Lab 11

Problem Solving

April 13th, 2010
TAs: Carol Jim, James Marshall

Problem Solving?

- How to approach writing a program.
  - Understand the problem (including test cases)
  - Outline a plan
  - Write pseudo code
  - Implement the pseudo code
  - Test your code
  - Refine as necessary

Problem Solving ≠ Coding

- Code is the end result
- Focus on the problem

The Problem

- Sudoku solution checker
- Given a completed Sudoku board, is it valid?
  - Each row has one of each digit, 1-9
  - Each column has one of each digit, 1-9
  - Each 3x3 box has one of each digit, 1-9

Interface

- Input: array of 81 ints,
  - First 9, top row
  - Second 9, second row
  - Etc.
- Output:
  - Print “Valid Solution” if valid
  - Print “Not Valid” otherwise

Testing

- Some assurance that the program is correct
- Test with different inputs
  - ValidBoard.txt
  - Come up with examples that aren't valid
- Important! Must fulfill program requirements, not test cases.
  - Test cases may be incomplete

Sketch a Plan

- In english (or natural language of choice), describe the steps needed.
- Informal, explaining solution to a person
- Don't worry about code yet
- Refer to problem statement as needed, resolve ambiguities
- Do it!

Example: Plan

- Check each row of the board to see if there is exactly one of each digit, 1-9. Then repeat for each column, and each 3x3 box.
- If any row, column, or box violates this, print “Not Valid”. Otherwise print “Valid Solution”.

Pseudo Code

- How Computer Scientists talk about code
- No syntax, but more formal than natural language
- Don't worry about correctness

Example: Pseudo Code

```
For each row in board:
    Check row contains 1, 2, 3, 4, 5, 6, 7, 8, and 9
    If false, print “Not valid”, exit
For each column in board:
    Check column contains 1, 2, 3, 4, 5, 6, 7, 8, and 9
    If false, print “Not valid”, exit
For each box in board...
```

Check?

```
Check ___ contains 1, 2, 3, 4, 5, 6,
7, 8, and 9
```

- Can we describe this check in more detail?
- Write pseudo code for it!

Java

- Need to translate into Java
- Start by creating a new Java program
- Add the pseudo code as comments

Implementation

- Pseudo code is lacking in certain areas
- What is a “row” exactly? A “column”?
  - You can decide how to represent row
  - Representation differs by language and needs
- We want `Check ____` to work for rows, columns, and boxes.

Get to it.

- To start, don't worry about checking boxes
  - Your program should have a test case that fails

Done? Never Done.

- Code is never “perfect”
- Anything you could have done better?
- Any test cases you missed?

Going Further

- http://projecteuler.net/ <- More cool problems
- Software Engineering <- Planning big programs
- Backtracking <- Algorithm need to solve sudoku
- Open Source <- See code to real programs
- Major in CS <- Coolest field ever.

“Big” Programs?

- View Linux Kernel: http://lxr.linux.no/
- Source: http://en.wikipedia.org/wiki/Source_lines_of_code

Operating System	Lines of Code in Millions
Windows NT 3.1	4-5
Windows XP	40
Mac OS X 10.4	86
Linux Kernel 2.6.32	12.6
Debian 5.0	324

Next Lab - Review

- Bring questions!
- Evaluations!
  - Please take them seriously <- We do!
  - Use pencil