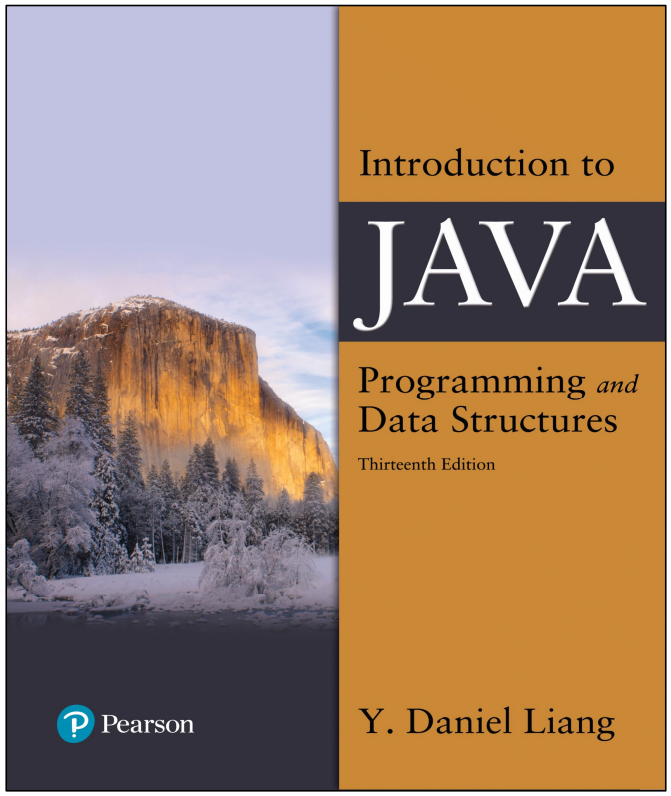
# Introduction to Java Programming and Data Structures

Thirteenth Edition




## Chapter 1

Introduction to Computers, Programs, and Java

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Pearson

# COMP 110/L Chapter 1

Bahram Zartoshty

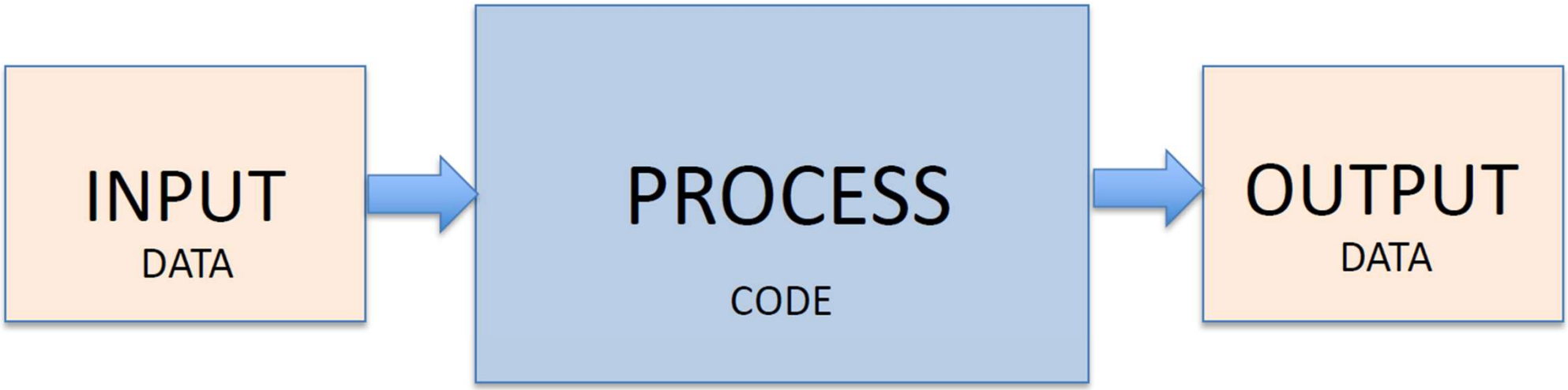
# Objectives

- To understand computer basics, programs, and operating systems (§§1.2–1.4).
- To understand the meaning of Java language specification, API, JDK, and IDE (§1.6).
- To write a simple Java program (§1.7).
- To display output on the console (§1.7).
- To explain the basic syntax of a Java program (§1.7).
- To create, compile, and run Java programs (§1.8).
- To use sound Java programming style and document programs properly (§1.9).
- To explain the differences between syntax errors, runtime errors, and logic errors (§1.10).
- develop Java programs using NetBeans (§1.11).

# What is Computer Science?

- The fundamental core of Computer Science is problem solving.
- Computers do not solve problems, you do
- Computers are dumb!
- It is up to you, the user, to approach a complex problem, study it, understand it, and develop a solution to it.
- Computers only automate solutions

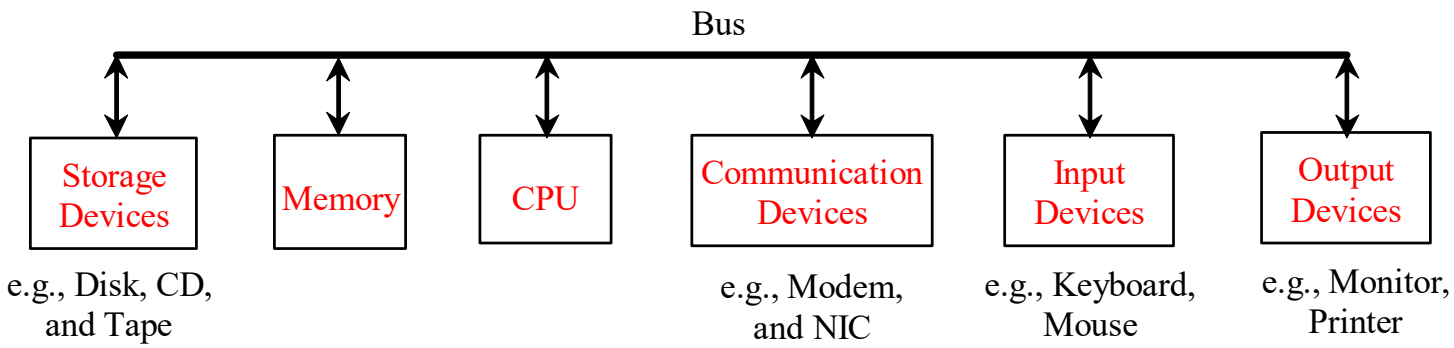
# Computer System (IPO Model)



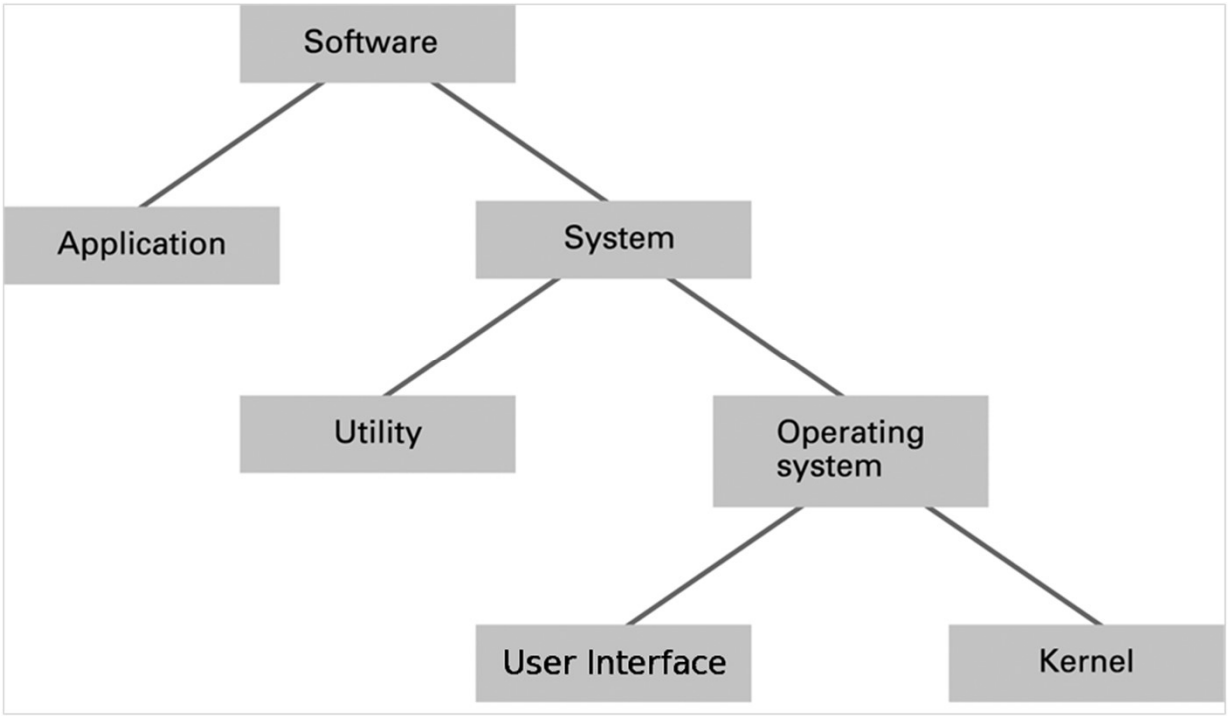
- Computer Programs
  - A computer program is a sequence of instructions in a programming language that a computer can execute or interpret.
    - Java Programming Language
    - Object oriented Programming Language
- *Software*
  - *Set of programs that tell computer how to solve specific problem*

# Hardware

- Physical Components
  - A computer consists of a CPU, memory, hard disk, floppy disk, monitor, printer, and communication devices.



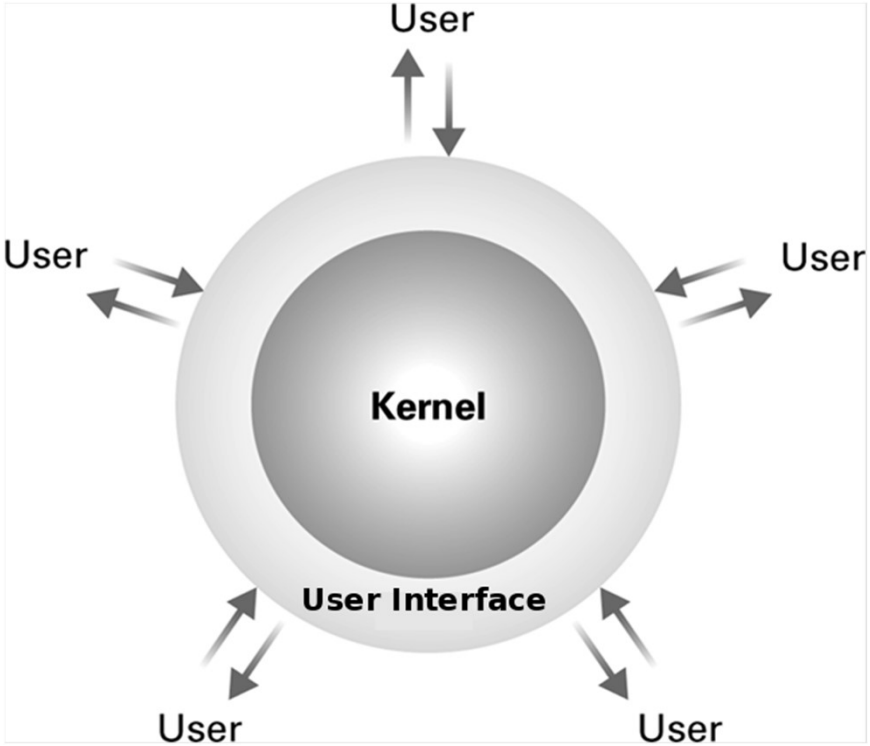
# Software classification



# Operating System Components

- **User Interface:** Communicates with users
  - Text based (Shell)
  - Graphical user interface (GUI)
- **Kernel:** Performs basic required functions
  - File manager
  - Device drivers
  - Memory manager
  - Scheduler and dispatcher

The user interface act as an intermediary between users and the operating system kernel



# Computational Thinking

- Algorithm
  - A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer

# Programming Languages

Machine Language  Assembly Language  High-Level Language

- Any computer can directly understand only its own machine language, *defined by its hardware design.*
  - Generally consist of strings of numbers (ultimately reduced to 1s and 0s) that instruct computers to perform their most elementary operations one at a time.
  - *Machine dependent—a particular ma-chine language can be used on only one type of computer.*
  - For example, to add two numbers, you might write an instruction in binary like this:

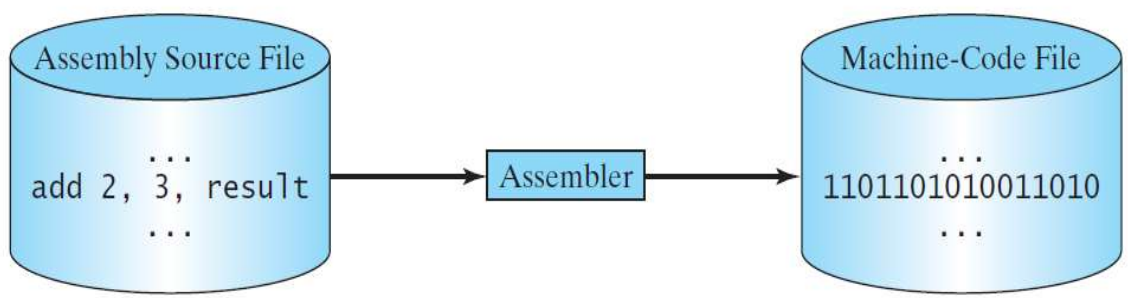
```
1101101010011010
```

# Programming Languages

Machine Language  Assembly Language  High-Level Language

- Assembly languages were developed to make programming easy.
- English-like abbreviations that represent elementary operations formed the basis of assembly languages.
- *Translator programs* called assemblers convert early assembly-language programs to machine language.
- For example, to add two numbers, you might write an instruction in assembly code like this:

ADDF3 R1, R2, R3



# Programming Languages

Machine Language  Assembly Language  High-Level Language

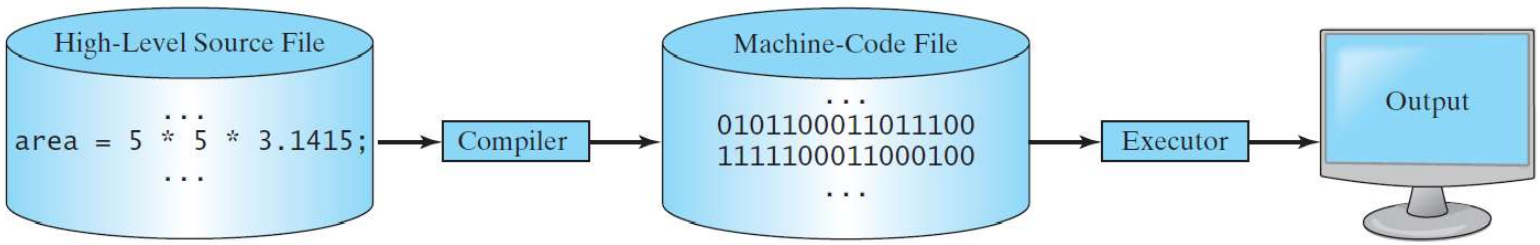
- The high-level languages are English-like and easy to learn and program.
- Single statements accomplish substantial tasks.
- A Java program to calculate the area of a circle might contain a single statement such as

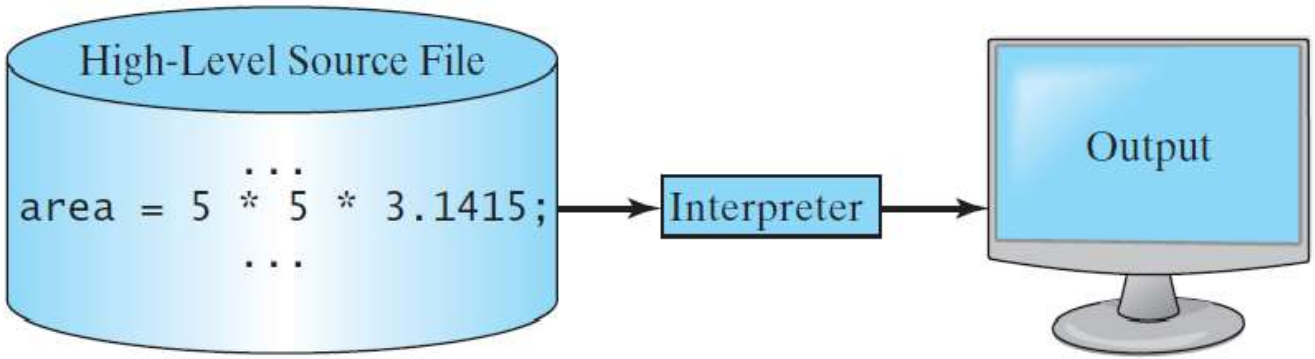
  area = radius * radius * Math.PI;

- High-Level programs must be converted to Machine Language.

# Interpreting/Compiling Source Code

- Computer Program: (Source code / Source Program)
- Compiling/Interpreting: (Object Code / Byte Code)



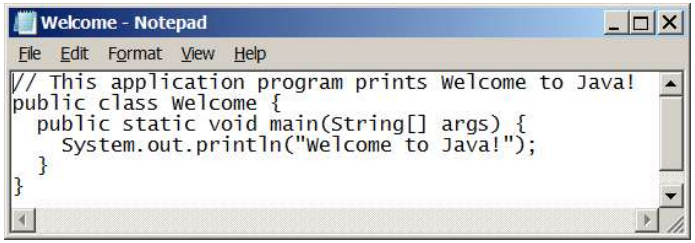



# Java (Cont.)

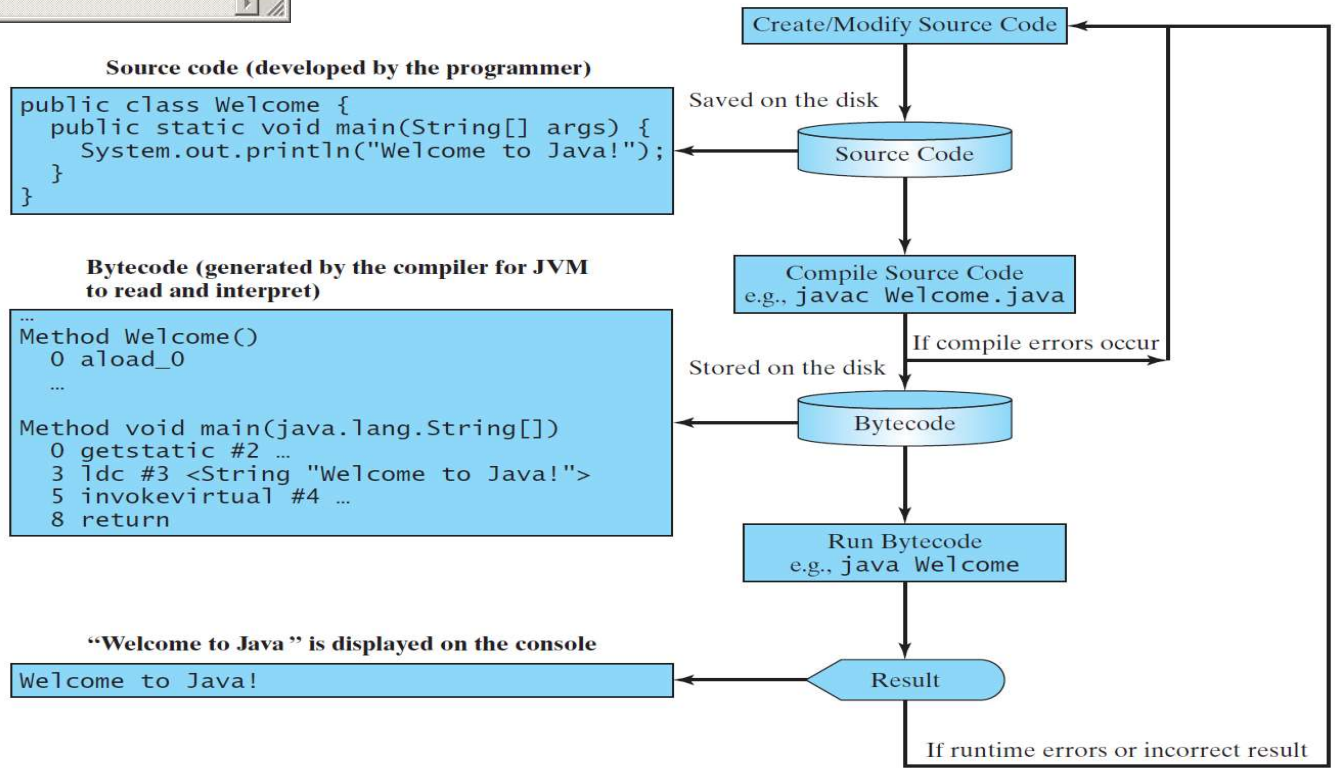
***Java Class Libraries***

- Rich collections of existing classes and methods
- Also known as the Java APIs (Application Programming Interfaces).

# Java Development Environment




Edit → Compile → Load → Verify → Execute



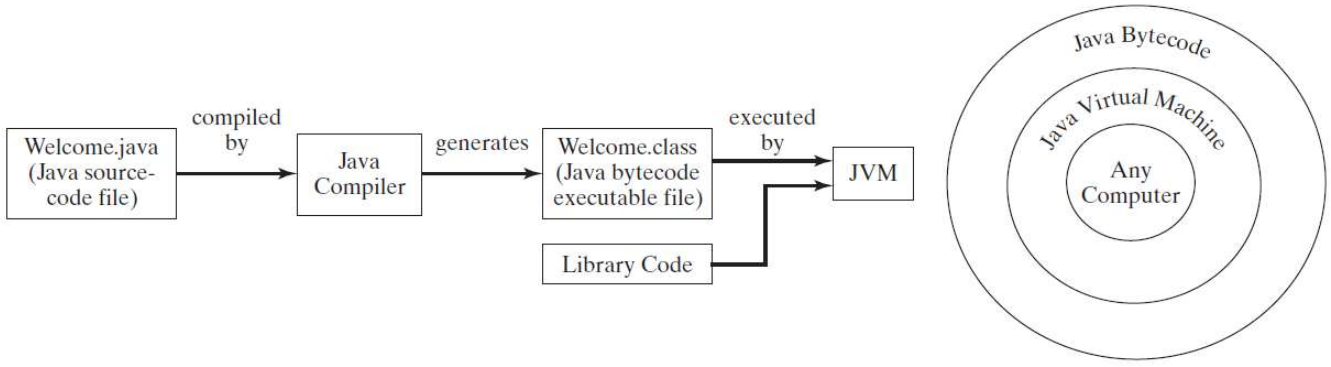
# Java SE Development Kit (JDK)

- The JDK is a development environment for building applications, applets, and components using the Java programming language.
- The JDK includes tools useful for developing and testing programs written in the Java programming language and running on the Java platform.

→**Java SE Development Kit**

# Java Development Environment (Cont.)

- Bytecodes are portable (platform independent)
- The JVM is invoked by the java command.
  - `java Welcome`
- The JVM places the program in memory to execute it. (loading .class file)
  - As the classes are loaded, the bytecode verifier examines their bytecodes
  - Ensures that they're valid and do not violate Java's security restrictions.
- The JVM executes the program's bytecodes.




(a) (b)

# Your First Program in Java: Printing a Line of Text

- Java application
  - A computer program that executes when you use the java command to launch the Java Virtual Machine (JVM).

```
1. /* File: Welcome.java
2. This program prints Welcome to Java!
3. */
4. public class Welcome {
5.  public static void main(String[] args) {
6.     System.out.println( "Welcome to Java!" );
7.  } // end main method
8. }  // end class Welcome
```

## Programming Style and Documentation

- Appropriate Comments
- Naming Conventions
- Proper Indentation and Spacing Lines
- Block Styles

# Programming Errors

- Syntax Errors
  - Detected by the compiler
- Runtime Errors
  - Causes the program to abort
- Logic Errors
  - Produces incorrect result

# Syntax Errors

```
public class Welcome {
  public static main(String[] args) {
    System.out.println("Welcome to Java);
  }
}
```

# Runtime Errors

```
public class Welcome {
  public static void main(String[] args) {
    System.out.println(1 / 0);
  }
}
```

# Logic Errors

```
public class Circle {
  public static void main(String[] args) {
    System.out.print("Area of a circle with radius 5 is ");
    System.out.println( 5 * Math.PI );
  }
}
```