Basic Terms and Concepts

• hardware
• software
• program
Hardware: physical components of a computer

- CPU
  - Central Processing Unit
  - Part of microprocessor (Xeon, Core i7, ARM, Atom)
  - the "brain" of the computer
Hardware: physical components of a computer

- Primary (main) memory
- RAM = Random Access Memory
- “Fast” storage, "close" to CPU
- Stores
  - Executing program (i.e., Microsoft Word)
  - Data it works on (current English paper)
Hardware: physical components of a computer

- Secondary memory
- Slower storage, "outside" main unit
- Hard disks
MY COMPUTER DOESN'T WORK! THE HARD DRIVE CRASHED! WHAT DO I DO?!

DID YOU BACK UP?

WHY? IS IT GONNA BLOW?!
Flow of Computation (abstract)

Program → Data → Results
(computer)
Flow of Computation

- Input
- CPU
- Storage
- Output

- Keyboard
- RAM
- Hard drive
- Mouse
- Processor
- Monitor
- Printer
Questions

- list 2 input devices
- list 2 output devices
What is?

- “official” name of the “brain” of the computer
- default input device
- default output device
Software: programs that run on computer

- MS Word
- Applications
  - Find my iPhone
  - Google
  - Twitter
- Games
  - Minesweeper
  - Sims
  - World of Warcraft
An algorithm is:
- Sequence of instructions used to accomplish a goal

A program is:
- Implementation of an algorithm
- Sequence of instructions for a computer to perform
- Expressed in a programming language (e.g., C++)
Algorithms

- Is 2011 a leap year?
Algorithms

- Is 2011 a leap year?
- Is 2012 a leap year?
Is 2011 a leap year?

Is 2012 a leap year?

Is 2000 a leap year?
Is 2011 a leap year?

Is 2012 a leap year?

Is 2000 a leap year?

Is 1900 a leap year?
Algorithms

- Is 2011 a leap year?
- Is 2012 a leap year?
- Is 2000 a leap year?
- Is 1900 a leap year?
- Write an algorithm to compute if a given year is a leap year.
if year modulo 4 is 0 then

else
if year modulo 4 is 0 then
  is_leap_year
else
  not_leap_year
if year modulo 4 is 0 then

if year modulo 100 is 0 then

else

else

not_leap_year
if year modulo 4 is 0 then

if year modulo 100 is 0 then
    not_leap_year
else
    is_leap_year
else
    not_leap_year
if year modulo 4 is 0 then

if year modulo 100 is 0 then

if year modulo 400 is 0 then

else

else

is_leap_year

else

not_leap_year
if year modulo 4 is 0 then

    if year modulo 100 is 0 then
        if year modulo 400 is 0 then
            is_leap_year
        else
            not_leap_year
    else
        is_leap_year

else
    not_leap_year
Programming Language

- Programming language should:
  - Describe (specify) sequence of instructions
  - Convenient for people to write programs
  - Convenient for computers to “understand”

- Why not “Natural Languages”?  
  - (like English)
Levels of Programming Languages

- Machine
- Assembly
- High-level
Machine Language - binary code

- Only code a computer runs
- Direct control of machine
- Difficult to program, read, debug
- Not *portable* to other platforms
Assembly Language

- LDA 5
- ADC 6
- STA sum

- Mnemonic codes
- Symbolic names (like sum)
- Direct control
- Still hard to use and not portable
- Executes fast
High-Level Languages

sum = 5 + 6;

- C++, Java, Fortran, Lisp, ...
- Easier to read, write, debug & modify
- Employ powerful data and control primitives
Compiler

- Translates high-level language to machine code
C++ Recently turned 30

- Makes it possible to create programs with
  - Fast execution
  - Small amount of code
  - Runs on a variety of computing environments (portable)
  - Features
C++ Today

- Enables creation of complex/powerful apps
  - Business
  - Open source
  - Most games
The following code is an example of

- assembly language
- machine code
- high level language

```cpp
int x = 2, y = 5;
int sum;
sum = x + y;
cout << sum;
```
LIFE BEFORE THE COMPUTER

• Memory was something you lost with age
• An application was for employment
• A program was a TV show
• A cursor used profanity

• A keyboard was a piano
• A web was a spider's home
• A virus was the flu
• A CD was a bank account

• A hard drive was a long trip on the road
• A mouse pad was where a mouse lived
Summary

- Hardware
- Software
- Program
- Algorithm
- Levels of programming languages