

INTRODUCTION TO JAVA

서울대학교 우리은행 교육과정 핀테크 산업 응용 1차시 강의 파트 II

엄현상(Eom, Hyeonsang)
School of Computer Science and Engineering
Seoul National University

©COPYRIGHTS 2022 EOM, HYEONSANG ALL RIGHTS
RESERVED

Outline

- Java Overview
- Java Examples
- Brief Introduction to GO
- Q&A

Java Overview

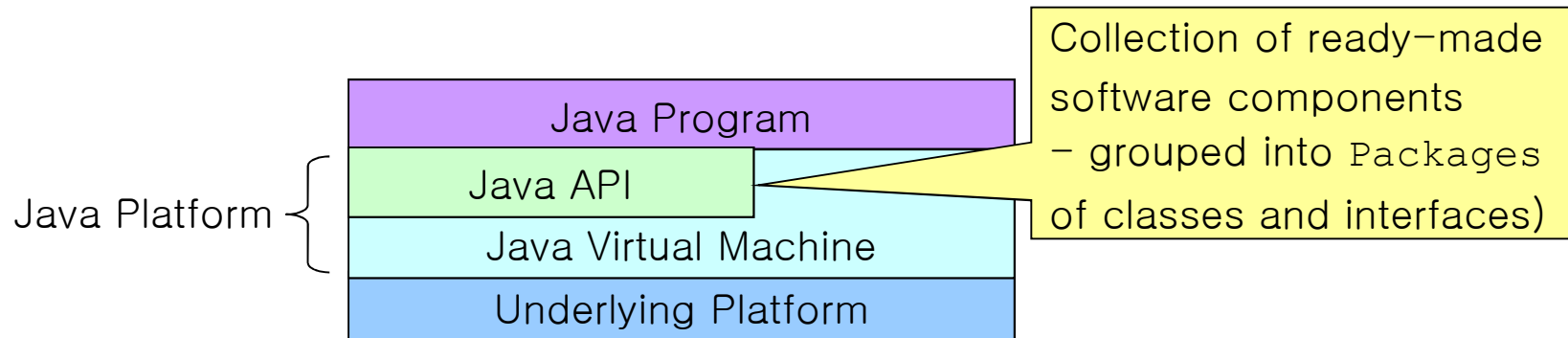
- Object-Oriented Programming Language (OOPL) by Sun in 1991
 - Programming with One or More Classes
 - Simple Structure
 - w/o header files, preprocessor, struct, operator overloading, multiple Inheritance, pointers, etc.
 - Garbage Collection
 - No need to delete or return any storage
 - Dynamic Loading
 - Classes being loaded as needed
 - Platform Independence
 - Java Virtual Machine (JVM)
 - Multithreading
 - Support for multiple threads of execution

Some Differences with C/C++

- Automatic Memory Management
 - Garbage Collector
 - No Dangling Pointers or Memory Leaks
- No Pointer Handling
 - No Explicit Reference/Dereference Operations
- No Makefiles
- No Header Files
 - cf, imported Packages
- No Function Declaration (Similar to C)
- No Default Function Argument

Java Platform

- S/W Platform for Running Java
 - On top of any platforms
 - Java Virtual Machine (JVM)
 - Java Application Programming Interface (Java API)

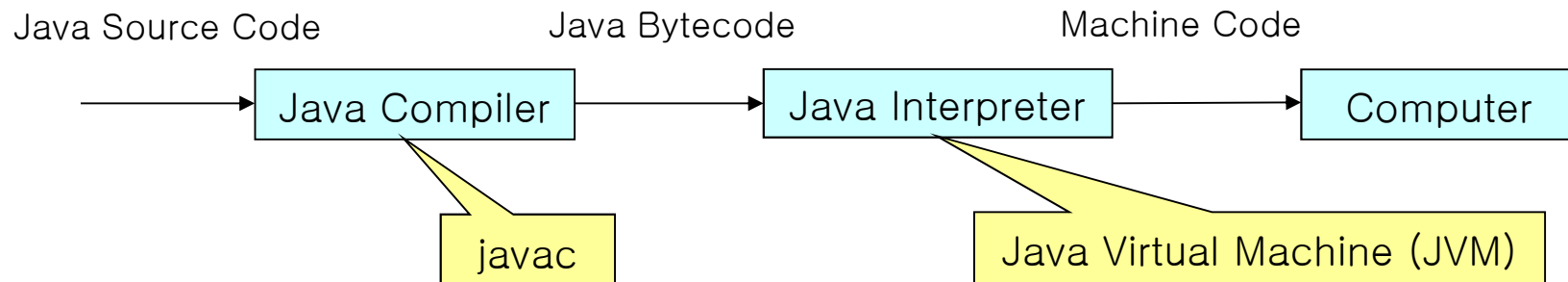


Java Interpreter

- Implementation of the JVM
 - Executing Java Bytecodes
 - Java bytecodes can be considered as intermediate code instructions for the JVM
 - Java programs, once compiled into bytecodes, can be run on any JVM

How a Java Program Runs

- Compilation and Interpretation
 - Compiler First Translates a Java Program into Java Bytecodes
 - Once
 - Interpreter Parses and Runs Each Java Bytecode Instruction
 - Multiple times on different platforms



Java Program

- Saved in Files, Each of Which Has the Same Name as the **public** Class
 - Containing Only One **public** Class
 - Containing Other Non-**public** Classes

```
public class HelloWorld {  
    public static void main(String args[]) {  
        System.out.println("Hello, World");  
    }  
}
```

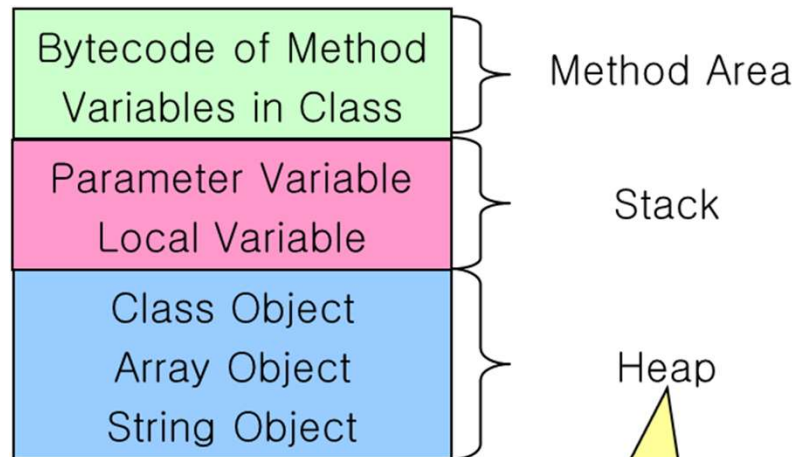
This code must be saved in HelloWorld.java

```
$ javac HelloWorld.java  
$ java HelloWorld  
Hello, World
```

compile (create HelloWorld.class; bytecode)

start the JVM and run the main method

Memory Layout of a Java Program



Space for **objects**
created by `new` operator

```
public class MemoryModelTest {  
    static int x=0;  
    public static void main(String args[]) {  
        int a=10, b=20, c;  
        c = add(a, b);  
    }  
    static int add(int a, int b) {  
        return(a + b);  
    }  
}
```

Sample Program:
MemoryModelTest.java

Class

- Unit of Programming
 - Java Program: a Collection of Classes
 - Source code in .java files
- Description (Blueprint) of Objects (Instances)
 - Common Characteristics
- Instances Have These Characteristics
 - Attributes (Data Fields) for Each Object
 - Methods (Operations) That Work on the Objects

Member Access Control

- Way to Control Access to a Class' Members from Other Classes
 - **private**
 - Accessible only in the class itself
 - Default (package or friendly)
 - Accessible in the same-package subclasses of the class or in the classes of the same package
 - **protected**
 - Accessible in the subclasses of the class or in the classes of the same package
 - **public**
 - Accessible everywhere

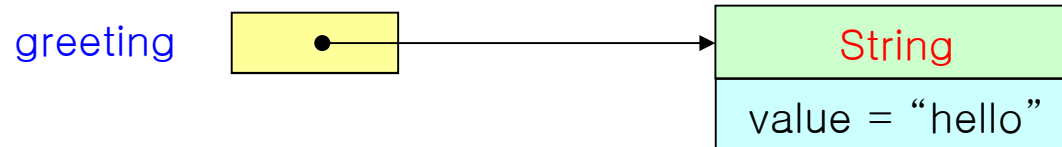
Object

- Instance of a Class
- Uniquely Identifiable Entity
 - w/ Its State, Behavior, and Interface
 - Maintaining Data Values in Its Attributes
 - Referenced by a Reference Variable (of Reference Type)
 - Inheriting from the Class **Object**
 - w/ a number of methods
 - **toString(), equals(), ... &, clone()**

Managing Objects

- Referencing Objects of Specified Types
 - Objects Created by the **new** Operator
- Creating Objects by Executing the Constructors
 - Constructor (Function) Overloading

```
String greeting = new String("hello");
```



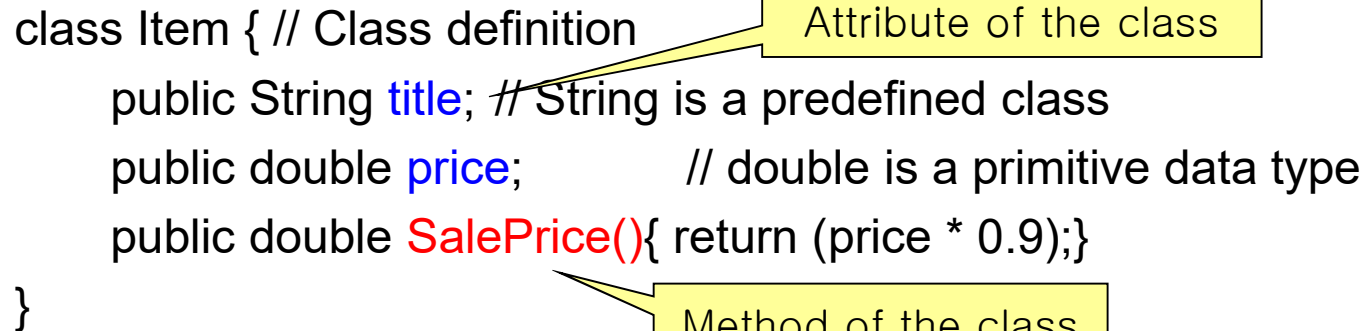
- Deleting Objects via Garbage Collection
 - Reference Count for Each Object

Cleanup occurs at the convenience of the Java runtime environment

Java Example: Abstraction

- Online Retailer Such as Amazon.Com
 - Item: Type, Title, Maker, Price, Availability, etc.

```
class Item { // Class definition
    public String title; // String is a predefined class
    public double price; // double is a primitive data type
    public double SalePrice(){ return (price * 0.9);}
}
```



```
Item A = new Item(); // Class object definition and creation
```

Variable of reference type

```
// OKAY : A.title, A.price, and A.SalePrice()
```

Java Example: Encapsulation

- Online Retailer Example Cont'd

```
class Item {  
    public String title;  
    public double price;  
    private int inStockQuantity;  
    public double SalePrice(){ return (price * 0.9);}  
    public boolean isAvailable(){  
        if(inStockQuantity > 0) return true;  
        else return false;  
    }  
}
```

inStockQuantity attribute is not accessible outside of the Item class

```
Item A = new Item(); // Class object definition and creation
```

```
// NOT OKAY: A.inStockQuantity  
// OKAY: A.isAvailable()
```

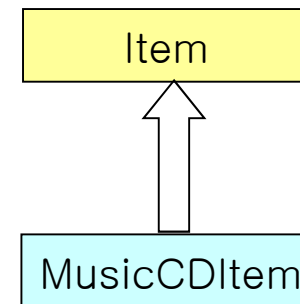
Java Example: Inheritance

- Online Retailer Example Cont'd

```
class MusicCDItem extends Item {  
    public String singer_name;  
}
```

```
// Class object definition and creation  
MusicCDItem B = new MusicCDItem;
```

```
// OKAY: B.singer_name, B.title, B.price, B.SalePrice(),  
// and B.isAvailable()  
// NOT OKAY: B.inStockQuantity
```



Java Example: Polymorphism

- Online Retailer Example Cont'd

```
class Item {  
    public String title;  
    public double price;  
    private int inStockQuantity;  
    public double SalePrice(){ return (price * 0.9);}  
    public boolean isAvailable(){  
        if(inStockQuantity > 0) return true;  
        else return false;  
    }  
    public void specificInfo() {  
        System.out.println("no info: a base-class object");  
    }  
}
```

Java Example: Polymorphism

- Online Retailer Example Cont'd

```
class MusicCDItem extends Item {  
    public String singer_name;  
    public void specificInfo(){  
        System.out.println("signer name=" + singer_name +  
            " : a derived-class object");  
    }  
}
```

```
public class OnlineRetailer {  
    static void printSpecificInfo(Item item){item.specificInfo();}  
    public static void main(String args[]){ ... }  
}
```

```
Item A = new Item();  
MusicCDItem B = new MusicCDItem();  
  
printSpecificInfo(A); // Call Item.specificInfo()  
printSpecificInfo(B); // Call MusicCDItem.specificInfo()  
// - Another derived class (e.g., MovieDVDItem) with specificInfo()
```

Static Modifier

- Use: Static Attributes & Static Methods
- Features
 - All Classes Share Static Members
 - It Is Possible to Invoke Static Methods w/o Instantiation
 - In Static Methods, It Is Allowed to Access Non-Static Data or Non-Static Methods of Classes after the Instantiation of the Objects

```
class A{  
    private int i = 5;  
    public static printI(){  
        System.out.println(i);  
        System.out.println(new A().i);  
    }  
}
```

// error!

GO

- Developed by Google
- Garbage Collector
- Concurrency
 - goroutine
 - Synchronization via message passing by Communicating Sequential Processes (CSPs)
- Small Memory
 - Small stack

GO vs Java

- “Probably” Faster
 - No interpretation
- Asynchronous or Parallel “Threads”
 - goroutine
- More Practical
 - Similar to C/C++
- Dependent on the Architecture
 - Using the Libraries on the Computer
- Not Major
 - Not supported in some platforms

Thank You!

Eom, Hyeonsang(엄현상)
(hseom@snu.ac.kr)