Farmingdale State College

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Introduction to Programming

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Introduction

Program: set of instructions that a computer follows to perform a task

- Commonly referred to as *Software*

Programmer: person who can design, create, and test computer programs

- Also known as software developer

Hardware and Software

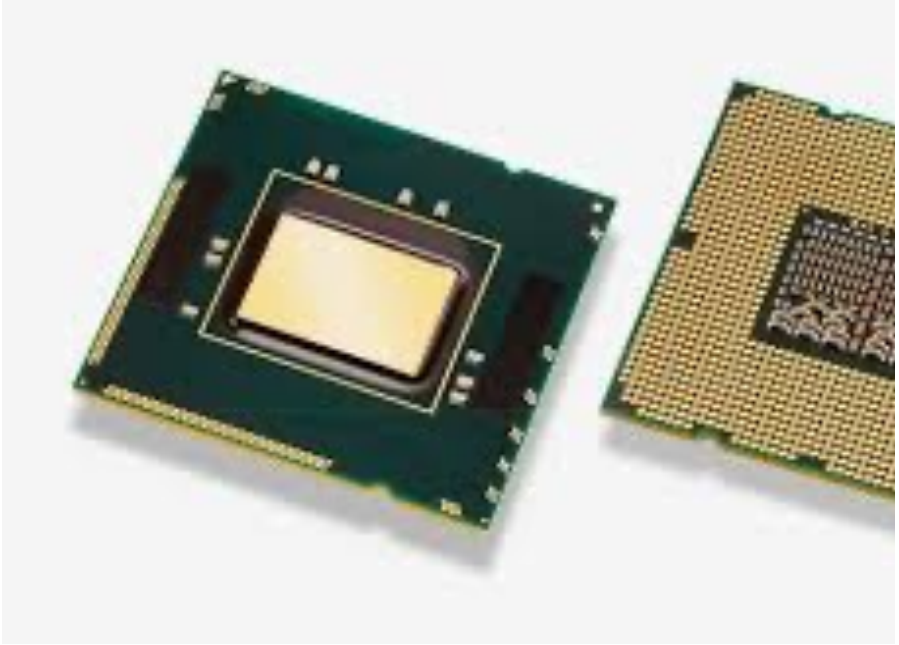
- **Hardware**: The physical devices that make up a computer. Keyboard, mouse and interior part of your computer

- Typical major components:
  - Central processing unit
  - Main memory
  - Secondary storage devices
  - Input and output devices

The CPU

- **Central processing unit (CPU):** the part of the computer that actually runs programs, sometimes it is called the brain of the computer
  - Most important component
  - Without it, cannot run software
  - Used to be a huge device

- **Microprocessors:** CPUs located on small chips



Main Memory

- **Main memory:** where computer stores a program while program is running, and data used by the program
- Known as *Random Access Memory* or *RAM*
  - CPU is able to quickly access data in RAM
  - Volatile memory used for temporary storage while program is running
  - Contents are erased when computer is off

Secondary Storage Devices

- **<u>Secondary storage</u>:** can hold data for long periods of time
  - Programs normally stored here and loaded to main memory when needed
- Types of secondary memory
  - Disk drive: magnetically encodes data onto a spinning circular disk
  - Solid state drive: faster than disk drive, no moving parts, stores data in solid state memory
  - Flash memory: portable, no physical disk

Input Devices

- **<u>Input</u>:** data the computer collects from people and other devices
- **<u>Input device</u>:** component that collects the data
  - Examples: keyboard, mouse, touchscreen, scanner, camera
  - Disk drives can be considered input devices because they load programs into the main memory

Output Devices

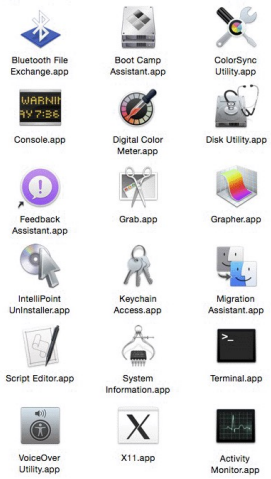
- **<u>Output</u>:** data produced by the computer for other people or devices
  - Can be text, image, audio, or bit stream
- **<u>Output device</u>:** formats and presents output
  - Examples: video display, printer
  - Disk drives and USB drives can be considered output devices because data is sent to them to be saved

Software

- Everything the computer does is controlled by software
  - General categories:
    - Application software
    - System software
- **<u>Application software</u>:** programs that make computer useful for everyday tasks
  - Examples: word processing, email, games, and Web browsers

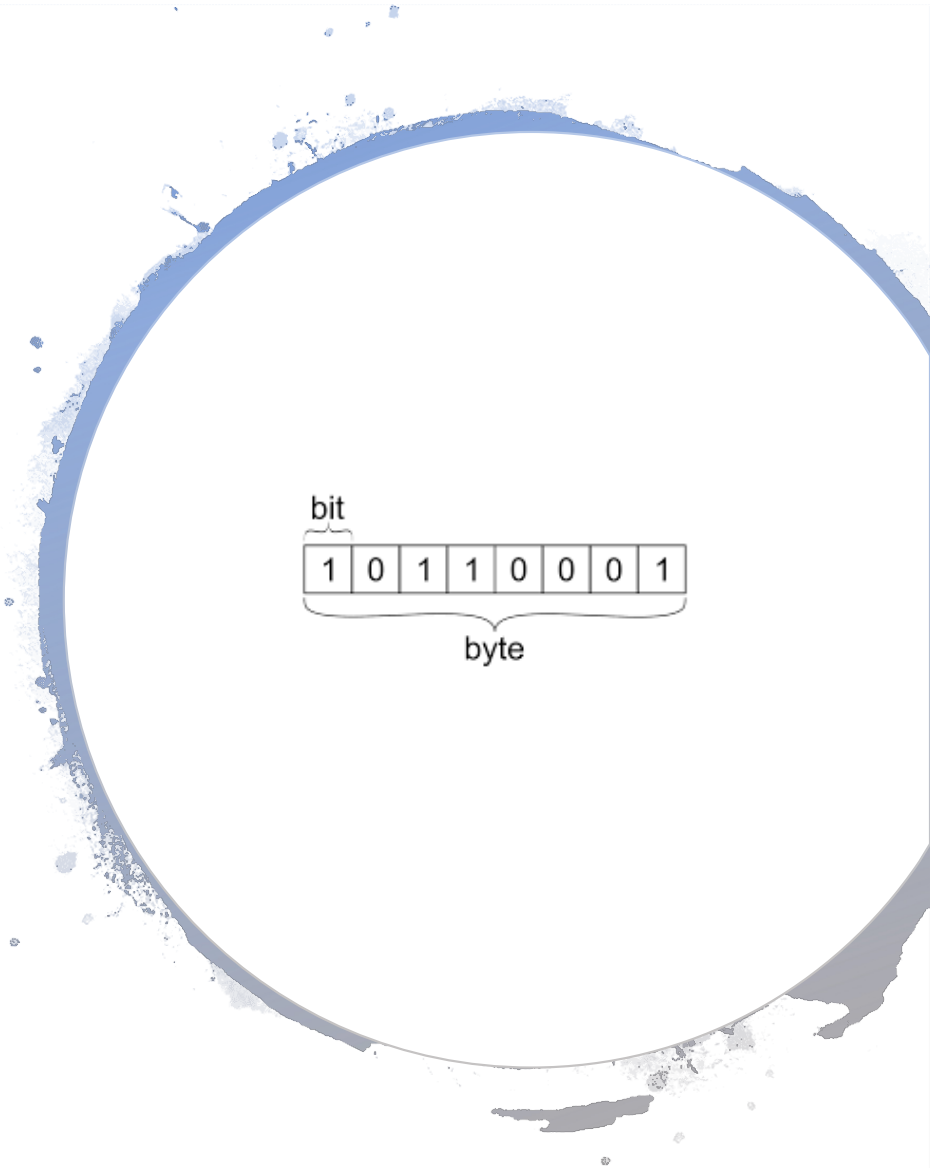
Software

- **<u>System software</u>:** programs that control and manage basic operations of a computer
  - **Operating system:** controls operations of hardware components
  - **Utility Program:** performs specific task to enhance computer operation or safeguard data
  - **Software development tools**: used to create, modify, and test software programs



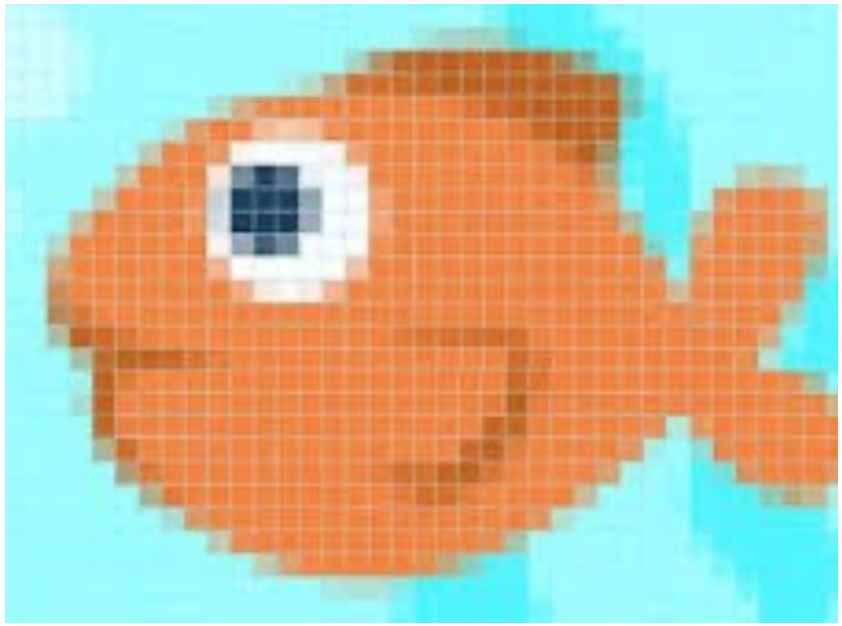
How Computers Store Data

- All data in a computer is stored in sequences of 0s and 1s
- **Byte:** just enough memory to store letter or small number
  - Divided into eight bits
  - **Bit:** smallest unit of data in a computer. A bit has a single binary value, either 0 or 1



Other Types of Data

- Digital: describes any device that stores data as binary numbers
- Digital images are composed of pixels
  - To store images, each pixel is converted to a binary number representing the pixel's color
- Digital music is composed of sections called samples
  - To store music, each sample is converted to a binary number



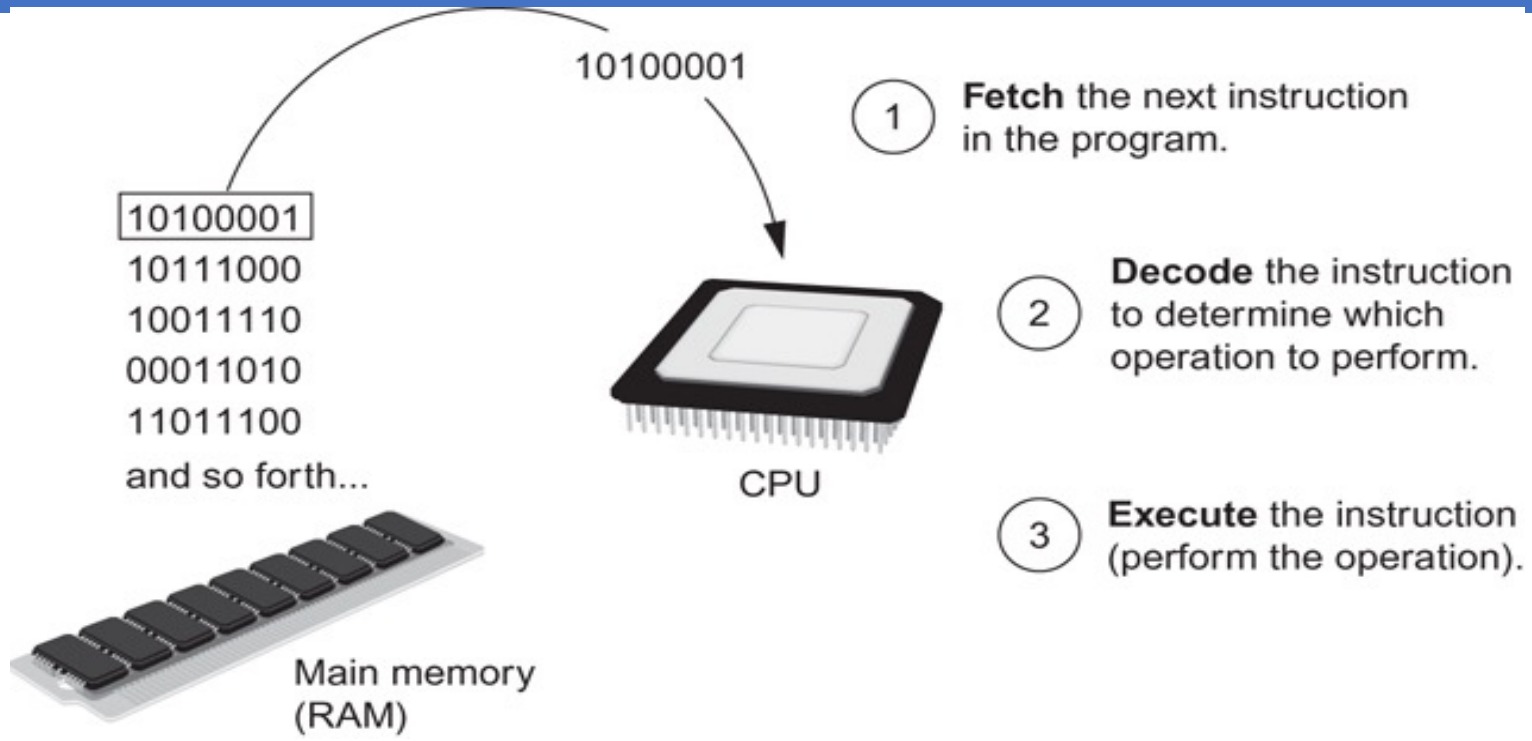
How a Program Works (1 of 3)

- CPU designed to perform simple operations on pieces of data
  - Examples: reading data, adding, subtracting, multiplying, and dividing numbers
  - Understands instructions written in machine language and included in its instruction set
    - Each brand of CPU has its own instruction set
- To carry out meaningful calculation, CPU must perform many operations

How a Program Works (2 of 3)

- Program must be copied from secondary memory to RAM each time CPU executes it
- CPU executes program in cycle:
  - **Fetch**: read the next instruction from memory into CPU
  - **Decode**: CPU decodes fetched instruction to determine which operation to perform
  - **Execute**: perform the operation

How a Program Works (3 of 3)



Learning Programming Terminology (1 of 3)

- **Computer program**
  - A set of written instructions that tells the computer what to do
- **Machine language**
  - The most basic circuitry-level language
  - A low-level programming language
  - All programs get translated into machine language
- **High-level programming language**
  - Allows you to use a vocabulary of reasonable terms

1.1 Learning Programming Terminology (2 of 3)

- **Syntax**
  - A specific set of rules for the language
- **Program statements**
  - Similar to English sentences
  - Commands to carry out program tasks
- **Compiler or interpreter**
  - Translates language statements into machine code
- **Debugging**
  - Freeing program of all errors

Learning Programming Terminology (3 of 3)

- **Syntax error**
  - Misuse of language rules
  - A misspelled programming language word
- **Logic errors**
  - Also called semantic errors
  - Incorrect order or procedure
  - The program may run but provide inaccurate output

Activity 1: Knowledge Check

- Every language has its own specific, limited vocabulary called the language's _____.

a. syntax
b. keywords
c. statements
d. commands

Comparing Procedural and Object-Oriented Programming Concepts (1 of 5)

- **Procedural programming**
  - Sets of operations executed in sequence
  - Variables
  - Named computer memory locations that hold values
  - Procedures
  - Individual operations grouped into logical units
- **Object-oriented programs**
  - Create classes
  - Blueprints for an object
  - Create objects from classes
  - Create applications

Comparing Procedural and Object-Oriented Programming Concepts (2 of 5)

- **Class**
  - Describes objects with common properties
  - A definition
  - An instance
- **Attributes**
  - Characteristics that define an object
  - Differentiate objects of the same class
  - The value of attributes is an object's state
- **Objects**
  - Specific, concrete instances of a class

Comparing Procedural and Object-Oriented Programming Concepts (3 of 5)

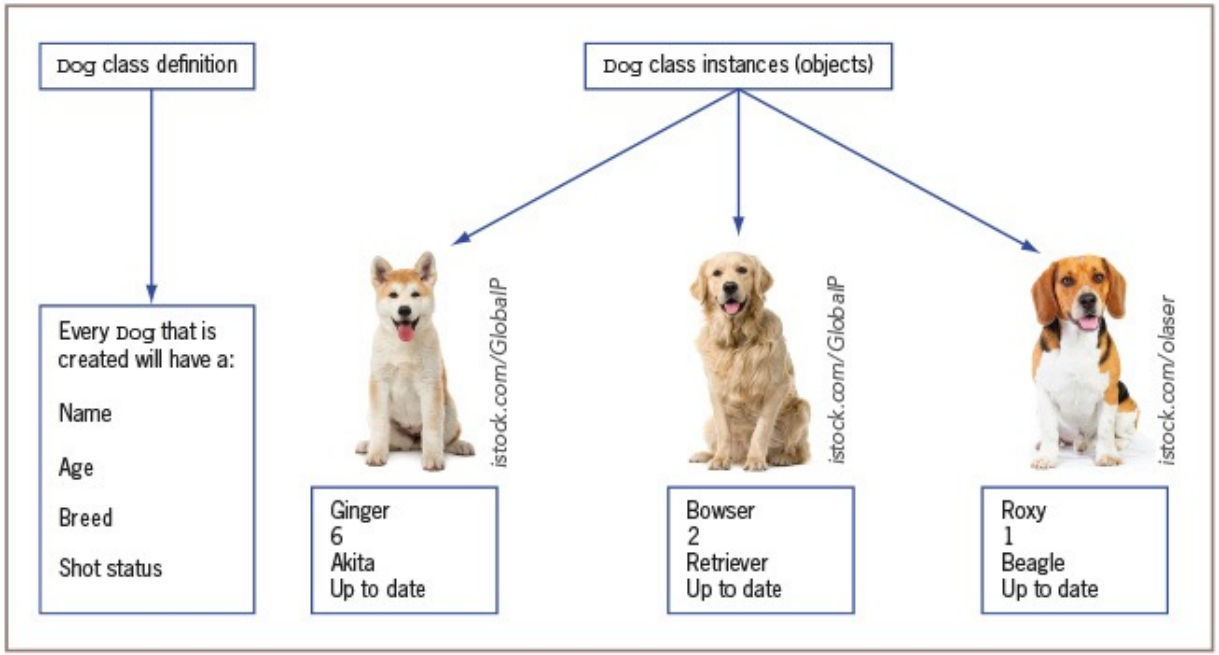


Figure 1-`Dog` class definition and some objects created from it

Comparing Procedural and Object-Oriented Programming Concepts (4 of 5)

- **Method**
  - A self-contained block of program code that carries out an action
  - Similar to a procedure
- **Encapsulation**
  - Conceals internal values and methods from outside sources
  - Provides security
  - Keeps data and methods safe from inadvertent changes

Comparing Procedural and Object-Oriented Programming Concepts (5 of 5)

Inheritance

- An important feature of object-oriented programs
- Classes share attributes and methods of existing classes but with more specific features
- Helps you understand real-world objects

Polymorphism

- Means “many forms”
- Allows the same word to be interpreted correctly in different situations based on context

Features of the Java Programming Language (1 of 4)

Java

- Object-oriented general-purpose language
- Can be run on a wide variety of computers
- Does not execute instructions on the computer directly
- Runs on a hypothetical computer known as a **Java Virtual Machine (JVM)**
- Advantages:
  - Security features
  - Architecturally neutral

1.3 Features of the Java Programming Language (2 of 4)

Source code

- Programming statements written in high-level programming language

Development environment

- A set of tools used to write programs

Bytecode

- Statements saved in a file
- A binary program into which the Java compiler converts source code

Java interpreter

- Checks bytecode and communicates with the operating system
- Executes bytecode instructions line by line within the Java Virtual Machine

1.3 Features of the Java Programming Language (3 of 4)

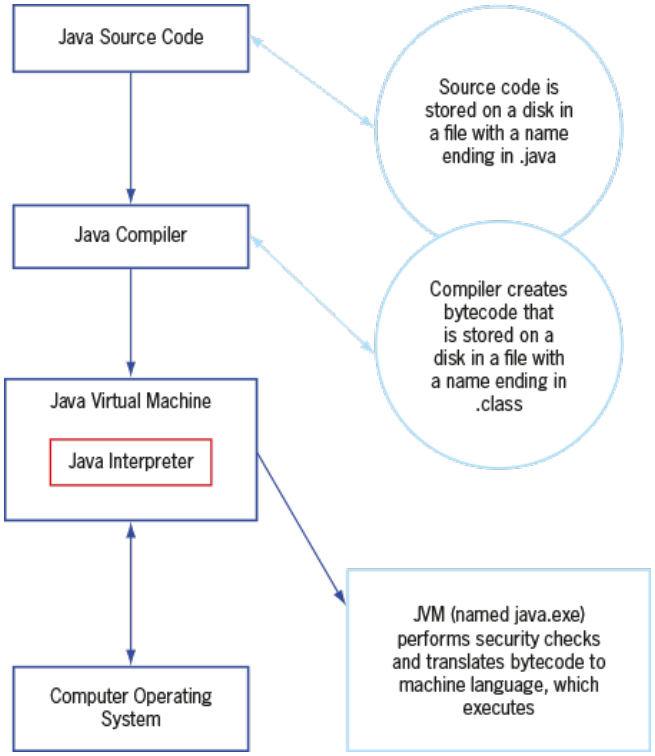


Figure - The Java environment

Features of the Java Programming Language (4 of 4)

WORA

- Write once, run anywhere

Console applications

- Support character output

Windowed applications

- Menus
- Toolbars
- Dialog boxes

Activity 2: Knowledge Check

- The slogan, Write once, run anywhere, describes the ability of one Java program to _____.

a. work correctly on multiple platforms
b. translate into different languages
c. perform unrelated tasks
d. create GUIs