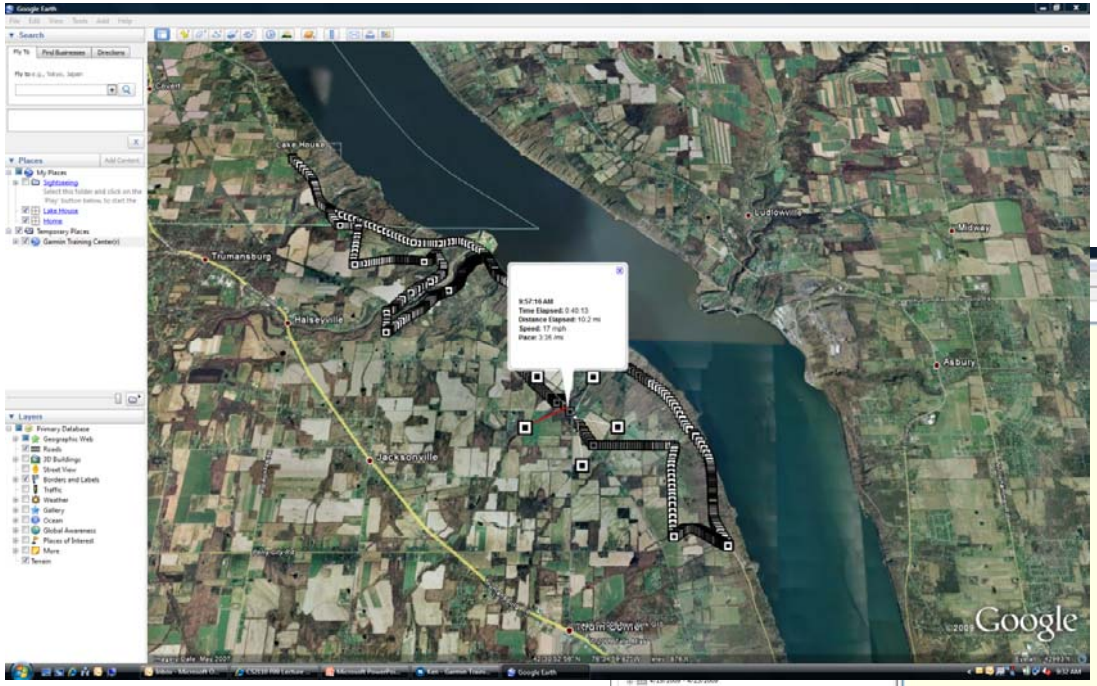
- Garmin GPS unit tracks your bike ride

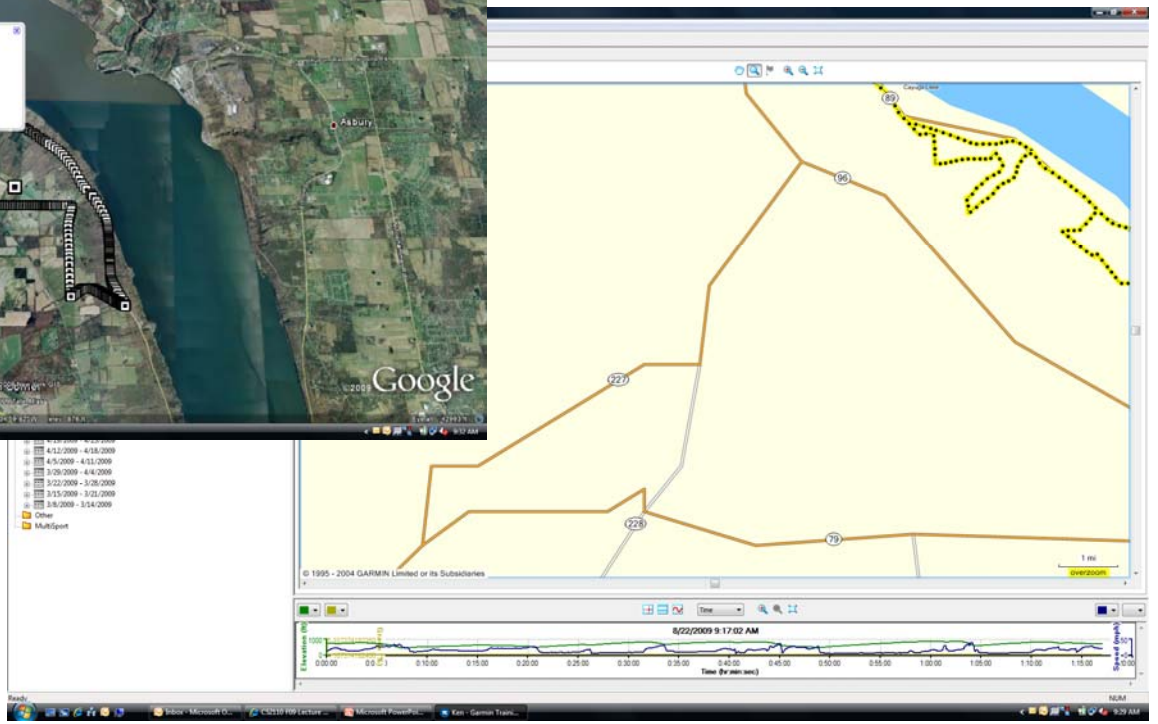


Actual data is a graph!

- Garmin GPS records a series of locations
  - (time, GPS-coordinates, distance since last record, temperature, etc)
  - The graph is defined by the sequence of points
- Road maps are also graphs and have a similar representation
- Allows Garmin to match my bike ride to a map for display

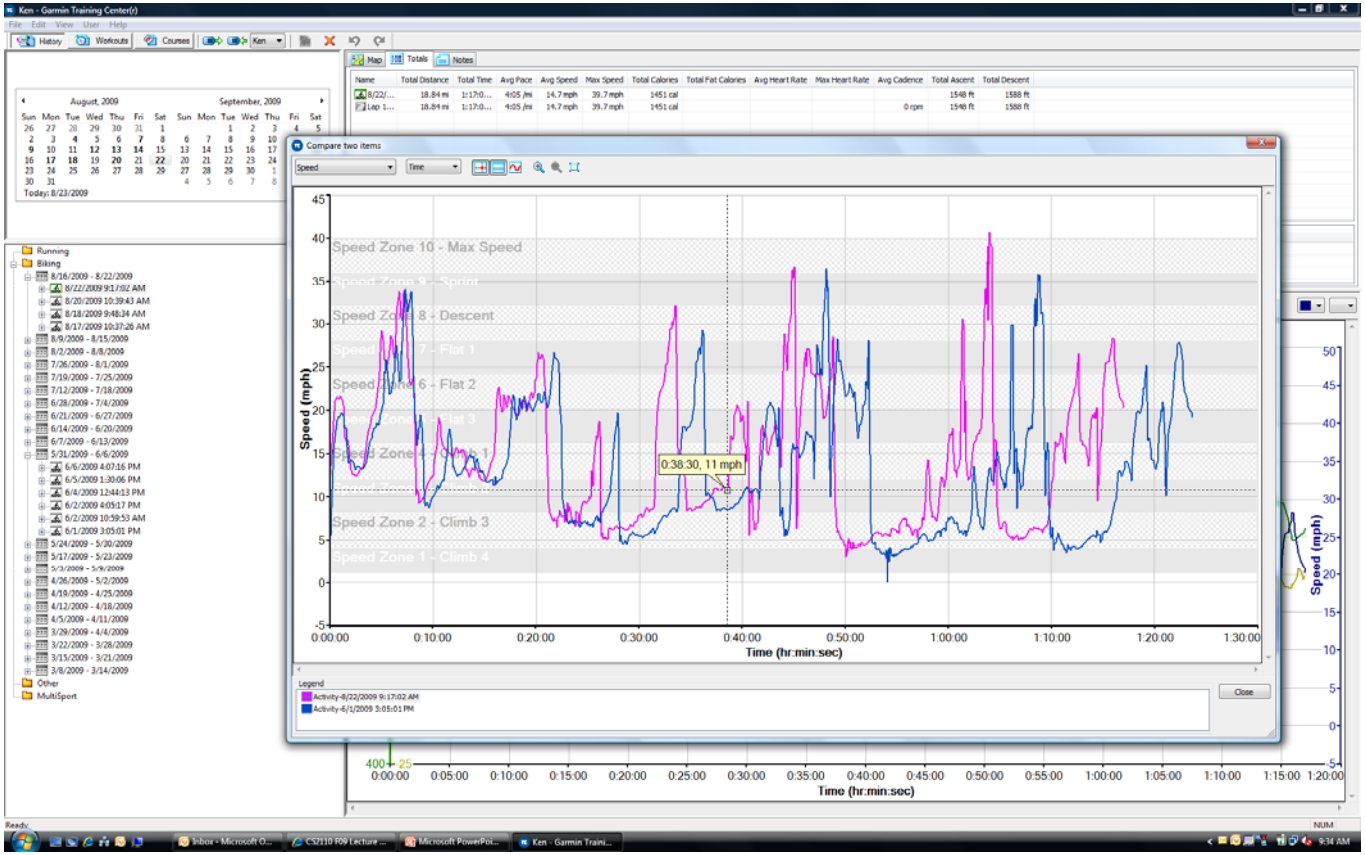
… graphical displays





… or comparisons

- How did I do today compared to the last time I rode this same route?



Path Problems in Graphs

- Is there a path from node A to node B?
  - If you can solve this problem you can solve the 8-puzzle, or recommend a bike route
- What is the shortest path from A to B?
  - Find fastest way to solve the 8-puzzle
  - Or the Google Maps / Mapquest problem
- Traveling salesman problem
- Hamiltonian cycles

Why take CS 2110?

- You'll learn to think in a more logical, structured way
- In the modern world, computational thinking pervades almost every subject of inquiry, is reshaping almost every industry, and is even reshaping society
- Mastery of computational thinking will help you become a master of the universe!
- Also: Great job prospects with high salaries…

So let’s go for it!

We hope you have fun, and enjoy programming and “computational thinking”

as much as we do