CSSE 230 Day 1

Brief Course Intro Math Review Growable Array Analysis

Pick up an in-class quiz from the table near the door

What is CSSE230?

Data structures and algorithm analysis

Agenda

- Roll Call (Now)
 - Please tell me
 - What name you prefer to be called
 - How to pronounce your name if I don't get it right.
 - Where you live on campus
- A few administrative details
- Brief tour of course materials
- Review: Algorithm Analysis/math formulas
- Growable Arrays exercise

A Few Instructor Facts

- Matt Boutell -
 - Grew up in Massachusetts
 - Was a high school MA/CS teacher for 6 years
 - Teaching is my passion!

- Steve Chenoweth
 - Grew up in Indy
 - Spent a lot of time in industry, but
 - Academia is my "family business"

Steve's Contact Info

- Office: F220
 - M R F 5th hour (after class)
 - Other times see schedule on my office door
- Phone: x8974
- Email: <u>chenowet@rose-hulman.edu</u>
- Better (when appropriate): Discussion forums on Piazza.

Matt's Contact Info

See syllabus

Getting help

- Use Piazza to ask questions.
- If you email about an assignment, etc., we'll usually reply, "Great question! Please post it to Piazza"

A quick tour of the online course materials

- Syllabus
 - Attendance required! (most days ICQ will be the attendance record)
- Schedule page
 - Look at imminent due dates
 - Posted schedule is preliminary; may change as we go along.
 - We are planning night exams on Tuesdays (March 28, April 25), 7–9 PM.
- Piazza, Diagnostic Quizzes and Drop Boxes

Major themes of the course

- Data structures and algorithms
- Efficient programming
- Calculating running times
- Proving properties of data structures and algorithms

Weiss Textbook

- Good mix of theory and practice, design and implementation.
- Lots of interesting language issues. He talks about Java, but applicable to other languages.
- Challenging problems, a good place to go as you review for exams.
- Read it!

Either 3rd or 4th edition is OK

This week: Chapters 1-6.

- Most should be review, so you can skim those parts.
- Make notes of things to ask about or to focus on later.

Bonus points for reporting bugs

- Errors n the textbook
- Errors n any of my materials.
- Use the Bug Report Forum on ANGEL
- More details in the Syllabus.
- Usually 2-4 points per bug in the Homework section.

Programming is not a spectator sport

And neither is this course.

Ask, evaluate, respond, comment!

Is it better to ask a question and risk revealing your ignorance, or to remain silent and perpetuate your ignorance?

Feel free to interrupt during class discussions

Learning trumps politeness in this course!

Installation and other help

Need help with Eclipse, checking things out from Subversion, or compiling and running your programs? Assistants will be in F217 tonight 7–9 PM.

All CSSE courses are sharing these top assistants: <u>http://www.rose-</u> <u>hulman.edu/class/csse/csse304/labAssistantSchedule.html</u>

Assistance and Assistants!

- I want to help those who are working hard and need help
 - And so do the student assistants
 - Please feel free to come to us for help
- But we're not your mother ...
 - YOU must take charge of your education
 - Don't procrastinate!
 - Ask questions!



Something due almost every day for the next week!

- Lots of reading (skim, slow down on parts that are new)
- Introduce Yourself discussion forum on piazza (due Wednesday at 8 AM)
- ANGEL diagnostic quizzes (due Wednesday 8AM and Thursday 8AM)
- First written assignment (due Friday 8 AM),
- Multi-part programming assignment
 - WarmUpAndStretching, due Tuesday at 8 AM.
 - 7 days, 5 programs (start today!)
- Read the schedule page carefully as you prepare for each day.

More Administrivia Next Time

Bring your questions about the syllabus!



Analysis/Math Review

Credit where credit is due...

Images like this one:



 are from *Data Structures and Algorithms in JAVA* by Michael Goodrich and Roberto Tomassia

Running Times

- Algorithms may have different time complexity on different data sets
- What do we mean by "Worst Case" time complexity?
- What do we mean by "Average Case" time complexity?
- What are some application domains where knowing the Worst Case time complexity would be important?

Average Case and Worst Case



You Floor Me

Floor

 java.lang.Math, provides the static methods floor() and ceil()

Yes, yes. Sum of the time.

- Summations
 - general definition:

$$\sum_{i=s}^{t} f(i) = f(s) + f(s+1) + f(s+2) + \dots + f(t)$$

- where *f* is a function, *s* is the start index, and *t* is the end index

You call this progress?

- Geometric progression: $f(i) = a^i$
 - given an integer $n \ge 0$ and a real number $0 \le a \ne 1$

$$\sum_{i=0}^{n} a^{i} = 1 + a + a^{2} + \dots + a^{n} = \frac{1 - a^{n+1}}{1 - a}$$
 Memorize this formula!

- geometric progressions exhibit exponential growth

Exercise: What is
$$\sum_{i=2}^{6} 3^i$$
 ?

This will be useful for today's Growable Arrays exercise! The sum can also be written

$$a^{n+1} - 1$$

a - 1

Q9,10

If the opposite of pro is con, what's the opposite of progress?

- Arithmetic progressions:
 - An example Memorize this formula! $\sum_{i=1}^{n} i = 1 + 2 + 3 + \dots + n = \frac{n^{-} + n}{2}$ i = 1Exercise: Also useful for today's Growable Arrays exercise!

i=21

Q11,12

Visual proofs of the summation formula

$$\sum_{i=1}^{n} i = 1 + 2 + 3 + \dots + n = \frac{n^2 + n}{2}$$

- two visual representations



Example: Selection Sort

for (i=n-1; i>0; i--) {

find the largest element among a[0] ... a[i];
exchange the largest element with a[i];
}

•How many comparisons of array elements are done?•How many times are array elements copied?

(When you think you have the answers, compare with a partner)

Q13, 14, turn in the quiz

Growable Array Analysis

An exercise in doubling, done by pairs of students

Growable Arrays

```
// Read an unlimited number of String; return a String [ ]
   public static String [ ] getStrings( ) {
      Scanner in = new Scanner( System.in );
      String [ ] array = new String[ 5 ];
                                            Original array size = 5
      int itemsRead = 0;
      System.out.println( "Enter any number of strings, one per line; "
      System.out.println( "Terminate with empty line: ");
                                           We don't know in advance how many
      while( in.hasNextLine( ) ) {
                                           strings there will be
        String oneLine = in.nextLine();
          if(oneLine.equals( "" ) )
Grow
             break;
when
          if( itemsRead == array.length)
necessary
             array = resize( array, array.length * 2 );
          array[ itemsRead++ ] = oneLine;
        ł
        System.out.println( "Done reading" );
        return resize( array, itemsRead );
    }
                      How does resize() work?
                      What is the main "overhead cost" of resizing?
```

Work on Growable Array Exercise

- Work with a partner
- Hand in the document before you leave today
- Get help as needed from me and the assistants.