

COS 130

Computer Programming  
Methodology

MidTerm Review

# Algorithm

“In mathematics and computing, an algorithm is a procedure (a finite set of well-defined instructions) for accomplishing some task which, given an initial state, will terminate in a defined end-state.” - **Wikipedia**

Like a Recipe, but . . .

- Strictly defines the order of steps

# Program

“A computer program is a list of instructions to be executed by the computer.”

- **Wikipedia**

- Programs implement algorithms
- Programs are executable by “machines”
- Programs group instructions into a unit of work

# Programs Exist in 2 Forms

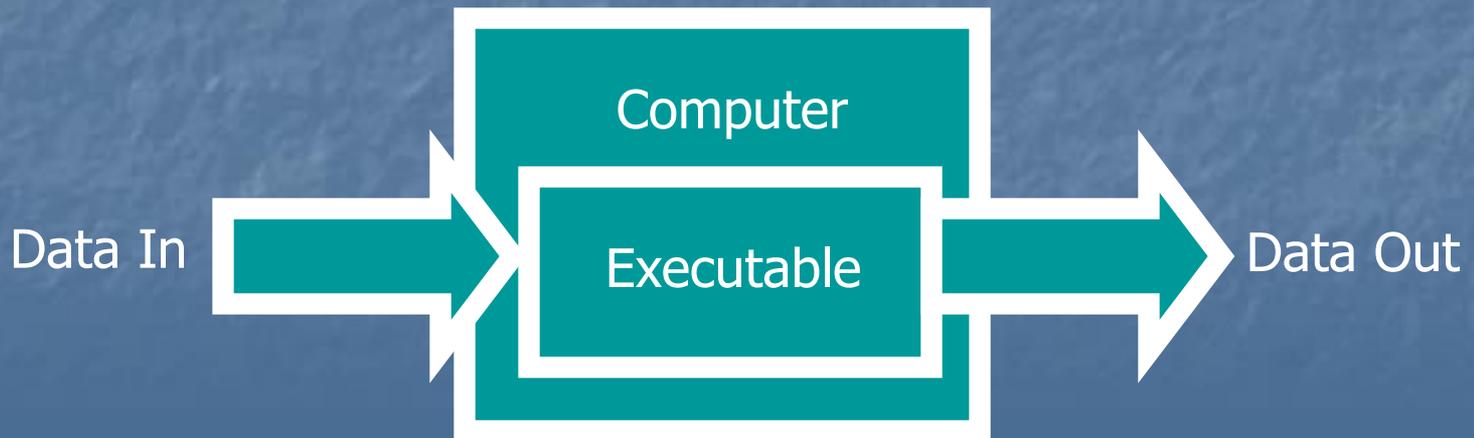
- Source
  - Designed to be understood by people
  - Letters, words
- Executable
  - Designed to drive the computer
  - Binary – 1's and 0's

# Computing a 2 Step Process

## Compilation



## Execution



# Instructions

- Noun and a Verb
- Examples:
  - Kick ball
  - Print "Hello World"

# More about Nouns

- Already in the problem domain waiting to be discovered
- Concrete – see, hear, touch, taste them
- More permanent
  - Class registration example

However, eventually we revert to verbs

# What Makes Computers Different?

When implemented on a computer



# Combine Flexible Data with Flexible Instructions

- Data is represented as 1's and 0's
- Instructions are represented as 1's and 0's
- Therefore we can write programs that manipulate programs as their data

Examples:

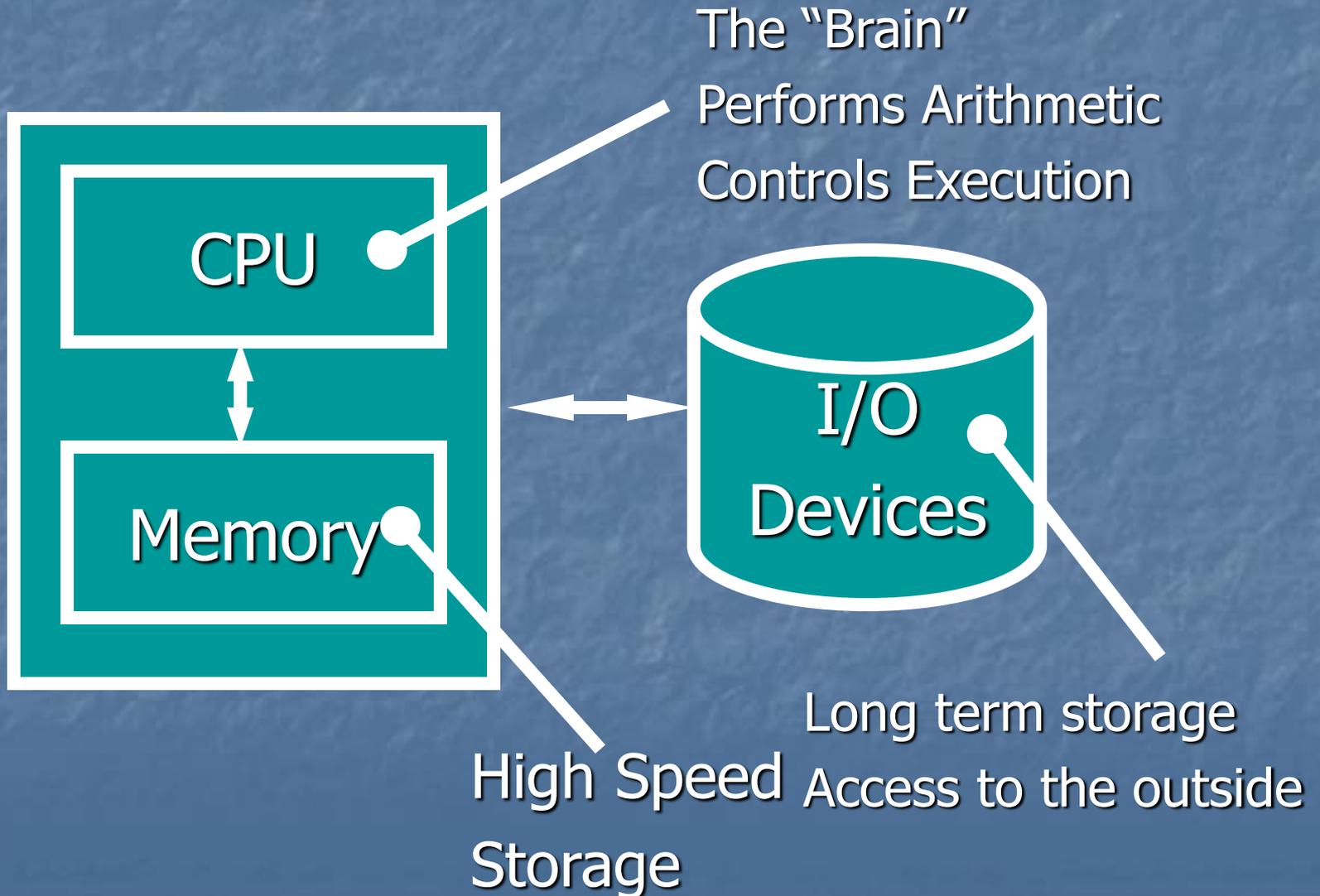
Compilers

Operating Systems

This should make your head hurt!

# A Brief Introduction to Computer Hardware

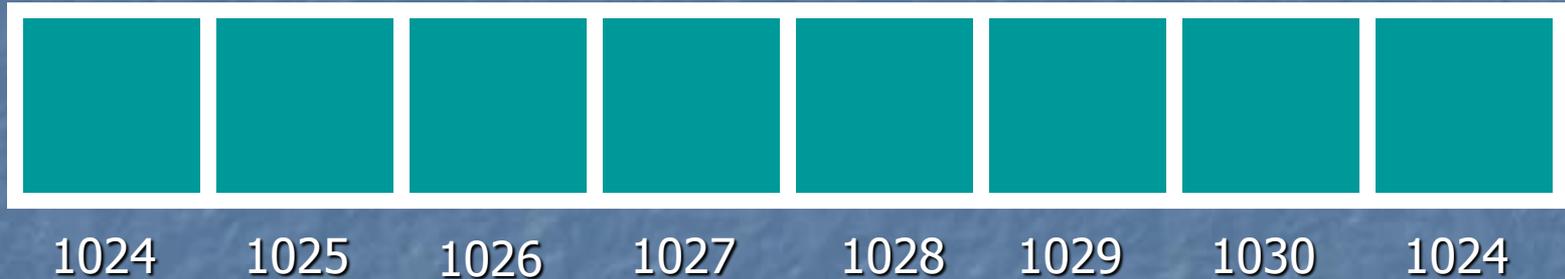
# Top Level Hardware



# CPU (Central Processing Unit) Details

- The “Brain” of the computer
- Fetches instructions from memory
- Executes the fetched instruction
- Does arithmetic (adds, multiplies, etc.)
- Compares data
- Moves data

# Memory Details



- A sequence of storage locations
- Much like mailboxes
- Each box has an address
- Each box can hold 32 bits
- Each box can be randomly accessed
- Goes away when the power is turned off

# Memory (cont)

- Stores both the instructions for the program and the data for the program
- All types of data and program instructions are stored as 1's and '0'
- Therefore, when looking at the contents of a memory location there is no way to tell what type of thing is in there.

# I/O (Input/Output) Details

- Slower than memory
- Varies depending on the device
- Accessed differently than memory usually read / write
- Disks are special they are often used as faux memory

# Vocabulary

# Control Flow

- What does the program do next?
- Three types of control flow:
  - Sequence
  - Selection
  - Repetition

# Class

- The basic unit for building Java programs
- A container for both data and instructions
- All Java code except for an import statement must be inside a class
- Classes are used to create object with the new operator
- By convention class names begin with a capital letter
- Class must be in a file with the same name

# Object

- An object is an instance of a class
- Objects are created at runtime by programs to do work

# A Very Brief Intro to Classes and Objects

- A class should be a reusable program that models some kind of thing
- It has information or data about the thing
- It has actions that the thing can do
- An object is a particular thing
- A class creates object

# Example: Dog Class

## ■ Data

- Weight
- Length
- Color
- Name

## ■ Actions

- bark
- run
- eat
- rollover

# Dog Objects



Name: Spot

Length 50

Weight 50

Color black and white

Name: Greta

Length 24

Weight 10

Color red



# Implementing Classes and Object in Java

- All Java code goes into a class
- Data about an object is called an attribute.
- We use variables for attributes
- Actions an object can take is called a method
- We write code to create methods
- We create objects by using the new operator on a class

# Example Java Dog

- Assume that someone else has written a dog class and we are going to use it.

```
Dog myDog = new Dog("Greta", 24,10,"red");
```

```
myDog.bark();
```

```
myDog.eat();
```

```
int weight = myDog.getWeight();
```

```
System.out.println(weight);
```

# Method

- A group of one or more instructions known and executed collectively
- Provides a way to bundle a group of instructions to perform an action
- Can be called from more than one place in the program providing reuse
- Must be in a class
- main is a special method that indicates where a program starts running

# Statement

- A complete instruction that causes the computer to perform some action
- Statements either end in a ; or a }

# Expression

- One or more operators and operand that produce a value
- Not a complete statement
- Examples:
  - $X * Y$
  - $X < Y$

# Variables

- A named storage location in the computers memory
- Stores a value
- Has a type
- Value may change as the program runs

# Coding Questions

- Constructs used through assignment 2 are fair game
- Arrays will not be on the midterm
- All code on test is intended to have correct syntax.
- You will not have to write code
- Questions will be multiple choice