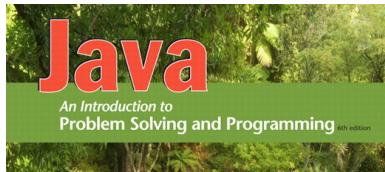


SENG1110/SENG6110

Object Oriented Programming

Lecture 1

Java basics



Outline

- Previously...
 - A computer system consist of two primary components
 - Hardware
 - Software
 - sets of instructions for the computer to follow (program)
 - Programming X software engineering
- Now...
 - Introduction to programming languages – Java
 - Compilers
 - Object Oriented Programming
 - A first Java application

Programming Languages

- *High-level languages* are relatively easy to use
 - Java, C#, C++, Visual Basic, Python, Ruby.
- Unfortunately, computer hardware does not understand high-level languages.
 - Therefore, a high-level language program must be translated into a *low-level language*.

Compilers

- A *compiler* translates a program from a high-level language to a low-level language the computer can run.
- You *compile* a program by running the compiler on the high-level-language version of the program called the *source program*.
- Compilers produce *machine-* or *assembly-language* programs called *object programs*.

Java Byte-Code

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- The Java *compiler* does not translate a Java program into *assembly language* or *machine language* for a particular computer.
- Instead, it translates a Java program into *byte-code*.
 - Byte-code is the machine language for a hypothetical computer (or *interpreter*) called the Java Virtual Machine.

A First Java Application

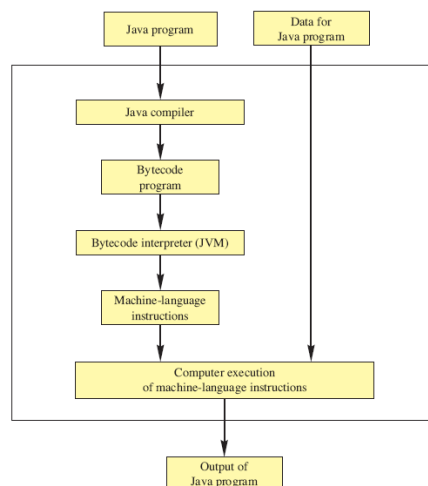
- View [sample program](#)
 - `class FirstProgram`

```
Hello out there.  
I will add two numbers for you.  
Enter two whole numbers on a line:  
12 30  
The sum of those two numbers is  
42
```

Sample
screen
output

Compiling and Running a Program

6



A First Java Application

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```
import java.util.Scanner;  
public class FirstProgram  
{  
    public static void main (String [] args)  
    {  
        int n1, n2;  
        Scanner keyboard = new Scanner (System.in);  
        System.out.println ("Hello out there.");  
        System.out.println ("I will add two numbers for you.");  
        System.out.println ("Enter two whole numbers on a line:");  
        n1 = keyboard.nextInt ();  
        n2 = keyboard.nextInt ();  
        System.out.println ("The sum of those two numbers is");  
        System.out.println (n1 + n2);  
    }  
}
```

Java aspects - 1

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- Java is
 - an object-oriented programming language
 - portable
 - resulting in program that can be run without change on different computer types
 - supportive of threads
 - allowing the construction of systems involving concurrent processes
 - similar to C++
 - for those who already know that language

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Java aspects - 2

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- The Java compiler produces byte code
 - Byte code is the machine language for an imaginary Java computer – Java Virtual Machine (JVM)
 - this is in contrast to most other compilers, which produce instructions compatible with the instruction set of the host CPU

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Java aspects - 3

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- The Java computer is created by running a Java virtual machine (JVM) program on the host computer
 - the JVM program is host-specific, so you need a version suitable for your computer/OS type

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Java aspects - 4

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- Advantage is that any computer can run it
- A JVM is now incorporated into most web browsers
 - so many web pages now have small Java programs embedded in them
 - providing active content to the page

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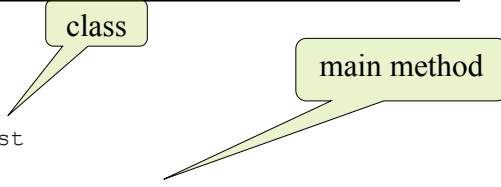
Java aspects - 5

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- Java program
 - collection of **classes** (a class defines the characteristics of similar objects).
 - there is a main **method** in every Java application program (a method is an operation).

Example 0

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```
public class First
{
    public static void main(String[] args)
    {
        System.out.println("Welcome to Seng1110");
    }
}
```

Java Code – Example 1 - Circle

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- A model for calculate a area of a circle:
 - Data: radius
 - Operation: calculate the area: πr^2

```
get radius
area = 3.14 * radius * radius
display area
```

PseudoCode – Example 1 - Circle

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```
double radius, area;
output "Please Enter Radius: "
input radius
area = 3.14 * radius * radius;
output "The Circle Area is ", area;
```

Java Code – Example 1 - Circle

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```
Scanner console = new Scanner(System.in);
double radius, area;
System.out.print("Please Enter Radius: ");
radius = console.nextDouble();
area = 3.14 * radius * radius;
System.out.print("The Circle Area is "+area);
```

The code is incomplete

Java Code – Example 1 - Circle

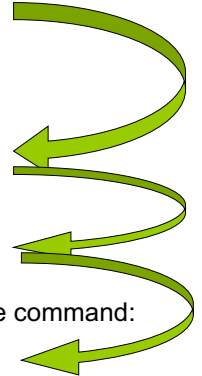
18

```
import java.util.*;
public class Circle
{
    public static void main (String[] args)
    {
        Scanner console = new Scanner(System.in);
        double radius, area;
        System.out.print("Please Enter Radius: ");
        radius = console.nextDouble();
        area = 3.14 * radius * radius;
        System.out.print("The Circle Area is "+area);
    }
}
```

Compiling & Running a Program - 1

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- The file's name (the class) must be `Circle.java`
- The program is compiled with the command:
`javac Circle.java`
- This creates a file called `Circle.class`
- This class file is then executed by the JVM via the command:
`java Circle`



Compiling & Running a Program - 3

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- Use a text editor (eg notepad) to **type in the program code**
 - making sure that the class name is exactly the same as the file name (except for the ".java" extension)
 - note that Wordpad puts an extra ".txt" on the end of the filename, and you will have to remove it
- **Compile** the class
 - using the command `javac Circle.java`
- **Run** the program
 - using the command `java Circle`
 - you don't need to provide the ".class" extension in the command, but it must be present in the filename

Programming

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- Programming is a creative process.
- Programming can be learned by discovering the techniques used by experienced programmers.
- These techniques are applicable to almost every programming language, including Java.

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Object-Oriented Programming

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- Our world consists of *objects* (people, trees, cars, cities, airline reservations, etc.).
- Objects can perform *actions* which affect themselves and other objects in the world.
- Object-oriented programming (*OOP*) treats a program as a collection of objects that interact by means of actions.

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Algorithms

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- An algorithm is a set of instructions for solving a problem (or provide actions for objects to perform)
- An algorithm must be expressed completely and precisely.
- Algorithms usually are expressed in English or in *pseudocode*
- Once an algorithm is defined, expressing it in Java (or in another programming language) usually is easy.

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Testing and Debugging

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- Eliminate errors by avoiding them in the first place.
 - Carefully design classes, algorithms and methods.
 - Carefully code everything into Java.
- Test your program with appropriate test cases (some where the answer is known), discover and fix any errors, then retest.

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Your task

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- Read
 - Chapter 1 of the text book
- Exercises
 - Chapter 1 of the text book

