CS107
Introduction to Computer Science

Lecture 1

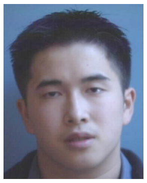
Introduction

Csci 107

- This class is a broad introduction to CS. The goal is to find out what CS is about and find out about its applications and impact in other disciplines.
- Step-by-step introduction into the art of problem solving using computers
- It **does not assume** previous knowledge of programming or computers.
- It **does assume** that you will keep the pace, work on the labs in a timely manner, come to the help sessions, etc
- Intended for majors and non-majors

Administrativia

- **Lab access**
  - Searles 128:
    - Mon-Friday 8am-5pm (unless class in progress) and 6-10pm
    - Sat, Sun noon-10pm
  - Searles 117: 6-10pm, Sat-Sun 12-10pm
- **Study group**
  - Leader: Richard Hoang'05
  - Time: TBD
  - Location: Searles 128



Resources

- Class webpage

http://www.bowdoin.edu/~ltoma/teaching/cs107/spring06/

- Office hours: M, T, W after class
- Grading policy
- Syllabus
- Lab assignments
- Readings

Csci 107

- Goal: learn to think like a computer scientist
- Why???
  - Computers are everywhere..
  - IT fastest growing industry, largest number of jobs
- so what? Can't I be a successful

  Biologist, Physicist, Chemist, teacher, therapist, geologist, environmentalist, …

…without computer science?

- Yes… if you are 70.
- Probably, if you are 18. But knowledge of computers will make you much more effective in any career you may choose.

What is Computer Science?

- **Computer Science is the study of computers (??)**
  - This leaves aside the theoretical work in CS, which does not make use of real computers, but of formal models of computers
  - A lot of work in CS is done with pen and paper! Actually, the early work in CS took place before the development of the first computer
  - *Computer Science is no more about computers than astronomy is about telescopes, biology is about microscopes, or chemistry is about test tubes.*
- **Computer Science is the study of how to write computer programs (programming) (??)**
  - Programming is a big part of CS.. ..but it is not the most important part.
- **Computer Science is the study of the uses and applications of computers and software (??)**
  - Learning to use software packages is no more a part of CS than driver's education is part of automotive engineering.
  - CS is responsible for building and designing software.

What is an algorithm?

- **Algorithm**: well-defined procedure that allows an agent to solve a problem.

- Example algorithms
  - Cooking a dish
  - Making a peanut-butter jelly sandwich
  - Shampooing hair
  - Programming a VCR
  - Making a pie

Example

Is this an algorithm?

- Step 1: Wet hair
- Step 2: Lather
- Step 3: Rinse
- Step 4: Repeat

Would you manage to wash your hair with this algorithm?
How about a robot? Why (not)?

Algorithms

An algorithm must:

1. Be well-ordered and unambiguous
2. Each operation must be effectively executable
3. Terminate.

Algorithm for Programming a VCR

- Step 1: If the clock and calendar are not correctly set, then go to page 9 of the instruction manual and follow the instructions before proceeding
- Step 2: Place a blank tape into the VCR tape slot
- Step 3: Repeat steps 4 through 7 for each program that you wish to record, up to a maximum of 10 shows
- Step 4: Enter the channel number that you wish to record, and press the button labeled CHAN
- Step 5: Enter the start time and press TIME-START
- Step 6: Enter the end time and press END-TIME
- Step 7: This completes the programming of one show. If you do not wish to program anything else press END-PROG
- Step 8: Press the button labeled TIMER. Your VCR is ready to record.

Types of Operations

- Basic operations
  - Wet hair
  - Rinse
  - Turn on VCR

- Conditional operations
  - If batter is too dry add water

- Repeat/looping operations
  - Repeat step 1 and 2 three times
  - Repeat steps 2,3,4,…10 until batter becomes soft.

Example

- Problem: Given two positive integers, compute their greatest common divisor

- Euclid’s algorithm:
  - Step 1: Get two positive integer values from the user
  - Step 2: Assign M and N the value of the larger and smaller of the two input values, respectively
  - Step 3: Divide M by N, and call the remainder R
  - Step 4: If R is not 0, then assign M the value of N, assign te value of R, and return to step 2; otherwise, the greatest common divisor is the value currently assigned to N

Algorithm

- How to come up with an algorithm?
  - Problem solving
- How to represent an algorithm?
  - In English??
  - In a programming language??

Coming up with algorithms..

- How do people think????
- Puzzle:
  - Before A, B, C and D ran a race they made the following predictions:
    - A predicted that B would win
    - B predicted that D would be last
    - C predicted that A would be third
    - D predicted that A's prediction would be correct.
  - Only one of these predictions was true, and this was the prediction made by the winner.

  In what order did A, B, C, D finish the race?

Example

- Problem: Adding two n-digit numbers

```
     7597831 +
     1287525
-------------------
      8885356
```

How would you write an algorithm to solve this problem? Assume the basic operation is adding one-digit numbers.

Examples of problems

Here are some problems that we'll think of during this class

- **Searching**
  - Given a list of student names, and a target name, find out if the name is in the list or not
  - E.g.: search name on Bowdoin website; search a phone number in the phone book
- **Matching**
  - Given two lists of symbols, find out whether one occurs in the other
  - E.g.: ACATTGTACATTG and CAT
- **Movie search**
  - Given a list of movie names, and a keyword, find ou all movies that contain the keyword

Expressing algorithms

- Is natural language good?
  - For daily life, yes…but for CS is lacks structure and would be hard to follow
  - Too rich, ambiguous, depends on context
- How about a programming language?
  - Good, but not when we try to solve a problem..we want to think at an abstract level
  - It shifts the emphasis from how to solve the problem to tedious details of syntax and grammar.

Pseudocode

- Pseudocode = English but looks like programming
- Good compromise
  - Simple, readable, no rules, don't worry about punctuation.
  - Lets you think at an abstract level about the problem.
  - Contains only instructions that have a well-defined structure and resemble programming languages