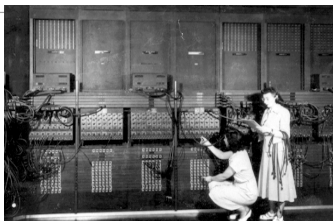## Computers and Algorithms

CS303E: Elements of Computers and Programming

June 6, 2012

## Computer History: ENIAC

- World's first programmable electronic computer (1945)
- Calculated artillery ballistic tables for the Army
- 8 feet tall, 100 feet long, weighed 30 tons

## Computers: What are they?

- A machine that processes information and performs calculations
  - Originally, a human!

## Computers: Overview

- Two main types of components:
  - Hardware: The mechanical and electronic parts of a computer
    - CPU, Memory, Secondary Storage, Input and Output Devices
  - Software: The programs that tell the hardware what to do

## Computers: Software

- Programs that tell the computer what to do
- Operating Systems
  - Software the allows other pieces of software and human users to interact with the hardware
- Applications
  - Specialized software (Word, Excel, IDLE)

## Computers: CPU

- Central Processing Unit
- Brain of the computer
- Repeatedly performs this cycle:
  - **Fetch** instruction from memory
  - **Decode** instruction
  - **Execute** instruction
- Controls the other components
- Performs all calculations (addition, subtraction, comparisons, etc)

## Computers: Input and Output

- Input devices bring data into the computer
  - Keyboard, mouse, scanner
- Output devices display the information stored in the computer
  - Monitor, printer, speakers

## Computers: Storage

- Main memory: temporarily stores data or programs
  - Very fast
  - Volatile: information is lost when the computer is turned off
  - Random Access Memory (RAM)
- Secondary Storage: devices used for long-term, permanent storage
  - Relatively slow
  - Not volatile: information is not lost when computer is turned off
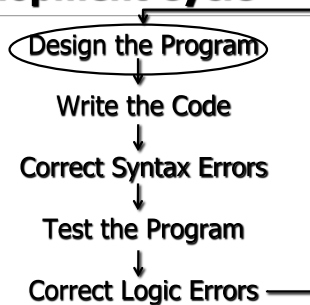  - Hard drives, CDs, USB sticks

## Computers: Data Storage

- All data is stored in *binary*
  - Either 0 or 1
  - Numbers: 1001 = 9
  - Characters: 0100 0001 = 'A'
- Bit: a unit of information on a computer
- Byte: eight bits
  - A character requires a byte of storage

## iClicker Question: Computers

- Which part of the computer executes a program?

A. Main memory
B. Keyboard
C. CPU

## Program Development Cycle

Design the Program
↓
Write the Code
↓
Correct Syntax Errors
↓
Test the Program
↓
Correct Logic Errors

## Designing the Program

Designing the program is actually two steps:
  - Writing the *specification*
  - Creating the *algorithm*

## Designing the Program: Specifications

- A *specification* specifies what the program should do and how it should interact with the user (i.e. expected input and output)
- Your assignments are specifications

## Algorithms: What are they?

- A step by step description of the solution to a specified problem
- Usually written in *pseudocode*
- A *program* converts an algorithm into a particular programming language
- An algorithm must have two properties:
  - Finiteness: the process terminates; the number of steps in the algorithm is finite
  - Definiteness: each step is precisely stated

## Algorithms: How do we create one?

- Identify how *you* solve the problem
- Specify the steps needed to solve the problem
- Consider each step:
  - Does it need to be more precise?
  - Should it be broken into additional steps?

## Algorithm: Examples

- PB&J
- Area of a rectangle
- Paycheck for an hourly employee
- Average of three test scores

## iClicker Question:
## True or False

An algorithm must be written in a
programming language.

A. True
B. False

## Announcements

If you will require accommodations for
the exam, please speak to me after
class

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