

Object Oriented Programming

n 1

Chapter 2 The Java Programming Environment

Dr. Helei Cui 4 Mar 2025

Slides partially adapted from lecture notes by Cay Horstmann



Before setting up your Java development environment



Java jargon

Name	Abbreviation	Explanation
Java Virtual Machine	JVM	Interprets the bytecode into code that will run on actual computer hardware
Java Development Kit	JDK	The software for programmers who want to write Java programs
Java Runtime Environment	JRE	The software for consumers who want to run Java programs
Standard Edition	SE	The Java platform for use on desktops and simple server applications
Enterprise Edition	EE	The Java platform for complex server applications
Micro Edition	ME	The Java platform for use on cell phones and other small devices
Update	u	Oracle's term for a bug fix release

E.g., JDK 8u281 - Java [™]SE Development Kit 8, Update 281



Quick question 1

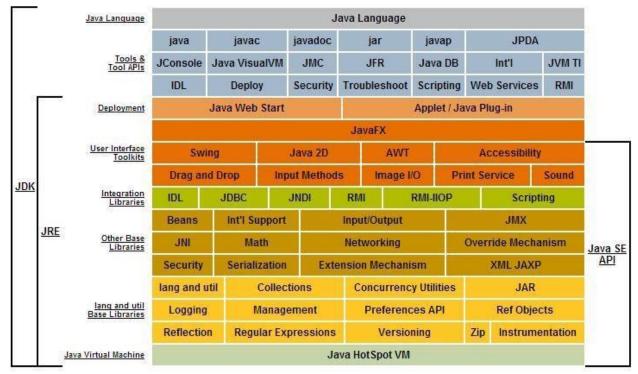
Which one is the best for you to learn Java?

- A. JVM
- B. JDK
- C. JRE



What is JDK?

- JDK is a software development environment used for making applets and Java applications.
 - Java developers can use it on Windows, macOS, Solaris, and Linux. JDK helps them to code and run Java programs.
 - It is possible to install different JDK versions on the same computer.





What is JRE?

- JRE is a piece of a software which is designed to run other software.
 - It contains the class libraries, loader class, and JVM.
 - In simple terms, if you want to run Java program you need JRE.
 - If you are not a programmer, you don't need to install JDK, but just JRE to run Java programs.
- All JDK versions comes bundled with JRE.





What is JVM?

- JVM is an engine that provides a runtime environment to drive the Java Code or applications.
 - It converts Java bytecode into machine language.
- JVM is a part of JRE.
 - It cannot be separately downloaded and installed.
 - To install JVM, you need to install JRE.





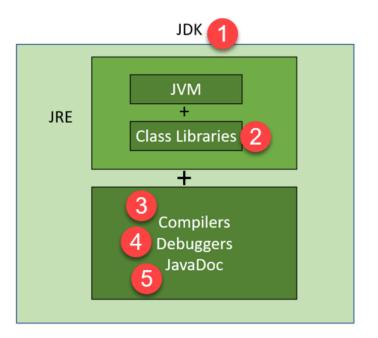
Key differences

JDK	JRE	JVM
a software development kit	a software bundle that allows Java program to run	an environment for executing bytecode
platform dependent	platform dependent	platform-independent
contains tools for developing, debugging, and monitoring java code	contains class libraries and other supporting files that JVM requires to execute the program	software development tools are not included in JVM
enables developers to create Java programs that can be executed and run by the JRE and JVM	is the part of Java that creates the JVM	is the Java platform component that executes source code
superset of JRE	subset of JDK	subset of JRE
JDK comes with the installer	JRE only contain environment to execute source code	JVM bundled in both software JDK and JRE



How JDK functions?

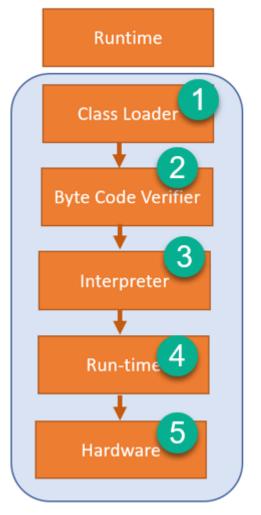
- (1) JDK and JRE: The JDK enables programmers to create core Java programs that can be run by the JRE, which included JVM and class libraries.
- ② Class Libraries: It is a group of dynamically loadable libraries that Java program can call at run time.
- ③ Compilers: It is a Java program that accepts text file of developers and compiles into Java class file.
 - It is the common form of output given by compiler, which contains Java byte code.
 - In Java, the primary compiler is Javac.
- (4) **Debuggers:** It is a Java program that lets developers test and debug Java programs.
- (5) **JavaDoc:** It is documentation made by Sun Microsystems for the Java. It can be used generating API documentation in HTML file from the source program.



https://www.guru99.com/difference-between-jdk-jre-jvm.html

How JRE functions?



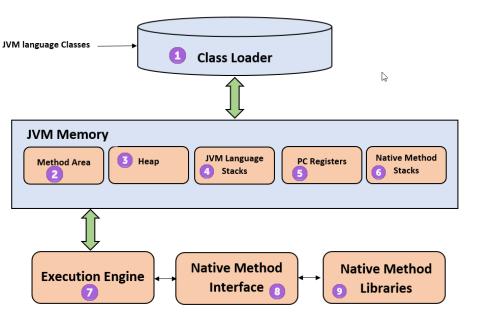


https://www.guru99.com/difference-between-jdk-jre-jvm.html

- (1) **Class loaders:** It loads various classes that are necessary for running a Java program.
 - JVM uses three class loaders called the bootstrap class loader, extensions class loader, and system class loader.
- ② **Byte code verifier:** It verifies the bytecode so that the code doesn't disturb the interpreter.
- ③ Interpreter: Once the classes get loaded, and the code is verified, the interpreter reads the code line by line.
- ④ Run-time: It is a system used mainly in programming to describe time period during which a particular program is running.
- (5) Hardware: Once you compile Java native code, it runs on a specific hardware platform.



How JVM functions?



https://www.guru99.com/java-virtual-machine-jvm.html

- Class Loader: It is a subsystem used for loading class files.
- (2) Method Area: It stores class structures like metadata, the constant runtime pool, and the code for methods.
- (3) Heap: All the Objects, their related instance variables, and arrays are stored in the heap.

- (4) JVM language Stacks: They store local variables, and partial results.
- (5) **PC Registers:** They store the address of JVM instruction which is currently executing.
- 6 Native Method Stacks: They hold the instruction of native code depends on the native library.
- (7) Execution Engine: It is a type of software used to test hardware, software, or complete systems.
- (8) Native Method Interface: It is a programming framework. It allows Java code, which is running in a JVM to call by libraries and native applications.
- (9) Native Method Libraries: is a collection of the Native Libraries (C, C++), which are needed by the Execution Engine.



How JVM works? (2 min)



https://www.youtube.com/watch?v=G1ubVOl9IBw



Installing the Java Development Kit



Download JDK

- Download Oracle JDK
 - https://www.oracle.com/java/technologies/downloads/

Java 23, Java 21, and earne	r versions available	e now
JDK 23 is the latest release of the Java SE P	latform.	Learn about Java SE Subscription
IDK 21 is the latest <i>Long-Term Support (LTS</i>) release of the Java SE Platfor	m.
Earlier JDK versions are available below.		
JDK 23 JDK 21 GraalVM for JDK 23	3 GraalVM for JDK 21	
ava SE Development Kit 21.0.6	downloads	
		o cost, under the Oracle No-Fee Terms and Conditions (NFTC).
	, until September 2026, a year	after the release of the next LTS. Subsequent JDK 21 updates will be licensed under the Java SE OTN License
IDK 21 will receive updates under the NFTC OTN) and production use beyond the limit .inux macOS Windows	, until September 2026, a year ed free grants of the OTN licen:	after the release of the next LTS. Subsequent JDK 21 updates will be licensed under the Java SE OTN Licenses will require a fee.
DK 21 will receive updates under the NFTC OTN) and production use beyond the limit inux macOS Windows Product/file description	, until September 2026, a year a ed free grants of the OTN licens	after the release of the next LTS. Subsequent JDK 21 updates will be licensed under the Java SE OTN License will require a fee.



Oracle JDK vs OpenJDK

- The biggest difference is the license.
 - OpenJDK is completely open-source Java with a GNU General Public License.
 - Oracle JDK requires a commercial license under the Oracle Binary Code License Agreement.
- Are they the same?
 - In brief, OpenJDK has the same code as Oracle JDK, depending on what provider you're using.

Performance?

- Historically, Oracle JDK has had better performance than OpenJDK. However, the performance of OpenJDK is growing.
- Can I use OpenJDK for commercials?
 - You can use OpenJDK for commercial software projects.



Choose a correct version

• For this course, you can select JDK 21.0.6.

Java 23, Java 21, and earlier version	ns available	now	
JDK 23 is the latest release of the Java SE Platform.			Learn about Java SE Subscription
JDK 21 is the latest Long-Term Support (LTS) release of the	he Java SE Platforn	n.	
Earlier JDK versions are available below.			
JDK 23 JDK 21 GraalVM for JDK 23 GraalVM	M for JDK 21		
Java SE Development Kit 21.0.6 download	ls		
JDK 21 binaries are free to use in production and free to	redistribute, at no	cost, under the Oracle No-Fee Terms and Conditio	ns (NFTC).
JDK 21 will receive updates under the NFTC, until Septen	nber 2026, a year a	fter the release of the next LTS. Subsequent JDK 2	1 updates will be licensed under the Java SE OTN License
(OTN) and production use beyond the limited free grants			
Linux macOS Windows			
Product/file description	File size	Download	Windows
x64 Compressed Archive	185.92 MB	https://download.oracle.com/java/21/latest/jdl	64-bit OS
x64 Installer	164.31 MB	https://download.oracle.com/java/21/latest/jdl	k-21_windows-x64_bin.exe (sha256)
x64 MSI Installer	163.06 MB	https://download.oracle.com/java/21/latest/jdl	k-21_windows-x64_bin.msi (sha256)



Install JDK

• Double click JDK package you just downloaded and start installing.

🕼 Java(TM) SE Development Kit 21.0.6 (64-bit) - Setup	\times
Java"	
Welcome to the Installation Wizard for Java SE Development Kit 21.0.6	
This wizard will guide you through the installation process for the Java SE Development Kit 21.0.6.	
Next > Cancel	



Choose installation folder

• You can change the directory during the installation.

🕼 Java(TM) SE Development Kit 21.0.6 (64-bit) - Destination Folder 🛛 🗡	🕼 Java(TM) SE Development Kit 21.0.6 (64-bit) - Destination Folder 🛛 👋
This will install the Java(TM) SE Development Kit 21.0.6 (64-bit), which requires 420MB on your hard drive. Click the "Change" button to change the installation folder.	This will install the Java(TM) SE Development Kit 21.0.6 (64-bit), which requires 420MB or folder. For example, using "D:\Program Files\Java\jdk-21.0.6\"
Install Java(TM) SE Development Kit 21.0.6 (64-bit) to: C:\Program Files\Java\jdk-21\ Change	Install Java(TM) SE Development Kit 21.0.6 (64-bit) to: D:\Program Files\Java\jdk-21.0.6\ Change
Back Next Cancel	Back Next Cancel



Finish installation

• Almost done!

🛃 Java(TM) SE Development Kit 21.0.6 (64-bit) - Complete	×
Java(TM) SE Development Kit 21.0.6 (64-bit) Successfully Installed	
Click Next Steps to access tutorials, API documentation, developer guides, release notes and more to help you get started with the JDK.	
Close	



What is Environment Variable?

- An environment variable is a dynamic-named value that can affect the way running processes will behave on a computer.
 - They are part of the environment in which a process runs.
 - For example, a running process can query the value of the TEMP environment variable to discover a suitable location to store temporary files.

	Value
OneDrive	C:\Users\Zenghao\OneDrive
Path	C:\Users\Zenghao\AppData\Local\Microsoft\WindowsApps;
TEMP	C:\Users\Zenghao\AppData\Local\Temp
TMP	C:\Users\Zenghao\AppData\Loca\\Temp
	New Edit Delete
/stem variables	
stem variables	
Variable	Value
Variable PROCESSOR_LEVEL	6
Variable PROCESSOR_LEVEL PROCESSOR_REVISION	6 b701
Variable PROCESSOR_LEVEL PROCESSOR_REVISION PSModulePath	6 b701 %ProgramFiles%\WindowsPowerShell\Modules;C:\Windows\syst
Variable PROCESSOR_LEVEL PROCESSOR_REVISION PSModulePath TEMP	6 b701 %ProgramFiles%\WindowsPowerShell\Modules;C:\Windows\syst C:\Windows\TEMP
Variable PROCESSOR_LEVEL PROCESSOR_REVISION PSModulePath TEMP TMP	6 b701 %ProgramFiles%\WindowsPowerShell\Modules;C:\Windows\syst C:\Windows\TEMP C:\Windows\TEMP
Variable PROCESSOR_LEVEL PROCESSOR_REVISION PSModulePath TEMP TMP USERNAME	6 b701 %ProgramFiles%\WindowsPowerShell\Modules;C\Windows\syst C:\Windows\TEMP C\Windows\TEMP SYSTEM
Variable PROCESSOR_LEVEL PROCESSOR_REVISION PSModulePath TEMP TMP	6 b701 %ProgramFiles%\WindowsPowerShell\Modules;C:\Windows\syst C:\Windows\TEMP C:\Windows\TEMP
Variable PROCESSOR_LEVEL PROCESSOR_REVISION PSModulePath TEMP TMP USERNAME	6 b701 %ProgramFiles%\WindowsPowerShell\Modules;C\Windows\syst C:\Windows\TEMP C\Windows\TEMP SYSTEM



Java Environment Variables

- JAVA_HOME
 - This means the JDK installation root path, e.g., "D:\Program Files\Java\jdk-21.0.6".
 - It is used by the launcher for finding the JDK/JRE to use. Programs like Tomcat needs it to be set in order to execute error-free.

• PATH



- If you want to be able to run the executables (javac, java, javadoc, etc.) from any directory without having to type the FULL PATH of the command, PATH needs to be set.
- If you don't set PATH variable, you need to specify the full path to the executable every time you run it, e.g., D:\Program Files\Java\jdk-21.0.6\bin\javac HelloWorld.java.

• CLASSESPATH

- This is the path where to find the java class when your application executes.
- "It is not a good idea to set this variable globally, but some poorly written software installers in Windows do just that."

のアルスま大学 NORTHWESTERN POLYTECHNICAL UNIVERSITY

Find "Environment Variables"

 It's a little tricky to find Path variable. First search "Settings" in Windows Start and then click "System" – "About" -"Advanced system settings".

← Settings		- 🗆 ×		
යි Home	About		System Properties	×
Find a setting	Your PC is monitored and protected.	This page has a few new settings		
System		Some settings from Control Panel have moved here, and you can copy your PC info so it's easier to share.	Computer Name Hardware Advanced System Protection Remote You must be logged on as an Administrator to make most of these changes.	
🖵 Display	Device specifications		Performance	
	Device name Harry-PC Processor Intel(R) Xeon(R) CPU E3-1225 v3 @ 3.20GHz	Related settings BitLocker settings	Visual effects, processor scheduling, memory usage, and virtual memory	
Notifications & actions	3.20 GHz Installed RAM 16.0 GB (15.8 GB usable)	Device Manager	<u>S</u> ettings	
 Focus assist 	Device ID 1F74E5DF-2F46-4358-9EDC-5085C05D4E67 Product ID 00330-80000-00000-AA558	Remote desktop	User Profiles	
() Power & sleep	System type 64-bit operating system, x64-based processor	System protection	Desktop settings related to your sign-in	
📼 Storage	Pen and touch No pen or touch input is available for this display	Advanced system settings		
다. Tablet	Сору	Rename this PC (advanced)	S <u>e</u> ttings	
	Rename this PC	Get help	Startup and Recovery	
甘 Multitasking		Give feedback	System startup, system failure, and debugging information	
Projecting to this PC	Windows specifications			_
lpha Shared experiences	Edition Windows 10 Pro Version 20H2		Se <u>t</u> tings	
🛱 Clipboard	Installed on 2021/10/8 OS build 19042.1266			
> [≮] Remote Desktop	Experience Windows Feature Experience Pack 120.2212.3920.0		Enviro <u>n</u> ment Variables	š
O About	Сору		OK Cancel Ap	volv
				P.J



Set "JAVA_HOME"

• If "JAVA_HOME" is not present in "System variables", you have to create it by yourself.

2	ystem variables		
	Variable	Value	^
	PROCESSOR_LEVEL	6	
	PROCESSOR_REVISION	b701	
	PSModulePath	$\label{eq:programFiles} Windows PowerShell \ Modules; C: \ Windows \ syst$	
	TEMP	C:\Windows\TEMP	
	TMP	C:\Windows\TEMP	
	USERNAME	SYSTEM	
	windir	C:\Windows	
			~
		New Edit Delete	

New System Variable			×
Variable name:	JAVA_HOME		
Variable value:	D:\Program Files\Java\jdk-21.0.6		
Browse Directory	Browse File	ОК	Cancel



Set "Path"

• In the "environment variables", there is a variable named Path, you need to double click and edit it.

vironment Variables		×
lser variables for Zenghao		
Variable	Value	
OneDrive	C:\Users\Zenghao\OneDrive	
Path	C:\Users\Zenghao\AppData\Local\Microsoft\WindowsApps;	;
TEMP	C:\Users\Zenghao\AppData\Local\Temp	
TMP	C:\Users\Zenghao\AppData\Local\Temp	
	New Edit E	Delete
ystem variables		
ystem variables Variable	Value	^
Variable		^
Variable NUMBER_OF_PROCESSORS		^
	2	
Variable NUMBER_OF_PROCESSORS OS Path	2 Windows_NT	
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI	2 <u>Windows NT</u> <u>C\Program Files\Common Files\Oracle\Java\javapath;C</u> <u>COM;EXE;BAT;CMD;VBS;VBE;JS;JSE;WSF;WSH;MSC</u> E AMD64	
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI PROCESSOR_IDENTIFIER	2 Windows_NT C\Program_Files\Common_Files\Oracle\Java\javapath;C .COM;,EXE;,BAT;.CMD;,VBS;,VBE;JS;,JSE;,WSF;,WSH;,MSC	
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI PROCESSOR_IDENTIFIER PROCESSOR_LEVEL	2 Windows NT CAProgram Files\Common Files\Oracle\Java\javapath:C COM; EXE;:BAT; CMD; VBS; VBE; JS; JSE; WSF; WSH; MSC E AMD64 Intel64 Family 6 Model 183 Stepping 1, GenuineIntel 6	ndow
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI PROCESSOR_IDENTIFIER PROCESSOR_LEVEL	2 Windows NT C\Program Files\Common Files\Oracle\Java\javapath;C .COM;EXE;BAT;.CMD;.VBS;.VBE;JS;JSE;WSF;.WSH;.MSC E AMD64 Intel64 Family 6 Model 183 Stepping 1, GenuineIntel	
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI PROCESSOR_IDENTIFIER PROCESSOR_LEVEL	2 Windows NT C\Program Files\Common Files\Oracle\Java\javapathxC Winv .COM;EXE;BAT;.CMD;.VBS;.VBE;JS;JSE;WSF;.WSH;.MSC E AMD64 Intel64 Family 6 Model 183 Stepping 1, GenuineIntel 6 b701	ndow
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI PROCESSOR_IDENTIFIER PROCESSOR_LEVEL	2 Windows NT C\Program Files\Common Files\Oracle\Java\javapathxC Winv .COM;EXE;BAT;.CMD;.VBS;.VBE;JS;JSE;WSF;.WSH;.MSC E AMD64 Intel64 Family 6 Model 183 Stepping 1, GenuineIntel 6 b701	ndow
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI PROCESSOR_IDENTIFIER	2 Windows NT C\Program Files\Common Files\Oracle\Java\javapathxC Winv .COM;EXE;BAT;.CMD;.VBS;.VBE;JS;JSE;WSF;.WSH;.MSC E AMD64 Intel64 Family 6 Model 183 Stepping 1, GenuineIntel 6 b701	ndow
Variable NUMBER_OF_PROCESSORS OS Path PATHEXT PROCESSOR_ARCHITECTURI PROCESSOR_IDENTIFIER PROCESSOR_LEVEL	2 Windows NT C\Program Files\Common Files\Oracle\Java\javapathxG Wini .COM;EXE;BAT;.CMD;.VBS;.VBE;JS;JSE;WSF;.WSH;.MSC E AMD64 Intel64 Family 6 Model 183 Stepping 1, GenuineIntel 6 b701 New Edit E	ndow

 If your "JAVA_HOME" has been added, you can simply insert the following value, i.e., "%JAVA_HOME%\bin".

Finish "environment variable" setting

• After editing Path variable, click "OK" to close current dialog, and click "OK" till all the windows are closed.

vironment Variables	×	System Properties
User variables for Zenghao		Computer Name Hardware Advanced System Protection Remote
Variable	Value	You must be logged on as an Administrator to make most of these changes.
OneDrive	C:\Users\Zenghao\OneDrive	
Path TEMP TMP	C:\Users\Zenghao\AppData\Local\Microsoft\WindowsApps; C:\Users\Zenghao\AppData\Local\Temp C:\Users\Zenghao\AppData\Local\Temp	Performance Visual effects, processor scheduling, memory usage and virtual memory Settings
	New Edit Delete	User Profiles Desktop settings related to your sign-in
ystem variables Variable	Value	Settings
NUMBER_OF_PROCESSORS	2	Start-up and Recovery
OS Path	Windows_NT C:\Program Files\Common Files\Oracle\Java\javapath;C:\Window	
PATHEXT	.COM;:EXE::BAT;.CMD;:VBS;:VBE;JS::JSE;:WSF;:WSH::MSC	System start-up, system failure and debugging information
PROCESSOR_ARCHITECTURE		
PROCESSOR_IDENTIFIER	Intel64 Family 6 Model 183 Stepping 1, GenuineIntel	Settings
PROCESSOR_LEVEL	6	
PROCESSOR REVISION	b701 🗸	
	3. click Delete	4. click Environment Variables
	OK Cancel	OK Cancel Apply
		a suitoi rippi



Test Java environment

 Open your *Terminal* and try to run "java -version" or "java -version"

C:\Windows\system32\cmd.exe

Microsoft Windows [Version 10.0.19042.508] (c) 2019 Microsoft Corporation. All rights reserved.

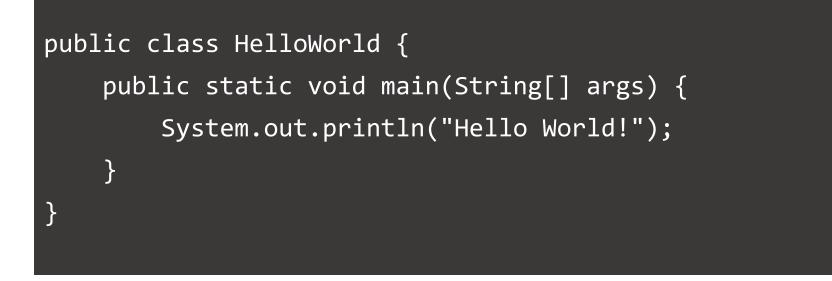
C:\Users\Zenghao>java -version java version "21.0.6" 2025-01-21 LTS Java(TM) SE Runtime Environment (build 21.0.6+8-LTS-188) Java HotSpot(TM) 64-Bit Server VM (build 21.0.6+8-LTS-188, mixed mode, sharing)



Using the Command-Line Tools



HelloWorld.java



- Copy the above code to a text file, and name it to HelloWorld.java
- Move it to D: \oop\ch02\



Using the Command-Line Tools

C:\Windows\system32\cmd.exe

Microsoft Windows [Version 10.0.19042.508] (c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\Zenghao>D:

D:\>cd .\oop\ch2

D:\oop\ch2>javac HelloWorld.java

D:\oop\ch2>java HelloWorld Hello World!

D:\oop\ch2>

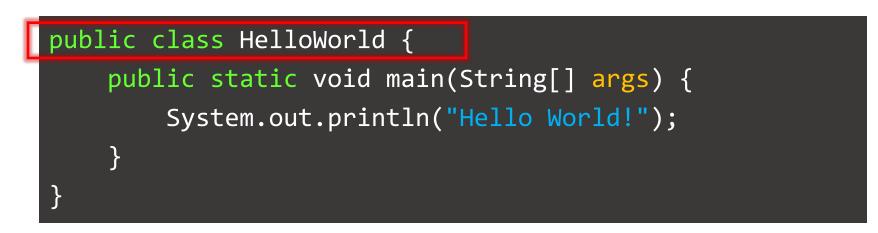
• Open the *Terminal*

- Search "cmd" on Win10/Win11
- Change to the directory
 D:
 cd .\oop\ch02\
 javac HelloWorld.java
 java HelloWorld

Congratulations! You have just compiled and run your first Java program!



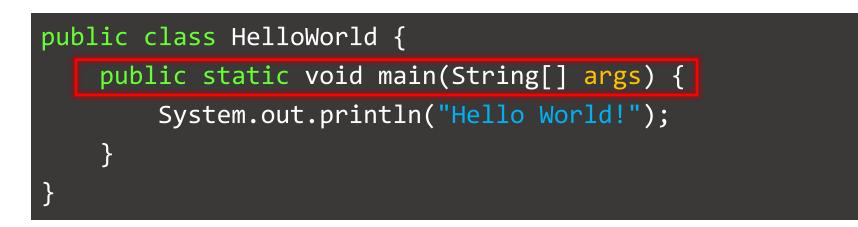
Exploring HelloWorld.java



- The first line declares a class named HelloWorld, which is public, that means that any other class can access it.
 - Notice that when we declare a public class, we must declare it inside a file with the same name (i.e., HelloWorld.java), otherwise we'll get an error when compiling.



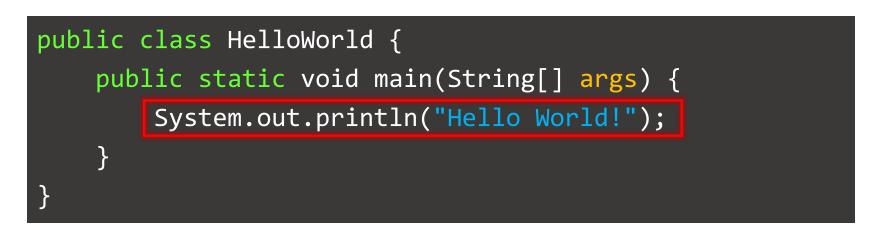
Exploring HelloWorld.java



- The second line is **the entry point** of our Java program.
 - "public" again means that anyone can access it.
 - "static" means that you can run this method without creating an instance of HelloWorld.
 - "void" means that this method doesn't return any value.
 - "main" is the name of the method.
 - "String[] args" are the arguments we get inside the method when running the program with parameters. It's an array of strings.



Exploring HelloWorld.java

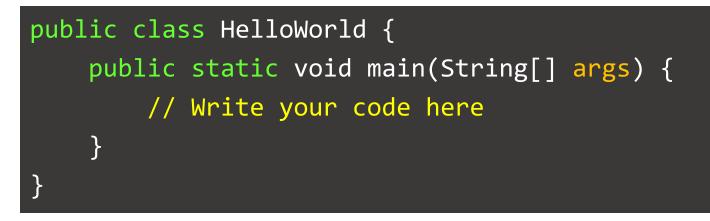


- The third line calls a **standard output function** to print a line to the console.
 - **"System"** is a pre-defined class that Java provides us and it holds some useful methods and variables.
 - **"out"** is a static variable within System that represents the output of your program (stdout).
 - "println" is a method of out that can be used to print a line.



Things to take away

- 1. Every valid Java Application must have a class definition (that matches the filename).
- 2. The main method must be inside the class definition.
- 3. The compiler executes the codes starting from the main function.



This is a valid Java program that does nothing.



Using an Integrated Development Environment (IDE)

Using an IDE

- Why?
 - More productive;
 - Several choices;
 - Free;
 - ...
- Most popular Java IDE:
 - Eclipse (Opensource and free)
 - IntelliJ IDEA (Community version is also free)
 - NetBeans
 - ... see more comparison on <u>https://hackr.io/blog/best-java-ides</u>













Quick question 2

Which one have you ever used?

- A. Eclipse
- B. IntelliJ IDEA
- C. NetBeans
- D. Others like BlueJ, JDeveloper, etc.









More about Eclipse

- A dedicated Java IDE as one of the big three of Java IDEs
- First Released November 2001
- Cross Platform Linux/macOS/Windows
- Features:
 - Code completion
 - Refactoring
 - Syntax checking
 - Source code formatting
 - ...



	Project Run Window Help		h ↔ ↔	e
🕄 Welcome 🛛			m <-	- A
ecl	IPSE Welcome to the Eclip	se IDE	for Java Developers	(
				F
		\sim	0	
•	Review IDE configuration settings Review the IDE's most fiercely contested	Ш	Overview Get an overview of the features	
	preferences			
(B)	Create a Hello World application		Tutorials	
8	A guided walkthrough to create the famous		Go through tutorials	
	Hello World in Eclipse			
•	Create a new Java project	1	Samples Try out the samples	
•	Create a new Java Eclipse project		Try out the samples	
		Ø	What's New	
	Checkout projects from Git		Find out what is new	
•	Checkout Eclipse projects hosted in a Git repository			
*	Import existing projects Import existing Eclipse projects from the			
	filesystem or archive			
			Always show Welcome	e at s

Eclipse is constantly assisting while coding!



Let's try Eclipse

Install your favorite desktop IDE pack

Download

Download x86_64

Download AArch64

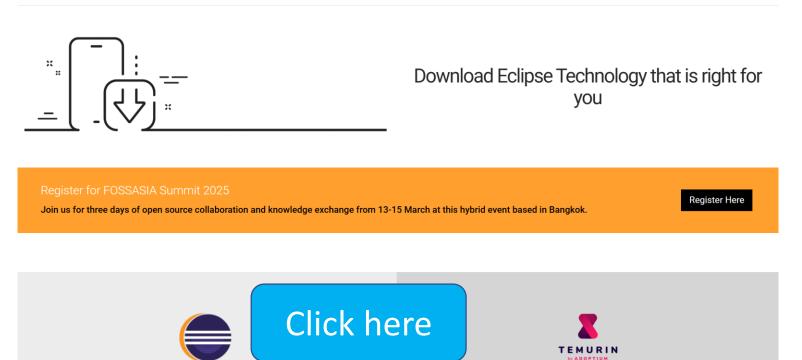
Learn More

Down

Download Eclipse installer from https://www.eclipse.org/downloads/

ECLIPSE

Projects Supporters Collaborations Resources The Foundation



U10M12004-OOP

Dr. Helei Cui

The Eclipse Temurin[™] project provides high-quality, TCK certified OpenJDK runtimes and associated technology for use across the

Java[™] ecosystem.

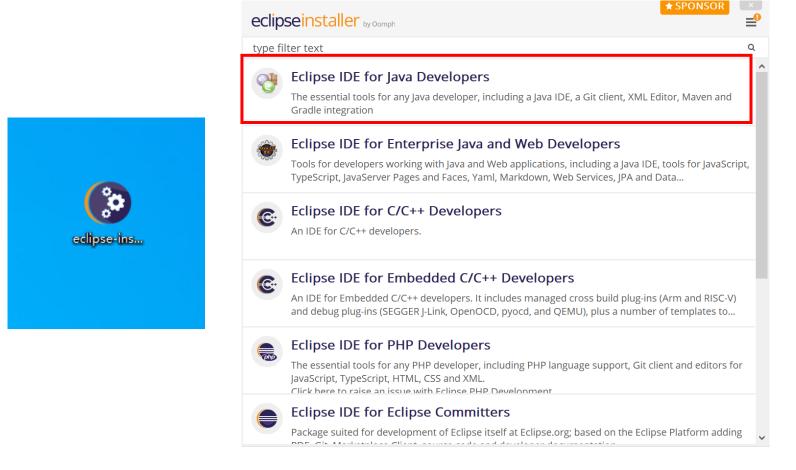
Download

Learn More



Install Eclipse

• Open the Eclipse-installer and choose the first one, i.e., "Eclipse IDE for Java Developers".





Choose the installation folder

• Find the path to the above installed JDK

eclipseinstalle	er by Oomph	
The esse	e IDE for Java Developers <u>d</u> ential tools for any Java developer, including a Java IDE, a Git client, XML Editor, Mave dle integration.	<u>etails</u> n
Java 21+ VM Installation Folder	D:\Program Files\Java\jdk-21.0.6 D:\Eclipse ✓ create start menu entry ✓ create desktop shortcut	> 1
	▲INSTALL	
< BACK		



Begin installation

• Choose "Accept Now" to agree with the user terms and begin installation.

📀 Eclipse Installer



Eclipse Foundation Software User Agreement

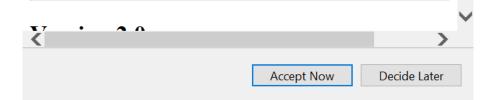
Applicable licenses will be discovered and prompted later in the installation process.



Eclipse Foundation Software User Agreement Versions

There are currently three versions of the Eclipse Foundation Software User Agreement. You may review them and accept them now, or wait until you are prompted to review and accept them later.

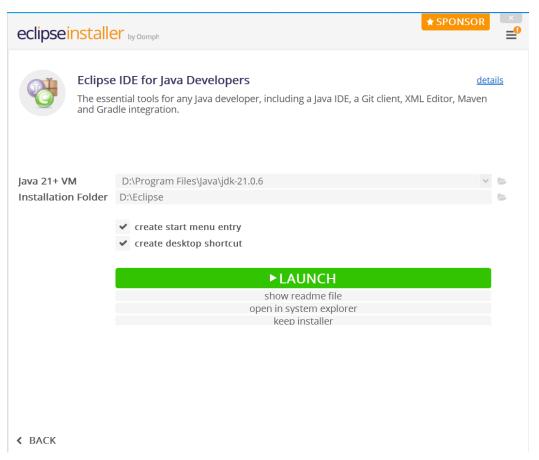
- Eclipse Foundation Software User Agreement Version 2.0
- Eclipse Foundation Software User Agreement Version 1.1
- Eclipse Foundation Software User Agreement Version 1.0





Launch Eclipse

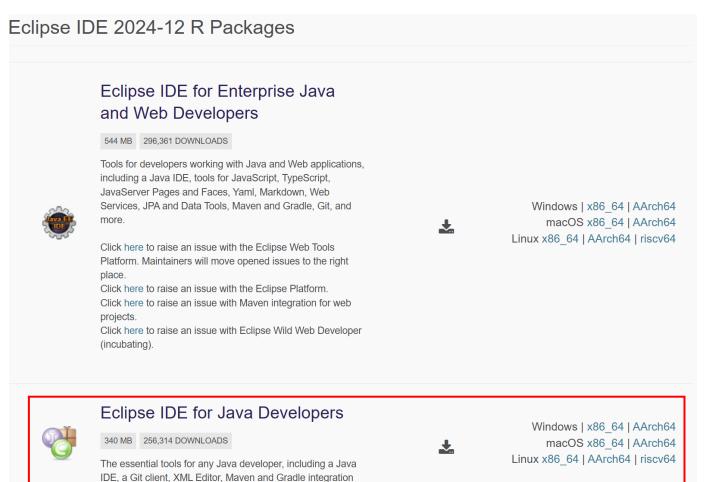
• After a while, when you see the "Launch" button, you click it and run Eclipse.





If the installer fails

• Try https://www.eclipse.org/downloads/packages/



Dr. Helei Cui



Setup Eclipse workspace

• Workspace is the location where you store preferences of Eclipse and your development artifacts.

Eclipse IDE Launcher				\times
Select a directory as workspace				
Eclipse IDE uses the workspace directory to store its preferences a	nd development a	rtifacts.		
D:\oop\eclipse-workspace		~	Brows	se
Use this as the default and do not ask again				
	Launch	Ca	ancel	



Create a Java project

• File -> New -> Java Project

(clipse-workspace - Eclipse IDE		
File	Edit Navigate Search Project Ru	n Window Help	
	New	Alt+Shift+N >	😕 Java Project < 🕶 🖻 💌 🗟 💌
	Open File		12 Maven Project
	Open Projects from File System		Project
	Recent Files	>	Package Glass For Java Developers
	Close Editor	Ctrl+W	
	Close All Editors	Ctrl+Shift+W	Interface
	Save	Ctrl+S	Enum Record
	Save As		Annotation
	Save All		Source Folder
	Revert		¹⁸ Java Working Set ettings
	Move		Folder tested preferences
r#	Rename	F2	🗅 File
	Refresh	F5	Cuntitled Text File
	Convert Line Delimiters To	>	Task ation ation
	Print	Ctrl+P	famous Hello World in Eclipse
	Import	Curri	Ctrl+N
	Export		
_		Alt+Enter	te a new Java project
	Properties		a new Java Eclipse project
	Switch Workspace	>	
	Restart		
	Exit		kout projects from Git
		Check	cout Eclipse projects hosted in a Git repository
		上 Impo	ort existing projects
		Impor	rt existing Eclipse projects from the filesystem or archive
			nch the Eclipse Marketplace
		Enhar	nce your IDE with additional plugins and install your Marketplace favorites
			n an existing file
		Open	a file from the filesystem



Java project pre-configuration

• You should specify the "Project name", change the "Project layout" from second choice to the first, and uncheck the "Module" option.

🕽 New Java Project					_	×
reate a Java Project						1
Create a Java project in the workspace or ir	an external locatio	n.				
Project name: HelloWorld						
✓ Use default location						
Location: D:\oop\eclipse-workspace\Helle	oWorld				Browse.	
JRE						
• Use an execution environment JRE:	JavaSE-21					~
O Use a project specific JRE:	jdk-21.0.6					\sim
O Use default JRE 'jdk-21.0.6' and work	space compiler pre	ferences			Configure JR	REs
Project layout						
• Use project folder as root for source	s and class files					
○ Create separate folders for sources a	nd class files				Configure defa	<u>ult</u>
Working sets						
Add project to working sets					New	
Working sets:				~	Select	
Module						
Create module-info.java file						
Generate comments						
?		< Back	Next >	Finish	Cance	el



The last step of project setup

• Click "Finish" to finish setup.

New Java Project						×
Java Settings						Ph.
Define the Java build settings.						
Source 🖙 Projects 🛋 Libraries & Order and Export [©] Modu	le Dependencies					
	le Dependencies				i ii 44	1
> ≌ HelloWorld						
▼ Details						
Create new source folder: use this if you want to add a new	w source folder to	your project.				
$\frac{1}{2}$ Link additional source: use this if you have a folder in the	file system that sho	uld be used as additi	ional source folder.			
Configure inclusion and exclusion filters: specify patterns folder or file manually.	to the inclusion and	exclusion filters inste	ead of including and	exclud	ing ead	:h
Remove project 'HelloWorld' from build path: Children of anymore and will not be included when building the projet		re not source folders	will not be seen by t	the con	npiler	
Allow output folders for source folders						
Default output folder:						
HelloWorld				В	rowse.	
0	< Back	Next >	Finish		Cancel	



Create Java class

 After the Java project has been set up, you need to create a class in .java file. Right click the "HelloWorld" name, select "New" -> "Class", a java file will be created.

eclipse-workspace - Eclipse IDE				
File Edit Source Refactor Navigate Sear				
	₿ @ ▼ 🥭 🗁 🔗 ▼ 🗳 🔍	· 웹 ▼ 위 ▼ ♡ 라 ↔		3 93 20 8 -
Package Explorer ×			-	\$
> 😂 HelloWorld New	> 1	😕 Java Project		
Go Into		Maven Project		
Open in New Window Open Type Hierarchy Show In	F4	 Project Package Class Interface 	-	
 Copy Copy Qualified Name Paste Delete 	Ctrl+V	 Enum Record Annotation Source Folder 		
 Remove from Context Build Path Source Refactor Import 	Alt+Shift+S > Alt+Shift+T >	 Java Working Set Folder File Untitled Text File Task JUnit Test Case 		
🖾 Export		Other	Ctrl+N	
Source	>			
 Refresh Close Project Assign Working Sets 	F5			
Coverage As	>			
Run As	>			
Debug As Restore from Local History	>			
Team	>			
Compare With	>			
GitHub	>			
Configure	>			
Properties	Alt+Enter			

Dr. Helei Cui



Configure Java Class

• In this step, you need to specify the name of Java class, and check box before "public static void main(String[] args)".

Source folder:	HelloWorld	Browse
Package:	(default)	Browse
Enclosing type:		Browse
Name:	HelloWorld	
Modifiers:	public Opackage Oprivate Oprotected abstract final static none Osealed Opinal	
Superclass:	java.lang.Object	Browse
Interfaces:		Add
		Remove
Which method stul	os would you like to create?	
	public static void main(String[] args)	
	Constructors from superclass	
	Inherited abstract methods	
Do you want to ad	d comments? (Configure templates and default value here)	



Write our first line of code

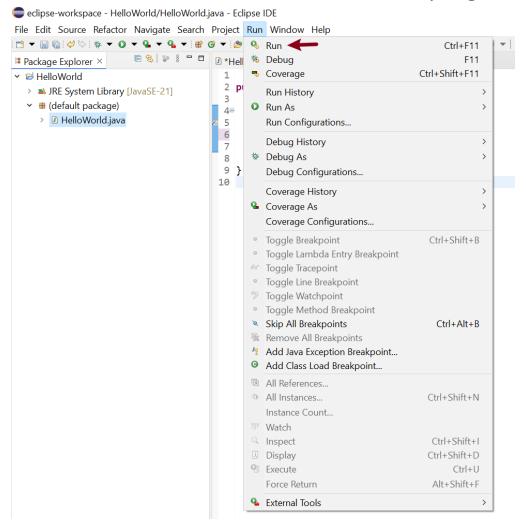
 Inside the main method of HelloWorld, you can write our conventional first line of code "System.out.println("Hello World!");".

墡 Package Explorer × 🛛 🖻 😫 🕴 🗖 🗖	J) *H	elloWorld.java $ imes$
✓ ≌ HelloWorld		1	<pre>public class HelloWorld {</pre>
 > IRE System Library [JavaSE-21] > # (default package) 		3	
 HelloWorld.java 	Z	4⊜ 5	<pre>public static void main(String[] args) { // TODO Auto-generated method stub</pre>
		6	System. <i>out</i> .println("Hello World!");
		8	J
		9	}



Run HelloWorld in IDE

• Save the file and click "run" button to execute our program.





Console outputs "Hello World"

• Once the execution completes, the console will print out "Hello World!".

1 2 public class HelloWorld {	
<pre>3 4 public static void main(String[] args) { 5</pre>	
9 } 0	
<	

<terminated> HelloWorld [Java Application] D:\Program Files\Java\jdk-21.0.6\bin\javaw.exe (26 Feb 2025, 21:53:56 – 21:54:02 elapsed: 0:00:06.520) [pid: 4104]

Hello World!



Welcome.java

```
/**
* This program displays a greeting for the reader.
* @version 1.30 2014-02-27
* @author Cay Horstmann
*/
public class Welcome
{
  public static void main(String[] args)
      String greeting = "Welcome to Core Java!";
      System.out.println(greeting);
      for (int i = 0; i < greeting.length(); i++)</pre>
         System.out.print("=");
      System.out.println();
```



Learn to use Violet UML editor



Violet UML Editor

- Violet is a UML editor with these benefits:
 - Very easy to learn and use.
 - Draws nice-looking diagrams.
 - Completely free. Cross-platform.
 - Violet is intended for developers, students, teachers, and authors who need to produce simple UML diagrams quickly.









- UML is short for Unified Modeling Language, a language intended to help to communicate upon object programming concepts that are not intuitive.
 - UML was born in the middle 90's by merging three methods: OMT, Booch and OOSE.
 - This is a graphical language composed by 13 diagrams (UML 2.0).
 - UML is powerful because these diagrams are always very friendly.
 - It's an efficient way to communicate between programmers and end users.
 - It can also be very precise and helps to avoid ambiguities when you define your system.
- UML is not a method.
 - It's a language. So, UML will not help you to organize your project. It will just help you to describe it, to communicate over it, to clarify its features.



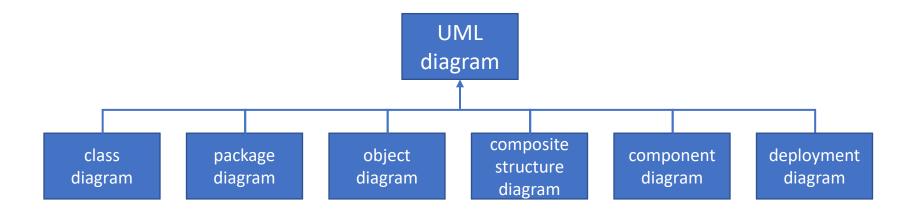
Introduction to diagram

- A diagram is a partial graphical representation of a system model.
- There are 13 types of them, which can be categorized into 2 types:
 - the static view
 - the dynamic view



The static view

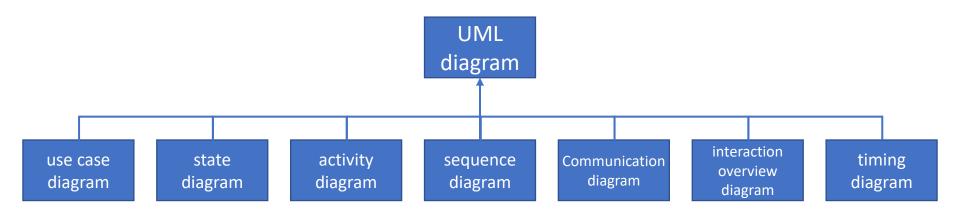
- The static view contains diagrams showing all the entities and behaviors of your system.
 - Think of an object as an entity. These diagrams would expose all your system entities, define their rules and how they will interact all together.





The dynamic view

- The dynamic view contains diagrams showing scenarios.
 - This time, you see how entities works, not only how they are made.





The UML class diagram (3 min)

Class Diagrams

https://www.youtube.com/watch?v=qmqIwAdSLpQ



Download violet UML editor

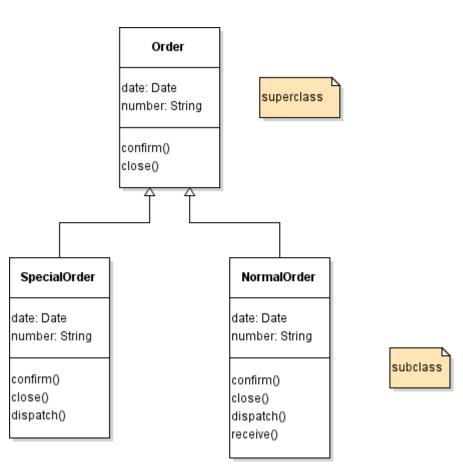
- http://alexdp.free.fr/violetumleditor/page.php?id=en:download
- In order to run violet UML editor, you need to install JRE.

Unsaved class diagram		- 🗆	\times
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>D</u> ocument <u>H</u> elp			
Standard buttons			
A 🖶 📼 🕱 🏱			
🖌 🖧 🗅 🛍			
Diagram tools 🛛 🕆			
	Car		
Select			
Cla	make: String		
- Interface - Enu	drive()		
Packa			
C Lollipop interfa			
No	Class: Properties X		
Depends	Class name Car		
△ Inherits fro			
`⊿ Implements interfa	make: String		
→ Is associated w	Attributes		
□ Is an aggregate			
Is composed			
Note connect	drive()		
Extended functions	Methods		
ے ات			
Colors	OK		
			_



An example

• Inheritance illustration in violet UML editor.





Alternatives

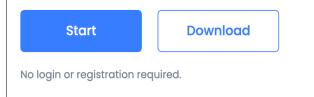
<u>https://www.diagrams.net/</u>

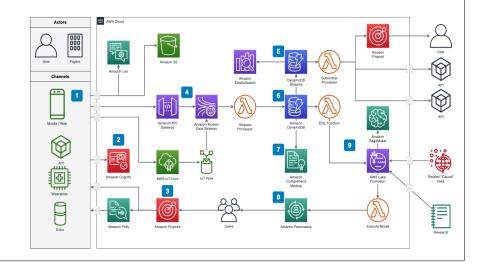
🚹 diagrams.net

Blog Start Now

Security-first diagramming for teams.

Bring your storage to our online tool, or go max privacy with the desktop app.

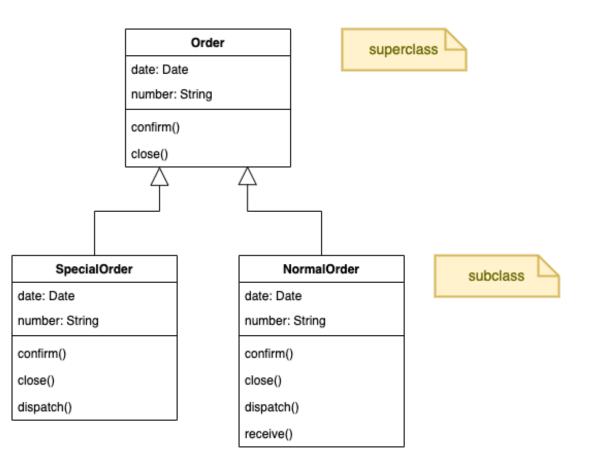






The example via diagrams.net

<u>https://www.diagrams.net/</u>





>JDK, JRE, JVM?

- JDK is a software development kit
- JRE is a software bundle that allows Java program to run
- JVM is an environment for executing bytecode

➢Run HelloWorld.java

- Using Command-Line Tools
- Using an IDE, e.g., Eclipse

➤Use UML editor

Violet or <u>diagrams.net</u>



JDK JRE JVM

C:\Windows\system32\cmd.exe Microsoft Windows [Version 10.0.19042.508] (c) 2019 Microsoft Corporation. All rights reserved. C:\Users\Zenghao>D: D:\>cd .\oop\ch2 D:\oop\ch2>javac HelloWorld.java D:\oop\ch2>java HelloWorld Hello World! D:\oop\ch2> Edit Navigate Search Project Run Window Help h () () A A B = 6 eclipse Welcome to the Eclipse IDE for Java Developers Overview Review the IDE's most fiercely contested Get an overview of the features Create a Hello World application Go through tutorials A guided walkthrough to create the famous Hello World in Eclipse Create a new Java project Try out the samples Create a new Java Eclipse project 🚱 🛛 What's New Checkout projects from Git Find out what is new Checkout Eclipse projects hosted in a Git repository Import existing Eclipse projects from the filesystem or archive Always show Welcome at start up