Object Oridented Programming (OOP) Introduction

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Contents

1. What is programming?

2. Java language, a leading player in object-oriented programming

3. Installation of Java Eclipse

4. Process of Java programming

1. What is programming?

Programming

Programming language: "컴퓨터가 실행할 프로그램을 작성하기 위한 언어"

기계어(Machine language): 이진수 명령어들로 구성
- 컴퓨터는 Binary code만 처리 가능

어셈블리어(Assembly language): 니모닉 (Mnemonic) 기호 활용

Machine code:
   1010111 11100111 11101010
   0001101 10101011
   01111001 10101101
   ....

Assembly code:
   MV 0, SUM
   MV NUM, AC
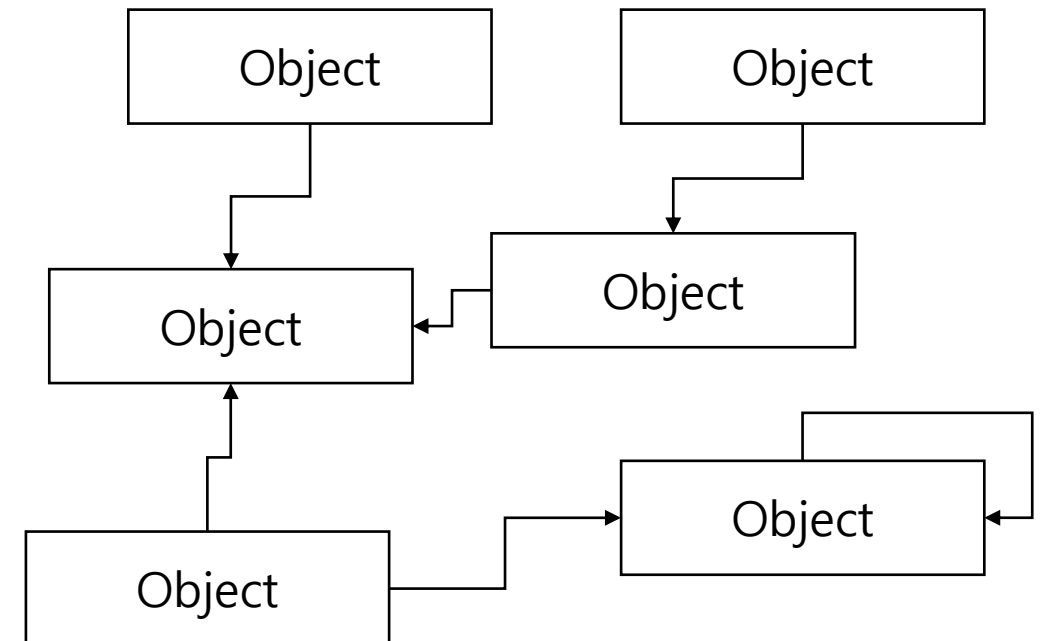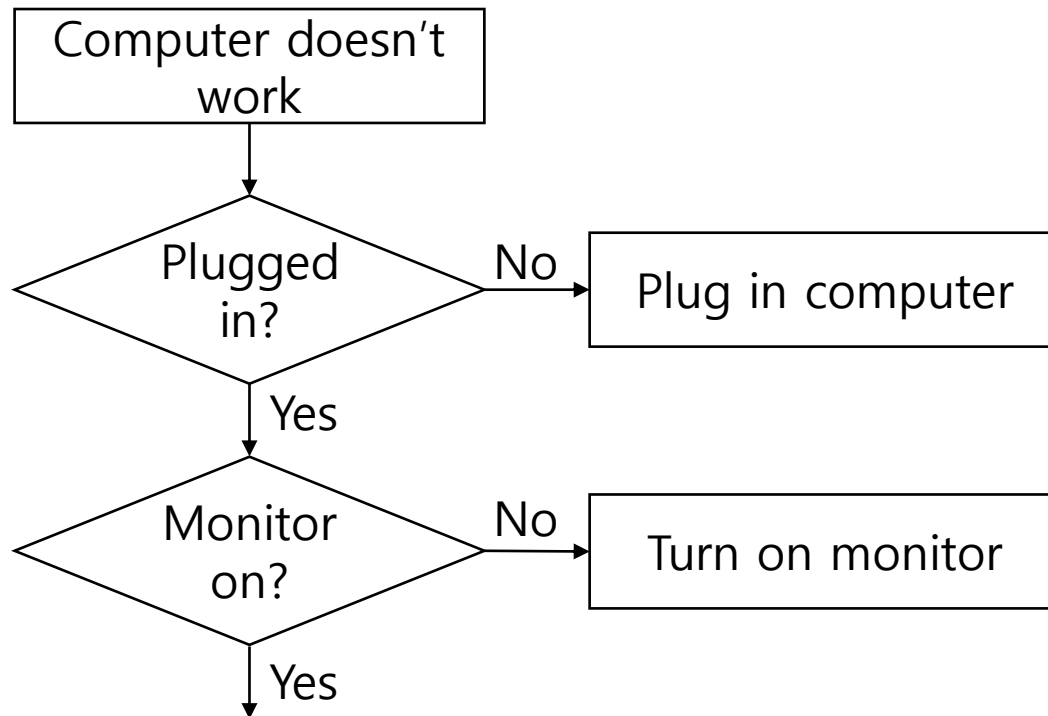   ADD   SUM, AC
   STO   SUM, TOT

Programming

고급 언어: 사람이 효율적으로 표현할 수 있는 언어
- Pascal, C/C++, C#, Java 등

절차지향 언어 vs 객체지향 언어

High-level code:
$$X = (2 * X + Z - Y) / 5$$

```
Computer doesn't work
        ↓
    Plugged in?  ── No ──→  Plug in computer
        │ Yes
        ↓
    Monitor on?  ── No ──→  Turn on monitor
        │ Yes
        ↓
```

| Object | | Object |

Object

Object

Object

Object

Programming

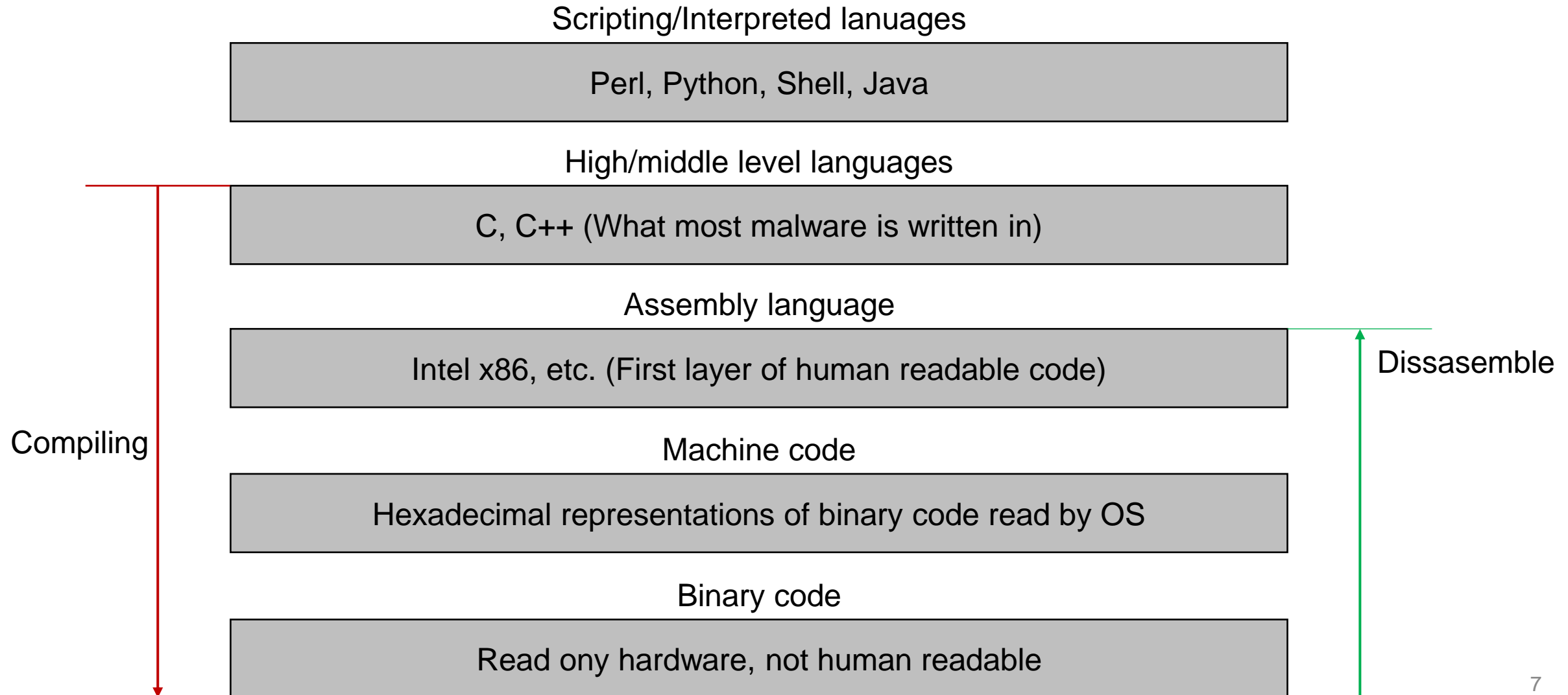Programming: 컴퓨터가 일을 수행하도록 프로그래밍 언어로 명령어 집합을 만드는 일
- 명령어 집합 = 프로그램

Compile: 프로그래밍 언어를 컴퓨터가 실행 가능한 기계어로 만드는 일

Compiler: 기계어로 바꾸어주는 프로그램 (ex. Java compiler, gcc, etc.)

Programming language: "컴퓨터가 실행할 프로그램을 작성하기 위한 언어"

Programming

Scripting/Interpreted lanuages

Perl, Python, Shell, Java

High/middle level languages

C, C++ (What most malware is written in)

Assembly language

Intel x86, etc. (First layer of human readable code)

Machine code

Hexadecimal representations of binary code read by OS

Binary code

Read ony hardware, not human readable

Compiling

Dissasemble

2. Java language, a leading player in OOP

Java Programming

Popularity of Java
- TIOBE Index (Before 2022)
    - www.tiobe.com/tiobe-index

| Programming Language	2023	2018	2013	2008	2003	1998	1993	1988
Python	1	4	8	7	13	27	17	-
C	2	2	1	2	2	1	1	1
Java	3	1	2	1	1	19	-	-
C++	4	3	4	4	3	2	2	6
C#	5	5	5	8	10	-	-	-
Visual Basic	6	15	-	-	-	-	-	-
JavaScript	7	7	10	9	8	22	-	-
Assembly language	8	12	-	-	-	-	-	-
SQL	9	251	-	-	7	-	-	-
PHP	10	8	6	5	6	-	-	-
Objective-C	17	18	3	46	48	-	-	-
Ada	28	28	16	18	15	8	8	2
Lisp	31	31	13	15	14	7	4	3
Pascal	227	136	15	20	99	12	3	14
(Visual) Basic	-	-	7	3	4	3	6	5

Java Programming

Popularity of Java
- TIOBE Index (2023)
  - www.tiobe.com/tiobe-index

| Feb 2023	Feb 2022	Change		Programming Language	Ratings	Change
1	1			Python	15.49%	+0.16%
2	2			C	15.39%	+1.31%
3	4	^		C++	13.94%	+5.93%
4	3	v		Java	13.21%	+1.07%
5	5			C#	6.38%	+1.01%
6	6			Visual Basic	4.14%	-1.09%
7	7			JavaScript	2.52%	+0.70%
8	10	^		SQL	2.12%	+0.58%
9	9			Assembly language	1.38%	-0.21%
10	8	v		PHP	1.29%	-0.49%
11	11			Go	1.11%	-0.12%
12	13	^		R	1.08%	-0.04%
13	14	^		MATLAB	0.99%	-0.04%
14	15	^		Delphi/Object Pascal	0.95%	+0.05%
15	12	v		Swift	0.93%	-0.25%

Java Applications

Typical java application
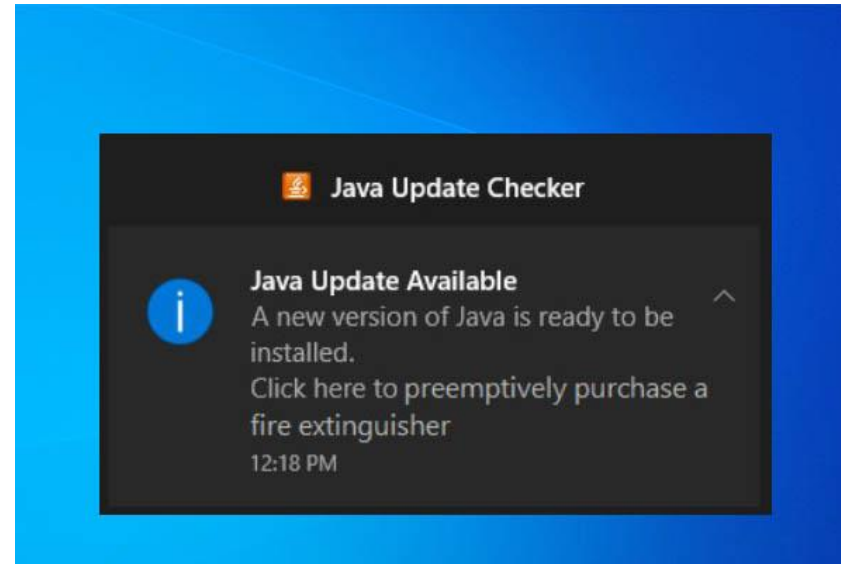
Java Applications

Java program running on a web server
- Servlet application
- * Servlet
  - 클라이언트의 요청을 처리하고, 그 결과를 반환하는 자바 웹 프로그래밍 기술
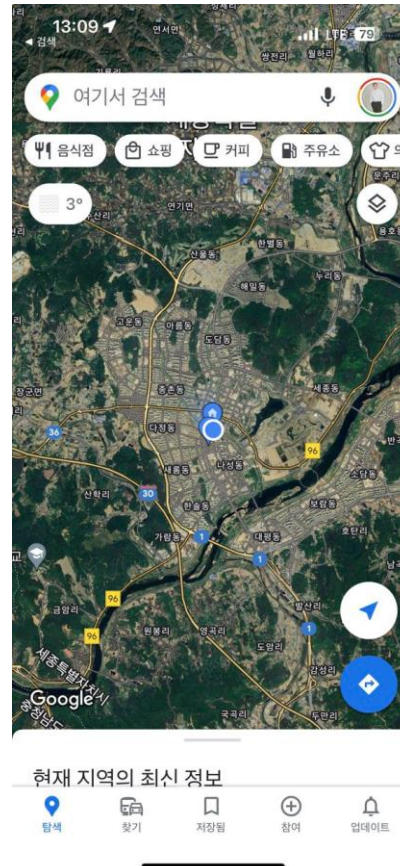 - Not Javascript (but closely related)

Browser

Web server

JVM

servlet

Internet

Server

Database
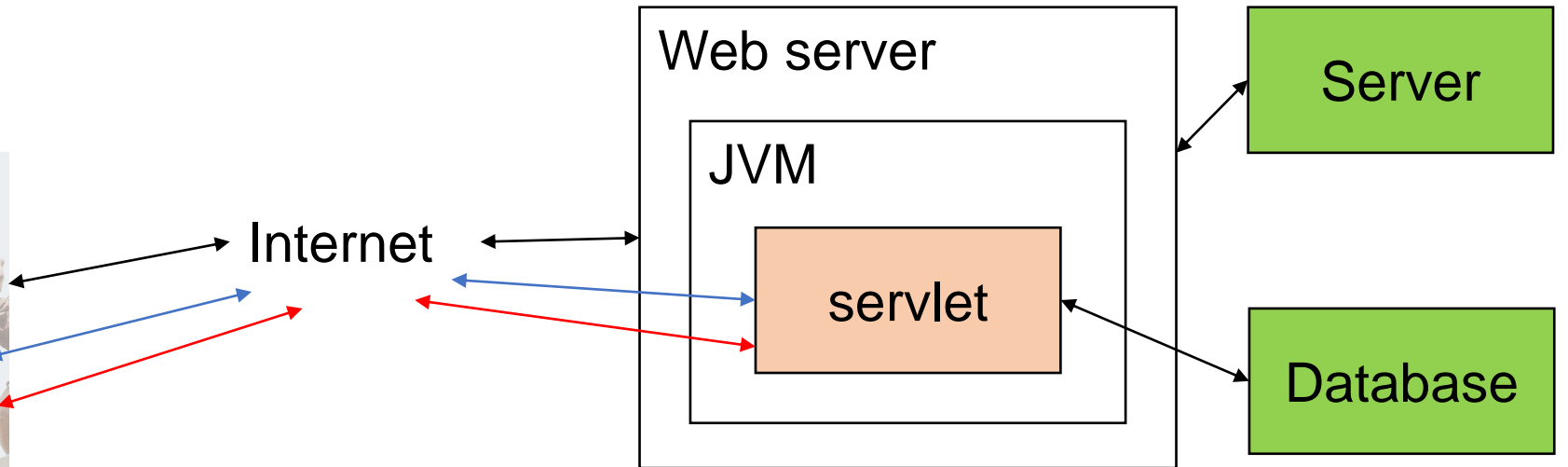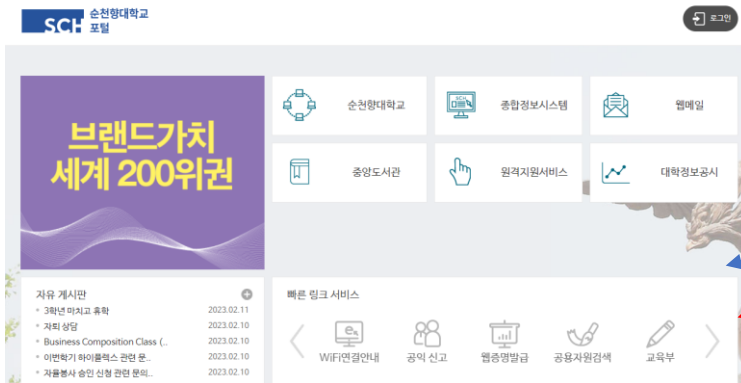
Java Applications

Mobile application (Android)
- Free mobile platform organized by several mobile companies led by Google

3. Installation of Java Eclipse

1ˢᵗ step: Java JDK

JDK
- Java Development Kit
- Java에서 제공되는 개발용 라이브러리. 계속 버전이 올라가고 있음

JRE
- Java Runtime Environment
- Java 프로그램이 실행되는 환경. 8.0까지 무료로 제공됨

JVM
- Java Virtual Machine
- Java 가상 머신으로 프로그램이 실행되는 환경인 JRE가 설치되어 있어야 함

1st step: Java JDK

JDK download link

- https://www.oracle.com/java/technologies/downloads/

Java 19   Java 17

Java SE Development Kit 17.0.6 downloads

Thank you for downloading this release of the Java™ Platform, Standard Edition Development Kit (JDK™). The JDK is a development environment for building applications and components using the Java programming language.

The JDK includes tools for developing and testing programs written in the Java programming language and running on the Java platform.

Linux   macOS   **Windows**

Product/file description	File size	Download
x64 Compressed Archive	172.11 MB	https://download.oracle.com/java/17/latest/jdk-17_windows-x64_bin.zip (sha256)
x64 Installer	153.22 MB	https://download.oracle.com/java/17/latest/jdk-17_windows-x64_bin.exe (sha256)
x64 MSI Installer	152.01 MB	https://download.oracle.com/java/17/latest/jdk-17_windows-x64_bin.msi (sha256)

1ˢᵗ step: Java JDK

Installing...
- Next > Next > Close

Check path
- C:/Program Files/Java/jdk-17/bin

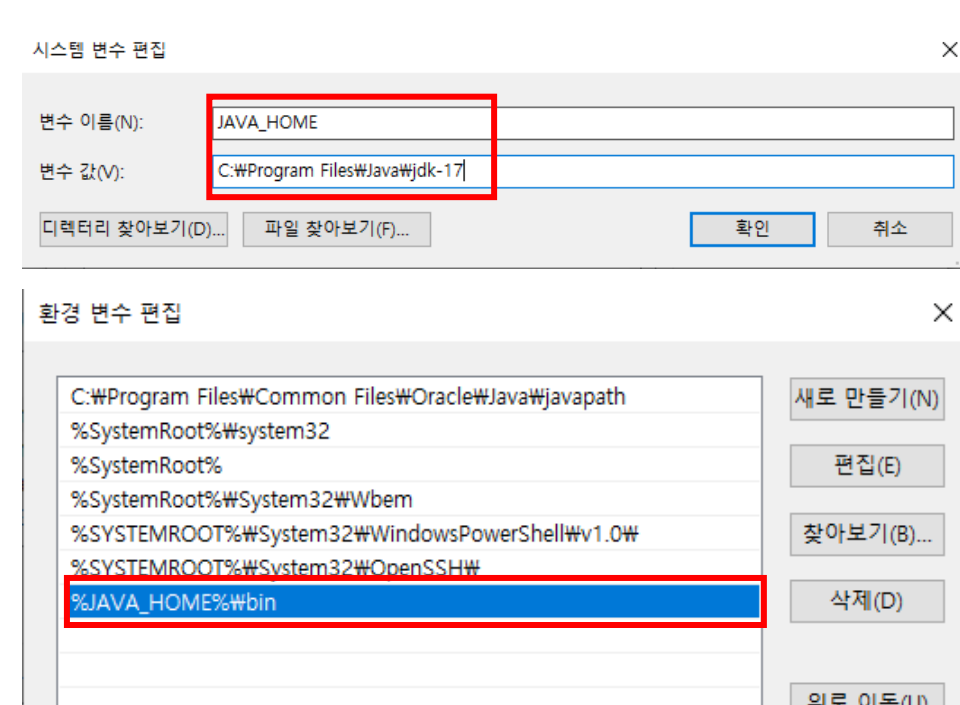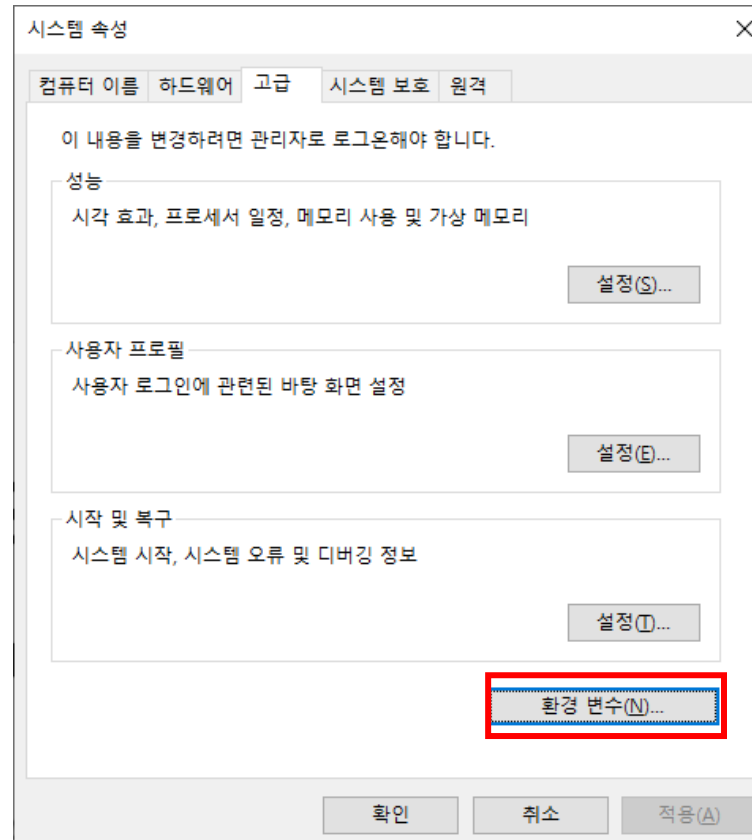# 1st step: Java JDK

Add the Java compiler to your PATH variable
- 1) Select Start -> Control Panel -> search control panel, for "environment" -> Edit the system environment variables -> Environment Variables

- 2) Under "System variables", find the one named "Path". Select Edit

- 3) Add location of bin folder in your system
  - (example) C:/Program Files/Java/jdk-17/bin

- In most cases, this step will be automatically applied in Windows 10.
  - But please check your Environment Variables

1ˢᵗ step: Java JDK
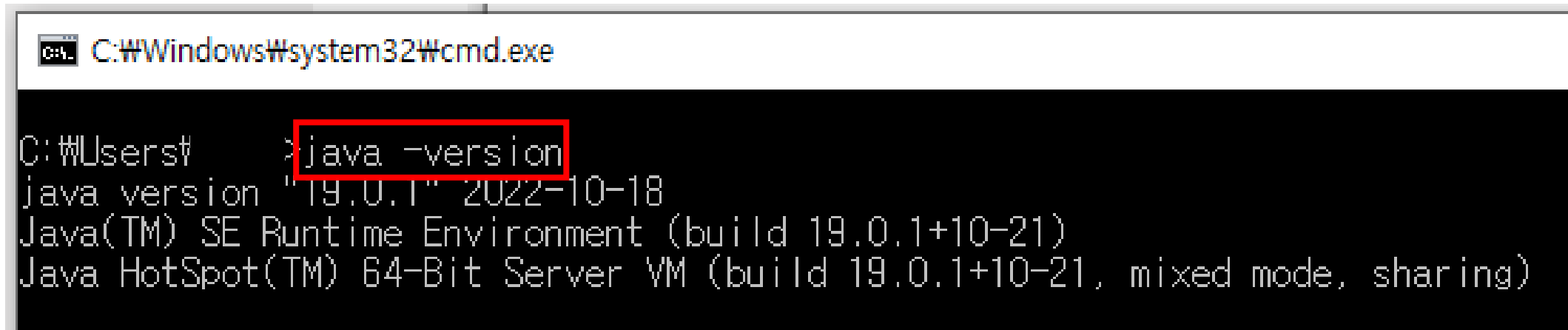
Result
- Recommend to make "JAVA_HOME" variable,
  and add like "%JAVA_HOME%bin" in variable editting

1st step: Java JDK

Test

- 1) win-key + R
- 2) type "cmd"
- 3) type "java -version" (Please be care space between "java" and "-version")
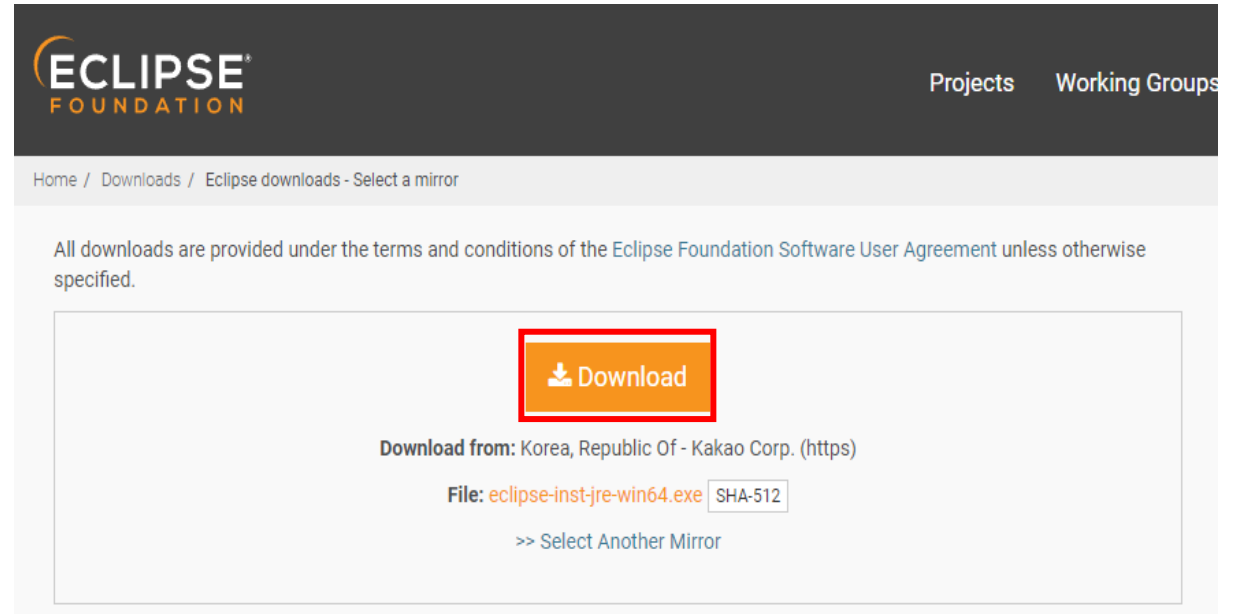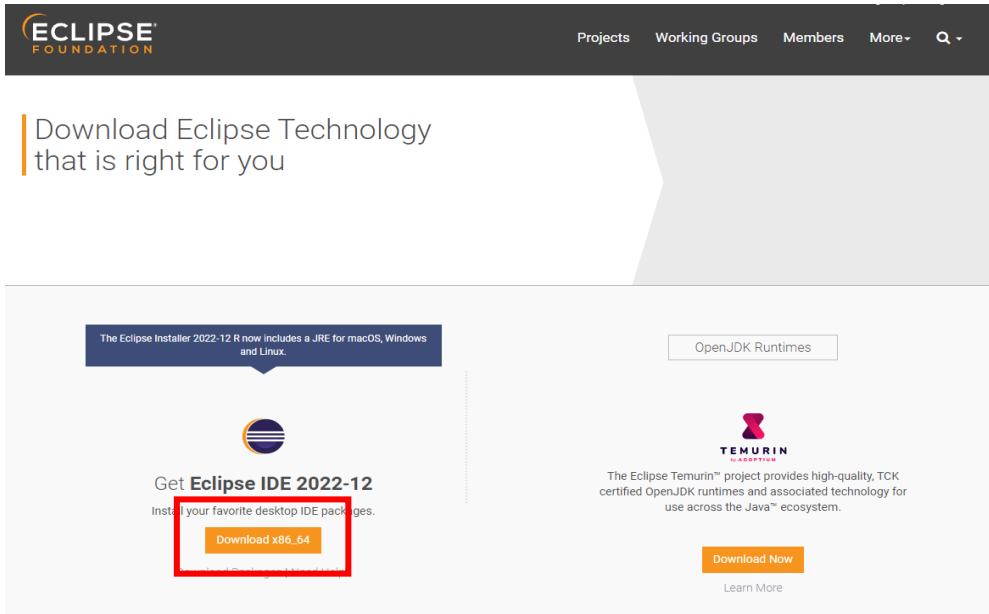
2nd step: Eclipse IDE

IDE
- Integrated development environment (통합 개발 환경)
- IDE가 없으면?

- IDE의 종류
  - Visual studio: mainly for C/C++/C#
  - Visual studio code (VS code), Jupyter Notebook: mainly for Python
  - Eclipse: mainly for Java
  - R Studio: mainly for R

2ⁿᵈ step: Eclipse IDE
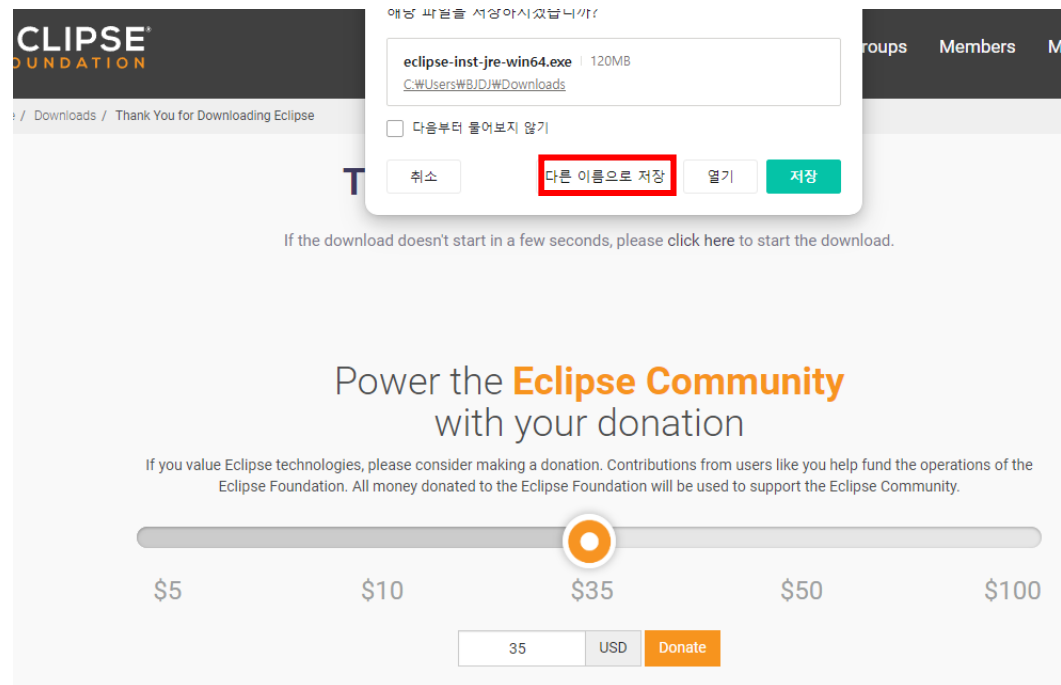
Eclipse download link

- https://www.eclipse.org/downloads/
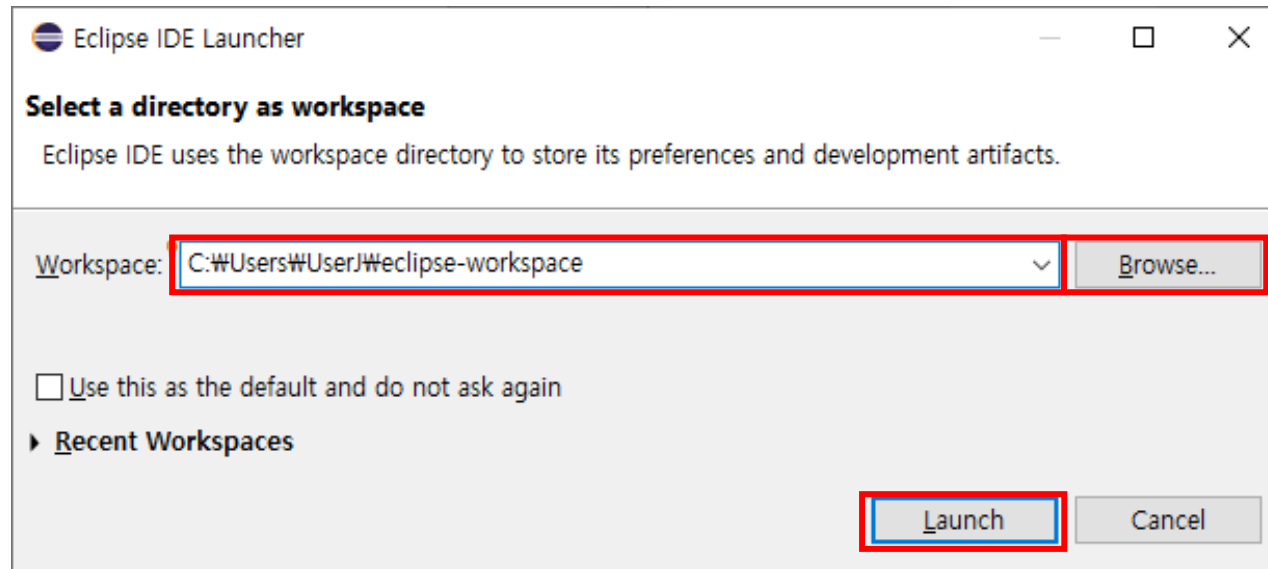
2ⁿᵈ step: Eclipse IDE

Installing...
- Don't donate it
- Please select "Eclipse IDE for Java Developers"

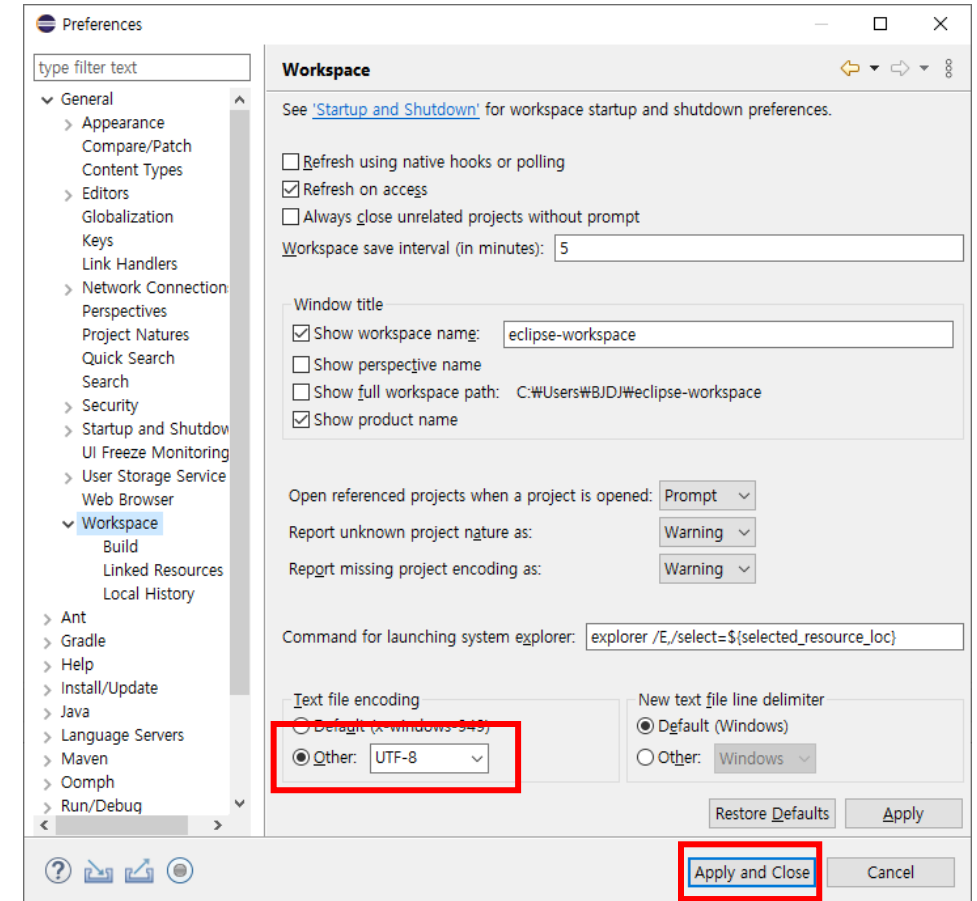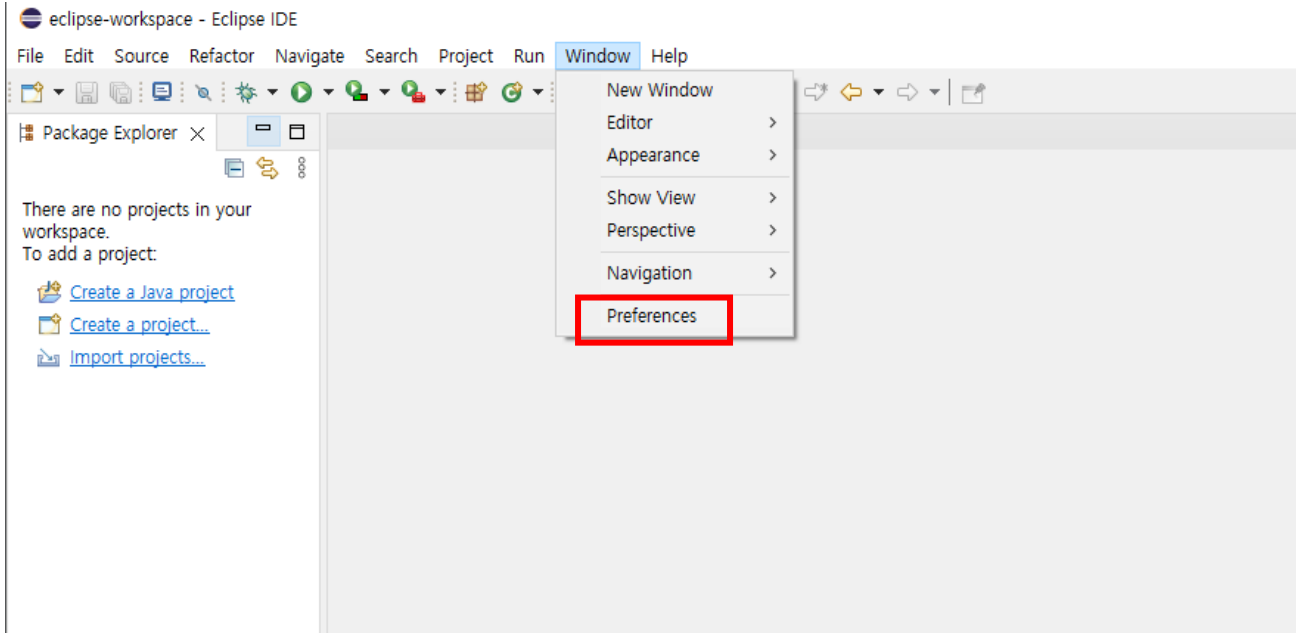# Final step: "Hello World!" test

Setup
- Set teh workspace by using "Browse..." button
- Click Launch

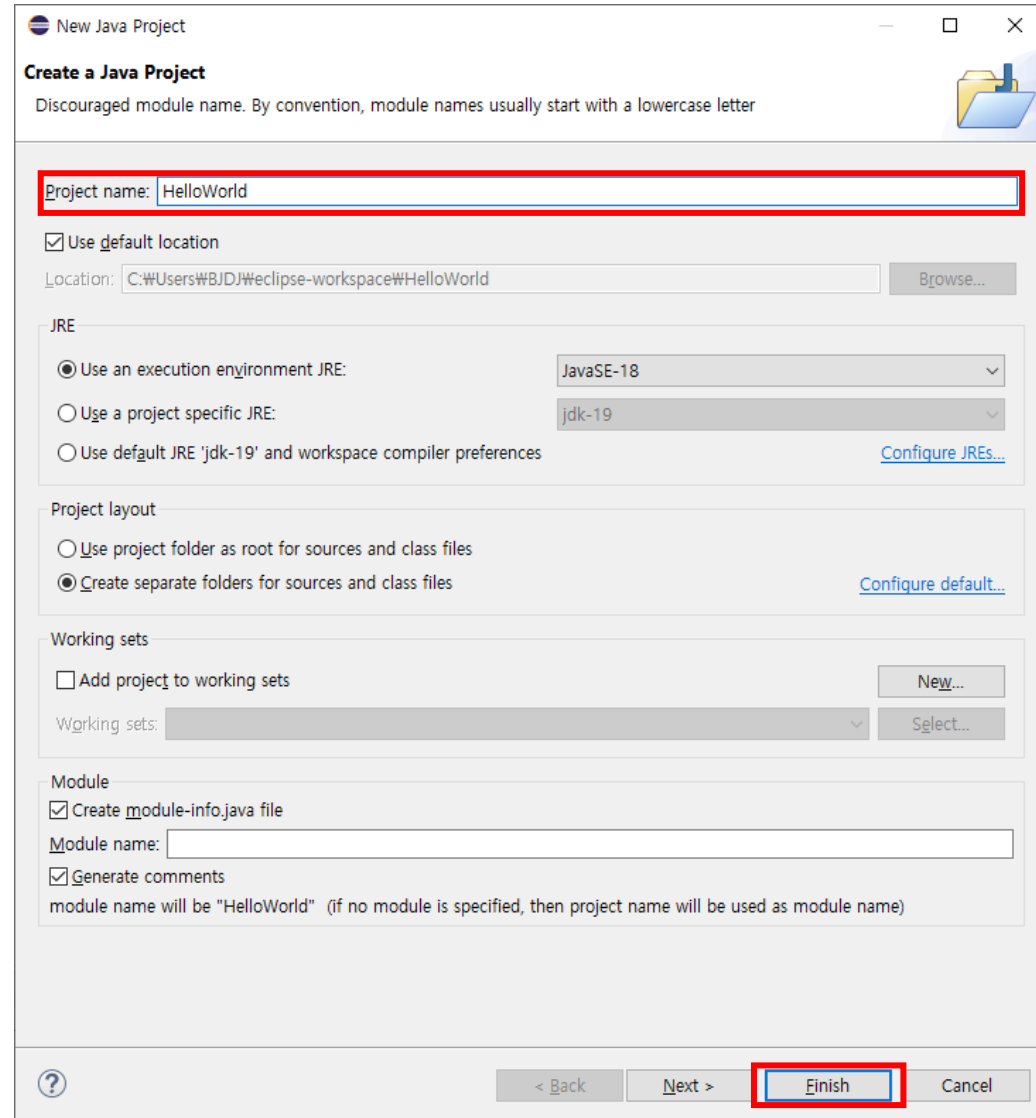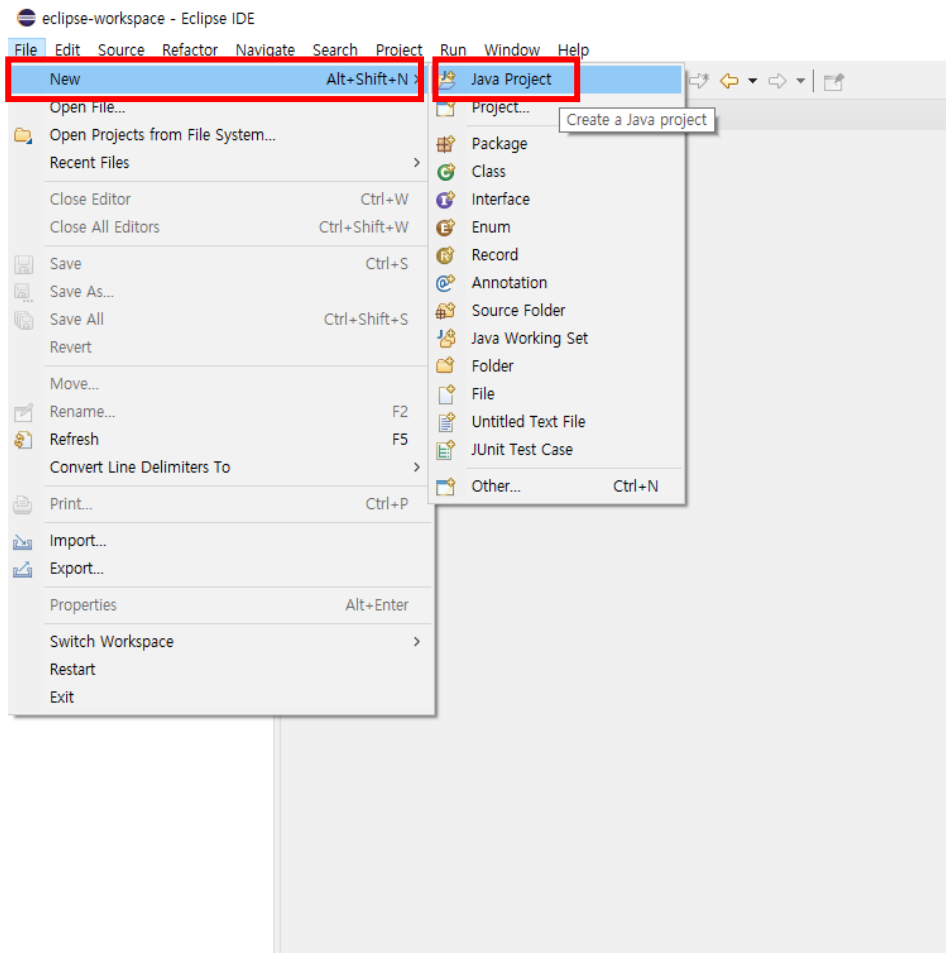# Final step: "Hello World!" test
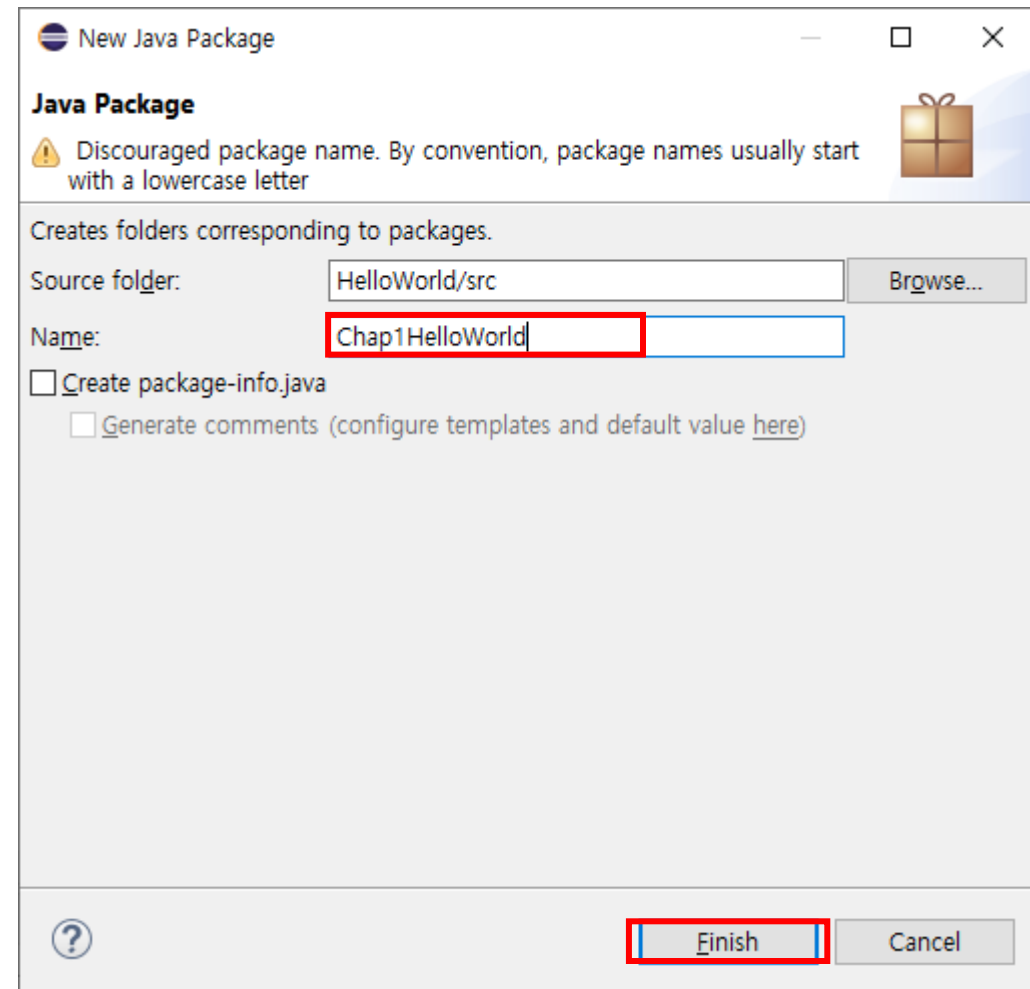
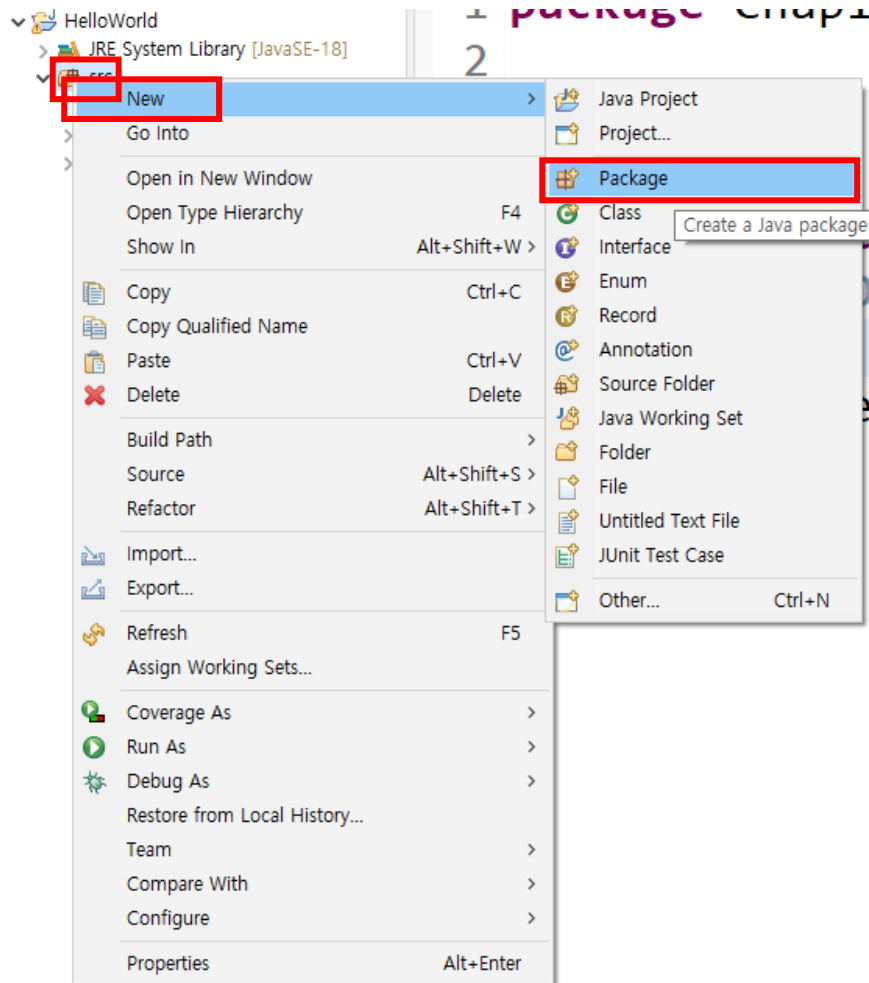Setup

- Language encoding setting

Final step: "Hello World!" test
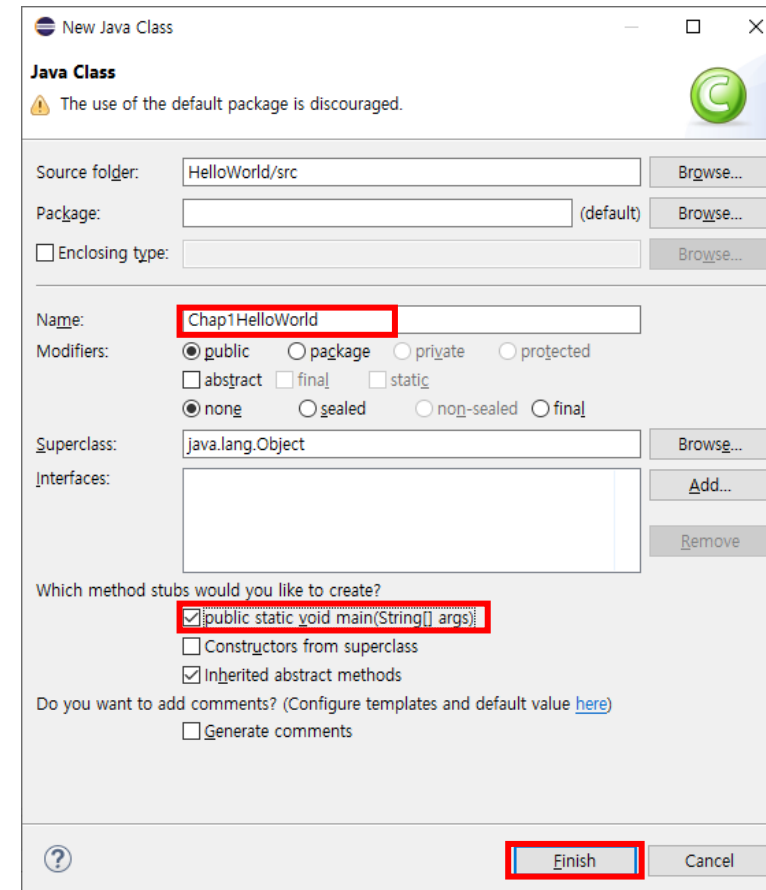
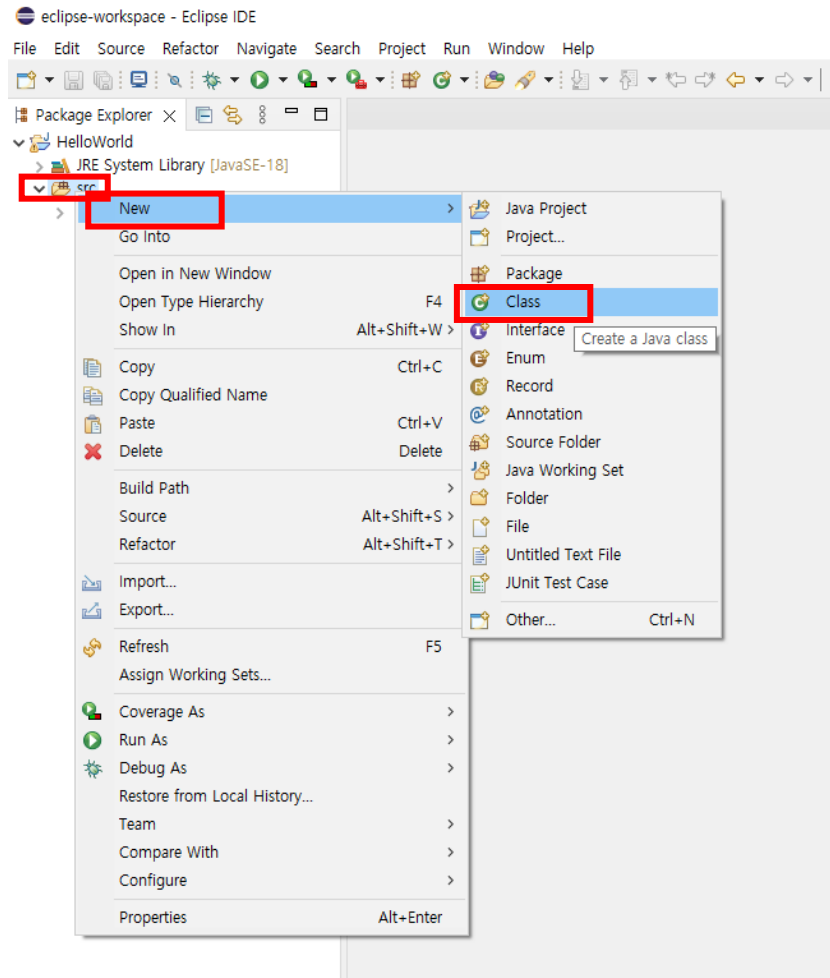Create Java Project

Final step: "Hello World!" test

Create Java Project

Final step: "Hello World!" test

Create Java Project

Java project structure

Java Project ➔ Package ➔ Class

Project
- 1개의 거대한 프로젝트
- Package들의 집합

Package
- Class, Interface, Enum 등 Instance(인스턴스)의 집합

Class
- Function(함수), Method(메소드)로 구성된 로직

Java project structure

Java Project ➔ Package ➔ Class

```java
package Chap1HelloWorld;

public class Chap1HelloWorld {

    public static void main(String[] args) {
        // TODO Auto-generated method stub
        System.out.println("Hello World!");
        System.out.println("Welcome to the Java!");

    }

}
```

Console ✕
<terminated> Chap1HelloWorld [Java Applicatio

Hello World!

Java project structure

Java Project ➔ Package ➔ Class

```java
package Chap1HelloWorld;

public class Chap1HelloWorld {

    public static void main(String[] args) {
        // TODO Auto-generated method stub
        System.out.println("Hello World!");
        System.out.println("Welcome to the Java!");

    }

}
```

Useful Shortcut

Frequently used shortcut keys
(1) Ctrl + F11: Compile & Run
(2) Ctrl + /: Single line comment & Remove comment
(3) Ctrl + Shift + \: Multiple lines comment
(4) Ctrl + Shift + /: Remove block comment
(5) Ctrl + I (i): Code sorting

4. Process of Java programming

Program development by Java

Development of Java Program
- Developed by dividing into several source (.java)
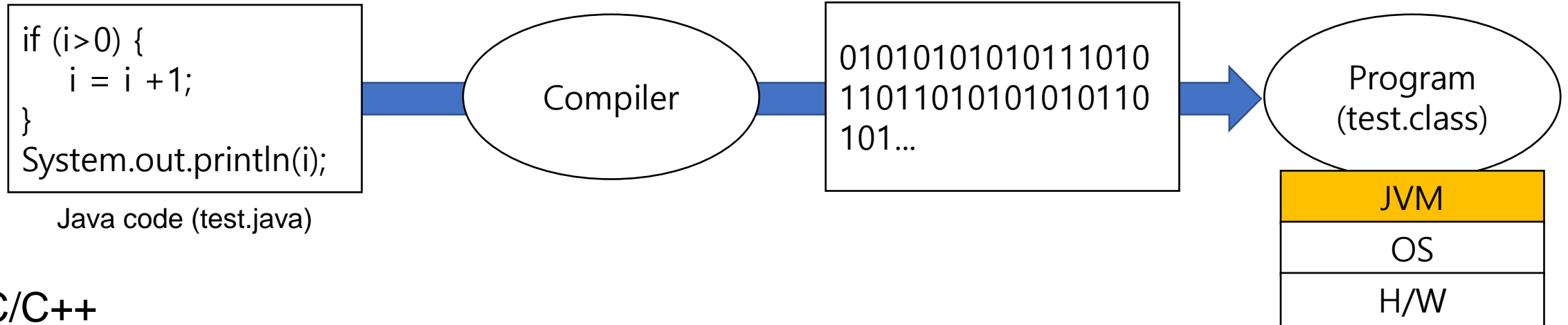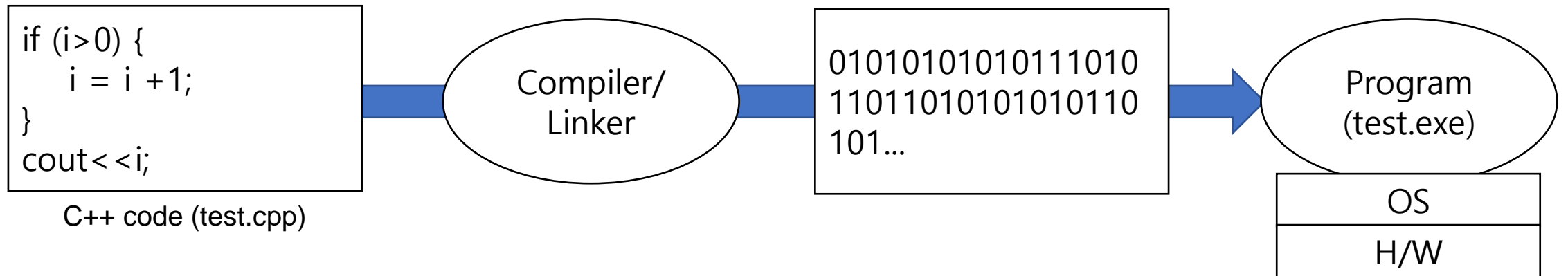- No linking process to make bytecode (.class) into one excutable file (.exe)
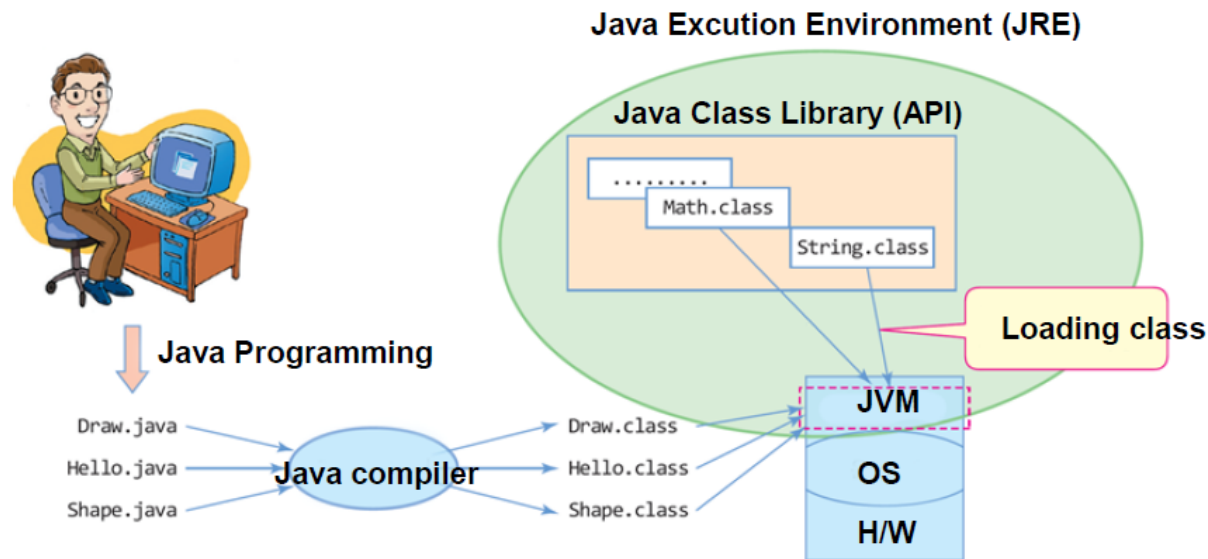
Execution
- Start execution from class with a main() function
- JVM can load class files when its be required, and executes with less memory

Deference between Java and C/C++

Java

```
if (i>0) {
    i = i +1;
}
System.out.println(i);
```
Java code (test.java)

→ Compiler →

```
010101010101111010
110110101010101101
101...
```

→

Program
(test.class)

JVM
OS
H/W

C/C++

```
if (i>0) {
    i = i +1;
}
cout<<i;
```
C++ code (test.cpp)

→ Compiler/
Linker →

```
010101010101111010
110110101010101101
101...
```

→

Program
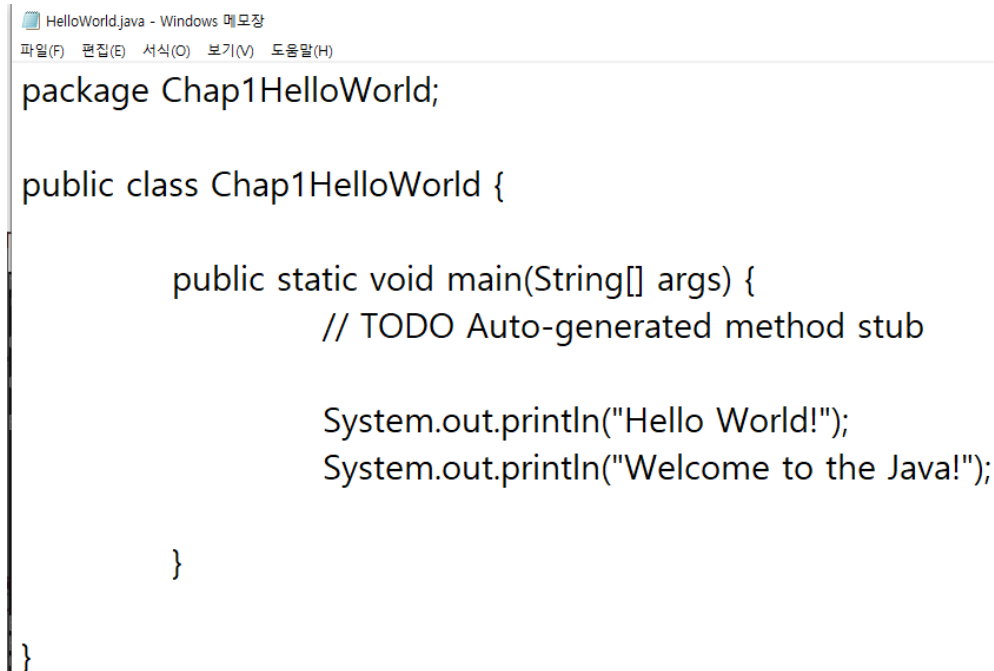(test.exe)

OS
H/W

Program development by Java

Please write down the source code and save as "HelloWorld.java" in notepad
- Any types of text-edicor can be used
- No IDE

Let's find out the location of HelloWorld.java file

Compile java file using following command; "java HelloWorld.java"

```
HelloWorld.java - Windows 메모장
파일(F) 편집(E) 서식(O) 보기(V) 도움말(H)

package Chap1HelloWorld;

public class Chap1HelloWorld {

        public static void main(String[] args) {
                // TODO Auto-generated method stub

                System.out.println("Hello World!");
                System.out.println("Welcome to the Java!");

        }

}
```
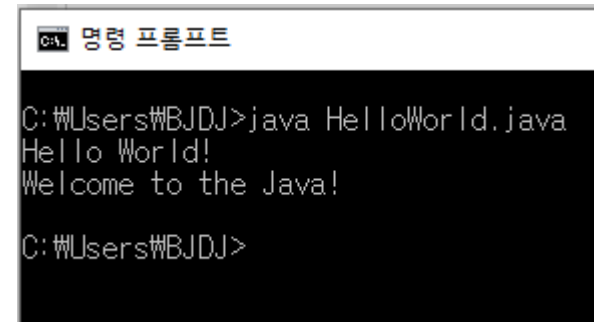
```
명령 프롬프트

C:\Users\BJDJ>java HelloWorld.java
Hello World!
Welcome to the Java!

C:\Users\BJDJ>
```

Characteristics of Java

Platform independence
- Java program can be excutable in any platforms

Object-oriented
- Inheritance, polymorphism, encapsulation
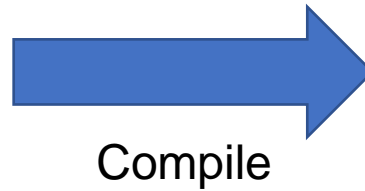
Source code (.java) and Class (.class) files
- Multiple classes can be written in one source file
- Only **one public class**
- Source file name should be matched with publich class

Characteristics of Java

Features

A.java

```
public class A {
    ...
}

class B {
    ...
}

class C {
  class D {
    ....
  }
}
```

Compile

A.class

Byte code

B.class

Byte code

C.class

Byte code

C&D.class

Byte code

Four classes were generated

Characteristics of Java

Exporting executable file
- Jar (.jar) file

main() method
- Java program starts from the main() function

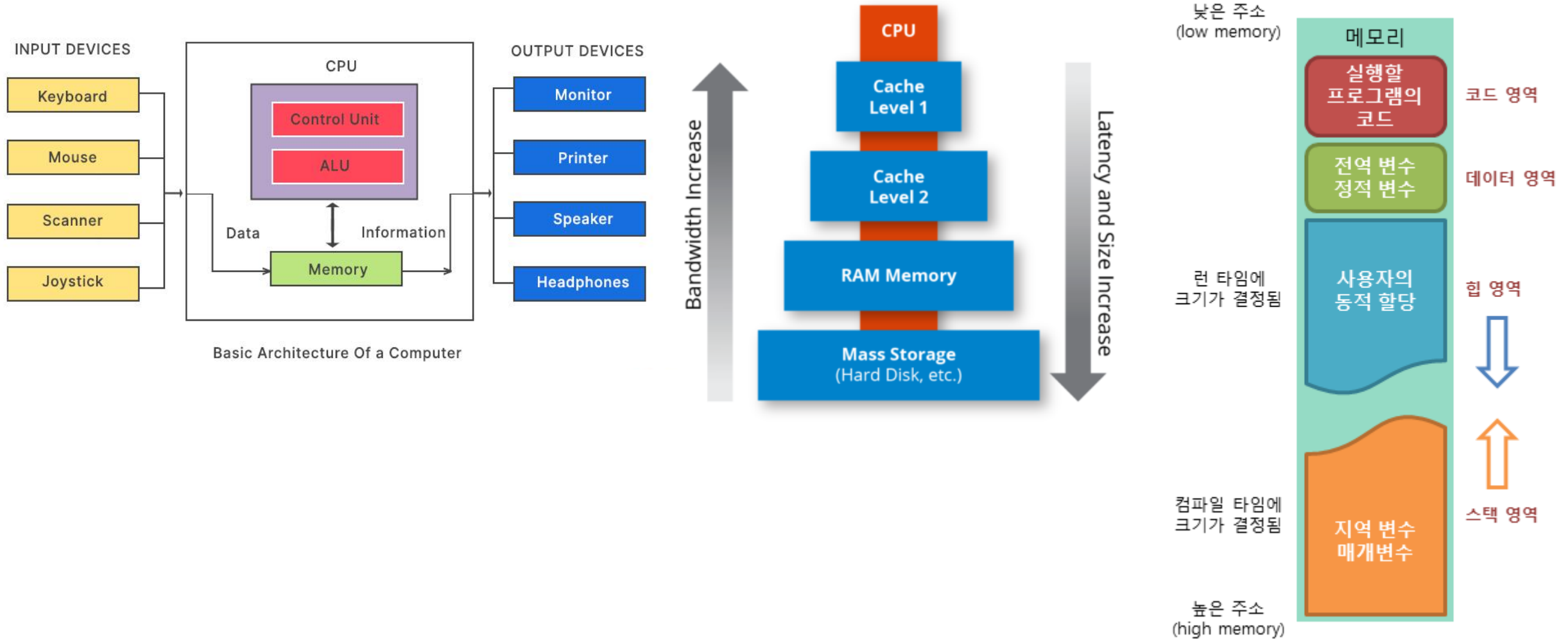Only one main() method in specific class

Package
- There are so many powerful libaries

Garbage collection
- Java has no memory return function in application
- There is only memory allocation function "new"
- Reduced developer burden

Appendix. Basic structure of computer

Common knowledge in computer

End of slide