MA/CSSE 473 Day 01

Course Intro
Algorithms Intro

Pick up quiz from back table

MA/CSSE 473 Day 01

- Student/Instructor Intro
- Questions about the Syllabus?
- Daily Quizzes
- The importance of Data Structures
- The importance of Algorithms
- Begin Algorithm Overview/Review
  - Which will last a few days

In-class "Quizzes"

- Mark Ardis' legacy to our department
- Mainly a note-taking device
- Also feedback for me on whether students "get it"
- May not have one every day.

Student Intros

- Your name (what you want people to call you)?
- What is the main thing you did this summer? Answer 2 or more of the following questions in 30 seconds or less.

•Where were you?
•What was your role?
•For whom?
•What specifically did you work on?
•What did you learn?
•What was the main value that you added there?

•Were you helped by something from Rose courses/experiences?
•Good tools that you used?
•What was the environment like?
•Would you recommend this place to your peers?

- Other interesting summer activities?
- A favorite algorithm?

A Few Claude Facts

- Degrees: Caltech, Illinois, Indiana (MA, MA, CS)
- This is my 23rd year at Rose
- Have taught about 20 different courses; favorites are …
- I have a large family (9 children, ages 8-29)
- I have a 1-year-old grandchild, and a 3-year-old.
- I live **very** close to campus
- This summer I was diagnosed with a very rare connective tissue disease, scleromyxedema.
- Despite ugly prognosis, I still know that God's in control.
- I offered 473 as an on-line independent study course to 12 students this summer.
- I *really* like it when you put 473 as part of the subject line in your email to me.

Contact Info

- Claude Anderson, F-210, x8331
- anderson@rose-hulman.edu
- http://www.google.com/calendar/embed?src=anderson%40rose-hulman.edu
  - View by week is probably best
- **Emailing me and the graders:**
  - csse473-staff@rose-hulman.edu .
  - I expect IAIT to set this up before the end of the week.
  - Graders are:
    David McGinnis, Stephen Mayhew, Doug Mann

Q1, 2

Questions about the Syllabus?

- You can ask now, or ask tomorrow

Q3, 4

A quick look at some course materials

- ANGEL: drop boxes, discussion forums, etc.
- Schedule page and things linked from it
- Notice the **Hints to Exercises** section that begins on p 497 of the textbook
  - First try to do each problem without using the hint.
  - But if you get stuck, by all means look at the hint.
- Often I will post my PowerPoint slides *after* lectures, because they may contain spoilers. If I do post them before, I may repost a different version after.
- Sometimes my slides (and in-class quizzes) contain more than we actually do in class. When that happens, I will usually move that material to the following day's class.

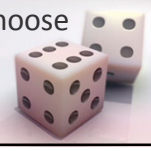
Q5, 6

The Ideal and the Real

- Ideal
  - Everyone comes to this course with the material from CSSE 230 and MA 375 fresh in their minds
- Real
  - Only about 40% of you took 230 during the 2009-10 year.
- We'll do quite a bit of review/reinforcement in this course
  - In many cases, you'll understand things much better the second time you see them.
  - The background survey will help me to see what you think you remember, and to plan how much review to include in this course.
  - Due tomorrow, but do it before 4:00 today if at all possible.
- A significant portion of the early reading assignments discuss things you have probably seen before
  - Sometimes treated at a higher level than what you saw before.

The Ideal and the Real, part 2

- Ideal
  - Everyone comes to this course with the same background
- Real
  - You have taken a variety of courses that introduce common algorithms
  - Not all versions of CSSE 230 and the Disco courses are the same
- Result
  - For every major algorithm we discuss, chances are good that someone in the class will have already seen it
- What to do about it?
  - Live with it, or only discuss obscure algorithms. I choose the former.



This is a very mathematical class

- More about ideas than implementations
- # implementation problems assigned in 2008: 3
- # implementation problems assigned in 2010: 2

An approach to this course

- Examine and/or analyze lots of algorithms.
- Look for similar approaches.
- Develop a toolbox.
  - Some might call it a "bag of tricks"
- Internalize the common terminology and ways of talking about algorithms.

Ways of organizing algorithms

- By area of application (230 approach), e.g.
  - Sorting algorithms
  - Search algorithms
  - Algorithms based on what data structure is used
    - Tree algorithms
    - Graph algorithms
    - Heap algorithms
- By techniques used (473 approach), e.g.
  - Brute Force
  - Greedy
  - Decrease and Conquer
  - Divide and Conquer
  - Dynamic Programming

Structuring Data Can Help a Lot

- If you have seen this problem before, please don't speak up (so others get a chance to think about it.
- Example is here.
  (Note: I am not putting the example on-line)

Algorithms are Important

- The next few slides are based on Chapter 0 of *Algorithms* by Dasgupta, Papadimitriou, and Vazirani (McGraw-Hill, 2008)
- Two enterprises have fueled the computer revolution:
  - Rapidly-increasing hardware speeds
  - Efficient Algorithms

A Big Idea That Changed the World

- Moveable type
  - Gutenberg, 1448 (I saw a Gutenberg Bible in summer 2008 at the Library of Congress)
  - According to Dasgupta, et. al
    - Literacy spread
    - The Dark Ages ended
    - The human intellect was liberated
    - Science and technology triumphed
    - The Industrial Revolution happened
    - Many historians say we owe all of this to typography
  - For a great discussion of algorithms and typography
    - See the interview with Donald Knuth in July-August CACM
    - It's assigned reading for this course. See Day 3 in schedule.

The Other Earth-Shaking Big Idea

- **Algorithms**
- First step: Replacing Roman Numerals by decimals (India, 7th century AD)
- Could now do arithmetic efficiently
- Codified by Al Khwarizimi (Baghdad, 9th cent.)
  - Add, subtract, multiply, divide, square roots, digits of Π.
  - Precise, unambiguous, mechanical
  - The word "algorithm" is derived from his name.
- The champion of algorithms in the West
  - Leonardo of Pisa (aka Fibonacci) (early 13th century)

Do you agree with Dasgupta?

- Are moveable type and algorithms the biggest change motivators since the Dark Ages?
- What else would you include in the list?

Q7

Brainstorm

- What is an algorithm?
- In groups of three, try to come up with a good definition.
- Goal: Short but complete
- Two minutes

Q8-9