
Java™

Track 1

Variable Types and Its size

Type	Size (bits)	Minimum	Maximum	Examples
byte	8	-2^7	$2^7 - 1$	*byte b = 100;*
short	16	-2^{15}	$2^{15} - 1$	*short s = 30_000;*
int	32	-2^{31}	$2^{31} - 1$	*int i = 100_000_000;*
long	64	-2^{63}	$2^{63} - 1$	*long l = 100_000_000_000_000;*
float	32	-2^{-149}	$(2-2^{-23})\cdot 2^{127}$	*float f = 1.456f;*
double	64	-2^{-1074}	$(2-2^{-52})\cdot 2^{1023}$	*double f = 1.456789012345678;*
char	16	0	$2^{16} - 1$	*char c = 'c';*
boolean	1	–	–	*boolean b = true;*

Keywords in Java

1. **abstract** Specifies that a class or method will be implemented later, in a subclass
2. **assert** Assert describes a predicate placed in a java program to indicate that the developer thinks that the predicate is always true at that place.
3. **boolean** A data type that can hold True and False values only
4. **break** A control statement for breaking out of loops.
5. **byte** A data type that can hold 8-bit data values
6. **case** Used in switch statements to mark blocks of text
7. **catch** Catches exceptions generated by try statements
8. **char** A data type that can hold unsigned 16-bit Unicode characters
9. **class** Declares a new class
10. **continue** Sends control back outside a loop

11.	**default**	Specifies the default block of code in a switch statement
12.	**do**	Starts a do-while loop
13.	**double**	A data type that can hold 64-bit floating-point numbers
14.	**else**	Indicates alternative branches in an if statement
15.	**enum**	A Java keyword is used to declare an enumerated type. Enumerations extend the base class.
16.	**extends**	Indicates that a class is derived from another class or interface
17.	**final**	Indicates that a variable holds a constant value or that a method will not be overridden
18.	**finally**	Indicates a block of code in a try-catch structure that will always be executed
19.	**float**	A data type that holds a 32-bit floating-point number
20.	**for**	Used to start a for loop
21.	**if**	Tests a true/false expression and branches accordingly
22.	**implements**	Specifies that a class implements an interface
23.	**import**	References other classes
24.	**instanceof**	Indicates whether an object is an instance of a specific class or implements an interface
25.	**int**	A data type that can hold a 32-bit signed integer
26.	**interface**	Declares an interface
27.	**long**	A data type that holds a 64-bit integer
28.	**native**	Specifies that a method is implemented with native (platform-specific) code
29.	**new**	Creates new objects
30.	**null**	This indicates that a reference does not refer to anything
31.	**package**	Declares a Java package
32.	**private**	An access specifier indicating that a method or variable may be accessed only in the class it's declared in
33.	**protected**	An access specifier indicating that a method or variable may only be accessed in the class it's declared in (or a subclass of the class it's declared in or other classes in the same package)
34.	**public**	An access specifier used for classes, interfaces, methods, and variables indicating that an item is accessible throughout the application (or where the class that defines it is accessible)
35.	**return**	Sends control and possibly a return value back from a called method
36.	**short**	A data type that can hold a 16-bit integer
37	**static**	Indicates that a variable or method is a class method (rather than being limited to one particular object)
38.	**strictfp**	A Java keyword is used to restrict the precision and rounding of floating-point calculations to ensure portability.
39.	**super**	Refers to a class's base class (used in a method or class constructor)
40.	**switch**	A statement that executes code based on a test value
41.	**synchronized**	Specifies critical sections or methods in multithreaded code

42. **this** Refers to the current object in a method or constructor
43. **throw** Creates an exception
44. **throws** Indicates what exceptions may be thrown by a method
45. **transient** Specifies that a variable is not part of an object's persistent state
46. **try** Starts a block of code that will be tested for exceptions
47. **void** Specifies that a method does not have a return value
48. **volatile** This indicates that a variable may change asynchronously
49. **while** Starts a while loop

0	<NUL>	32	<SPC>	64	@	96	`	128	Ä	160	†	192	¿	224	‡
1	<SOH>	33	!	65	A	97	a	129	Å	161	°	193	¡	225	·
2	<STX>	34	"	66	B	98	b	130	Ç	162	¢	194	¬	226	‚
3	<ETX>	35	#	67	C	99	c	131	É	163	£	195	√	227	„
4	<EOT>	36	$	68	D	100	d	132	Ñ	164	§	196	ƒ	228	‰
5	<ENQ>	37	%	69	E	101	e	133	Ö	165	•	197	≈	229	Â
6	<ACK>	38	&	70	F	102	f	134	Ü	166	¶	198	Δ	230	Ê
7	<BEL>	39	'	71	G	103	g	135	á	167	ß	199	«	231	Á
8	<BS>	40	(	72	H	104	h	136	à	168	®	200	»	232	Ë
9	<TAB>	41	)	73	I	105	i	137	â	169	©	201	…	233	È
10	<LF>	42	*	74	J	106	j	138	ä	170	™	202		234	Í
11	<VT>	43	+	75	K	107	k	139	ã	171	´	203	À	235	Î
12	<FF>	44	,	76	L	108	l	140	å	172	¨	204	Ã	236	Ï
13	<CR>	45	-	77	M	109	m	141	ç	173	≠	205	Õ	237	Ì
14	<SO>	46	.	78	N	110	n	142	é	174	Æ	206	Œ	238	Ó
15	<SI>	47	/	79	O	111	o	143	è	175	Ø	207	œ	239	Ô
16	<DLE>	48	0	80	P	112	p	144	ê	176	∞	208	–	240	
17	<DC1>	49	1	81	Q	113	q	145	ë	177	±	209	—	241	Ò
18	<DC2>	50	2	82	R	114	r	146	í	178	≤	210	"	242	Ú
19	<DC3>	51	3	83	S	115	s	147	ì	179	≥	211	″	243	Û
20	<DC4>	52	4	84	T	116	t	148	î	180	¥	212	'	244	Ù
21	<NAK>	53	5	85	U	117	u	149	ï	181	µ	213	′	245	ı
22	<SYN	54	6	86	V	118	v	150	ñ	182	∂	214	÷	246	ˆ
23	<ETB>	55	7	87	W	119	w	151	ó	183	∑	215	◊	247	˜
24	<CAN>	56	8	88	X	120	x	152	ò	184	∏	216	ÿ	248	¯
25	<EM>	57	9	89	Y	121	y	153	ô	185	π	217	Ÿ	249	˘
26	<SUB>	58	:	90	Z	122	z	154	ö	186	∫	218	⁄	250	˙
27	<ESC>	59	;	91	[	123	{	155	õ	187	ª	219	€	251	°
28	<FS>	60	<	92	\	124	|	156	ú	188	º	220	‹	252	¸
29	<GS>	61	=	93	]	125	}	157	ù	189	Ω	221	›	253	˝
30	<RS>	62	>	94	^	126	~	158	û	190	æ	222	fi	254	˛
31	<US>	63	?	95	_	127	<DEL>	159	ü	191	ø	223	fl	255	ˇ

Figure 1 Ascii Chart

Execution for a JAVA code

Editors	IDE
• Notepad • Notepad ++ • Visual Code • Sublime Text	• Eclipse • Intelli J • NetBeans

JVM, JRE and JDK are platform **dependent** because the configuration of each OS differs. But Java is platform-independent.

1. **Java Development Kit (JDK**) is a software development environment used for developing Java applications and applets. It includes the Java Runtime Environment (JRE), an interpreter/loader (Java), a compiler (javac), an archiver (jar), a documentation generator (Javadoc), and other tools needed in Java development.

JDK usage [Build, Compile, and Execute Application]

Java follows WORA (Write once read anywhere)

2. **JRE** (Java Runtime Environment) is an installation package that provides an environment to only run (not develop) the java program (or application) onto your machine. JRE is only used by those who only want to run Java programs that are end-users of your system.

3. **JVM** (Java Virtual Machine) is a very important part of both JDK and JRE because it is contained or inbuilt in both. Whatever Java program you run using JRE or JDK goes into JVM and JVM is responsible for executing the java program line by line, hence it is also known as an interpreter.

Installation Of JDK

1. Download jdk8
2. Set Environment Path Variables
3. Test the installation using the following commands

```
C:\Users\suman>javac -version
javac 17.0.2
C:\Users\suman>java -version
java version "17.0.2" 2022-01-18 LTS
Java(TM) SE Runtime Environment (build 17.0.2+8-LTS-86)
Java HotSpot(TM) 64-Bit Server VM (build 17.0.2+8-LTS-86, mixed mode, sharing)
C:\Users\suman>
```

Not the above result is for JDK 17, JDK 8 result might differ

A computer only understands Binary Numbers 0, 1

Steps to Execute JAVA Code

1. Write your Java code in a .java file [Source Code]
2. The compilation (Conversion of a Source code to a more machine-friendly language)
   The compilation will give you a .class file (.class file is also known as *ByteCode*)
3. Execution
   Run the compiled .class file using the following commands.

```
C:\Users\suman\Downloads\Y Hills\Source Code\Basics>javac Main.java

C:\Users\suman\Downloads\Y Hills\Source Code\Basics>java Main
Light Speed2.99794458676879 94E8
Light Speed@
```

RULES

- You must have to obey
- Apart from imports, annotations and package names, all will reside inside a class
- The name of the file should match the class name

Convention [Good Habits]

You should follow

- Class Names -> Use PascalCase KushankJain
- Variable and Method[function] names -> we use camelCase kushankJain

Packages

Package Intro

A java package is a group of similar types of classes, interfaces and sub-packages.

Advantage of Java Packages

- Java package is used to categorize the classes and interfaces so that they can be easily maintained.
- Java package provides access protection.
- Java package removes naming collision.

Naming Convention

Say Website is: www.jdk8.com

So package name will start as **com.jdk8.####**

Internally it will create a nested folder structure like

- com
  - jdk8
    - ####

Loops

Scope Of Variables

The reach of a variable will depend on where it is declared.

Continue and Break Statements

- Continue
- Break

The above two keywords can be used to further control the loops

While Loop

While loop can be also used for looping

- do while
- while

The basic difference between do-while and while loop is that do while will at least execute for one time.

Track 2

Wrapper Classes

Intro

The Wrapper class in Java provides the mechanism to convert primitive into object and object into primitive.

Autoboxing and Unboxing

We also have autoboxing and unboxing features that convert primitives into objects and objects into primitives automatically. The automatic conversion of a primitive into an object is known as autoboxing and vice-versa unboxing.

```
Integer num = 9;
Character ch = 'c';
```

WrapperClass.java

```
package com.jdk8.oop.basics;

public class WrapperClass {

	public static void main(String[] args) {

			String name = "rishav";
//			Primitive Variables
			int number = 10;
			boolean isSad = false;
//			Wrapping int to an Integer Object
			Integer integer = new Integer(10);

//			Wrapping boolean  to an Boolean Object
			Boolean boolean1 = new Boolean(true);

			byte by = 8;
			int p = by;

			// Generally You cannot fit a higher space data in lower space [Bucket - Mug
			// Analogy]
//			int m = 8;
//			byte c=m;

//			Here we have exception as long[64bit] is getting stored in float[32 bit],
//			The reason is that both have different storing algorithms, and floating
numbers is  getting stored using higher efficiency IEEE algo
			long lon = Long.MAX_VALUE;
			float fl = lon;
			System.out.println(fl);

			byte b = 10;
			short s = 20;
			int i = 30;
			long l = 40;
			float f = 50.0F;
			double d = 60.0D;
			char c = 'a';
			boolean b2 = true;

			// Autoboxing: Converting primitives into objects
			// With this mechanism So no need of "new" keyword
			Byte byteobj = b;
			Short shortobj = s;
			Integer intobj = i;
			Long longobj = l;
			Float floatobj = f;
			Double doubleobj = d;
			Character charobj = c;
			Boolean boolobj = b2;

			// Unboxing: Converting Objects to Primitives Automatically ,again no use of
			// "new" keyword
			byte bytevalue = byteobj;
			short shortvalue = shortobj;
			int intvalue = intobj;
			long longvalue = longobj;
			float floatvalue = floatobj;
			double doublevalue = doubleobj;
			char charvalue = charobj;
			boolean boolvalue = boolobj;

	}

}
```

OOP [Object Orientation Programming] Intro

Intro

Object-oriented programming (OOP) is a computer programming model that organizes software design around data, or objects, rather than functions and logic. An object can be defined as a data field that has unique attributes and behaviour.

Say a **mixer grinder**

1. Its Properties [has]
    a. Wattage
    b. Colour
    c. Speed
2. Its Functionality [does]
    a. grind()
    b. blend()
    c. juiceOut()

We use classes in OOP,

Classes are just like Formula/Recipe or a prototype for an Object.

Think like to make a Cake we need a Recipe

Recipe ---> Cake

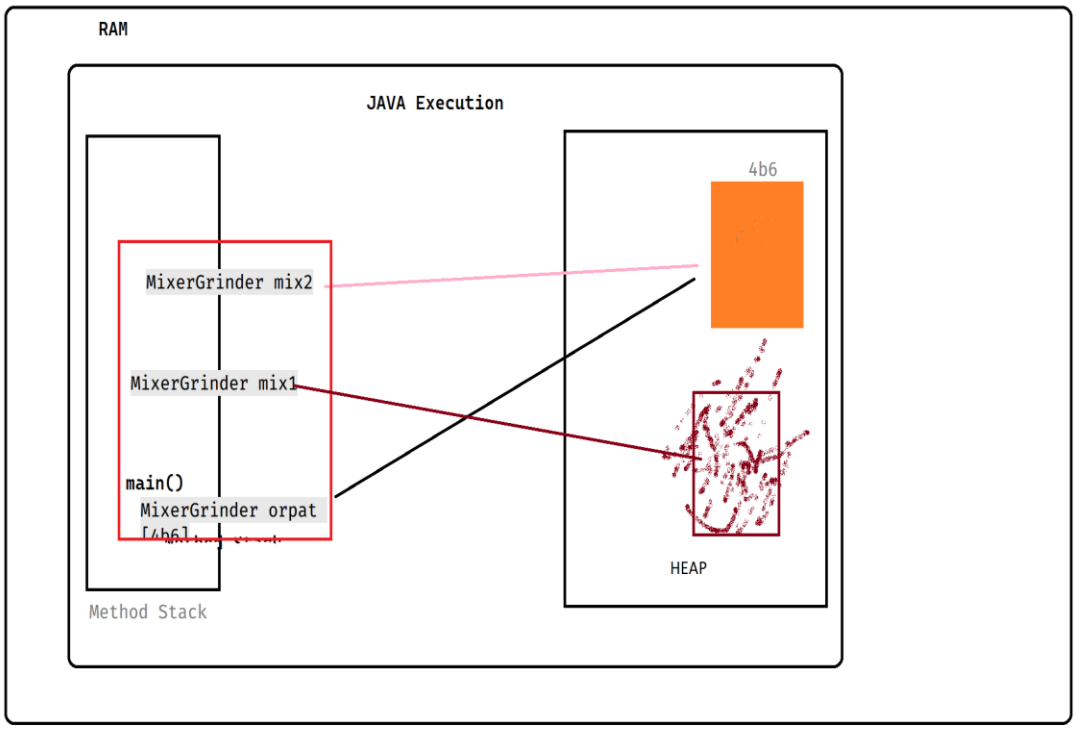


Figure 2 OOP Memory Discussion

MixerGrinder.java

```
package com.jdk8.oop.basics;

public class MixerGrinder {

	//Instance variable/Object Variables
	int wattage;
	String color;
	int speed;

	void grind(){
		System.out.println("GRINDING");
	}

	void mixing(){
		System.out.println("MIXING");
	}

	void blending(){
		System.out.println("BLENDING");
	}

	void readOutSpecs() {
		System.out.println("Wattage -> "+wattage);
		System.out.println("Speed -> "+speed);
		System.out.println("Color -> "+color);

	}

}
```

MixerBuy.java

```
package com.jdk8.oop.basics;

public class MixerBuy {

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

		MixerGrinder orpat =new MixerGrinder();//orpat as a Object Reference
		//MixerGrinder()
		System.out.println(orpat);//By default it will print the memory address



		orpat.readOutSpecs();// preint the defaulyt values


//		Default Values
//		integer --> 0
//		float/double -> 0.0
//		Objetct refer nce - null
//		String - null
//		char -> null char
//		boolean --> false

		orpat.color="Pink";
		orpat.speed=20000;
		orpat.wattage=240;

		orpat.readOutSpecs();



		System.out.println("\n\n\n\n mix1");
		MixerGrinder mix1;
		mix1 = new MixerGrinder();
		System.out.println(mix1);
		mix1.readOutSpecs();


		MixerGrinder mix2= orpat;
		System.out.println(mix2);
		mix2.readOutSpecs();

		orpat.readOutSpecs();
//		mix1.readOutSpecs();

		mix1=null;
		orpat=null;

	}

}
```

Garbage and Garbage Collector

Garbage collection in Java is the process by which Java programs perform automatic memory management. Java programs compile to bytecode that can be run on a Java Virtual Machine, or JVM for short. When Java programs run on the JVM, objects are created on the heap, which is a portion of memory dedicated to the program. Eventually, some objects will no longer be needed. The garbage collector finds these unused objects and deletes them to free up memory.

Java garbage collection is an automatic process. Automatic garbage collection is the process of looking at heap memory, identifying which objects are in use and which are not, and deleting the unused objects. An in-use object, or a referenced object, means that some part of your program still maintains a pointer to that object. An unused or unreferenced object is no longer referenced by any part of your program. So, the memory used by an unreferenced object can be reclaimed. The programmer does not need to mark objects to be deleted explicitly. The garbage collection implementation lives in the JVM.

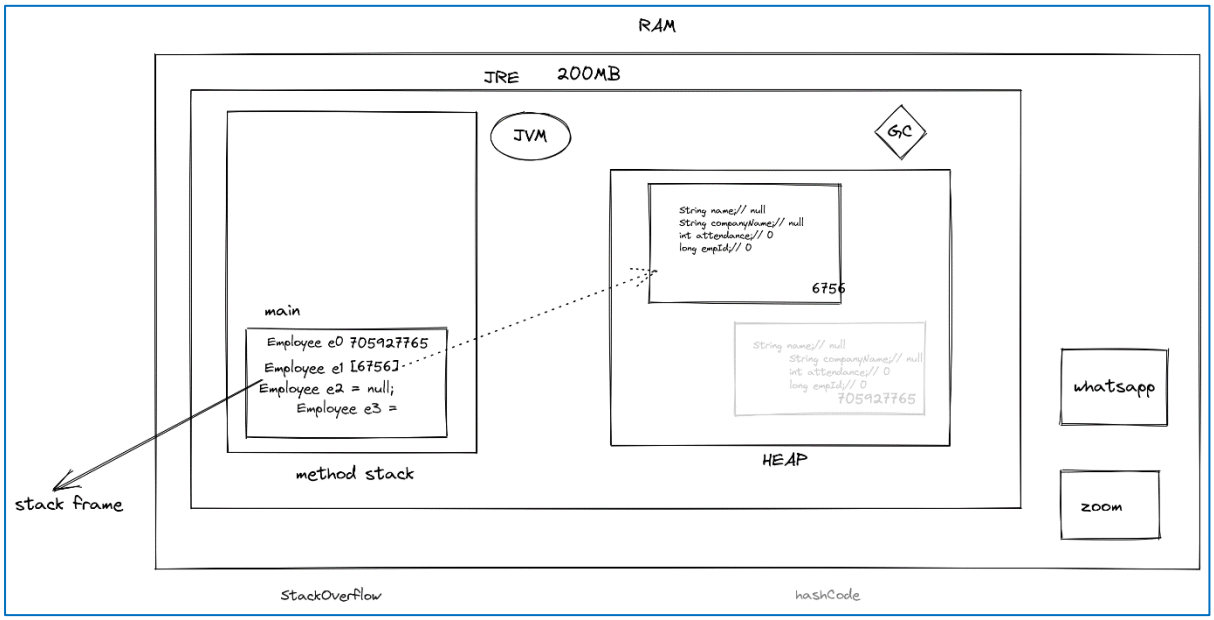


Figure 3 Memory Working in Java

Scanner Class

Scanner is a class in java.util package used for obtaining the input of the primitive types like int, double, etc. and strings. It is the easiest way to read input in a Java program.

ScannerInput.java

```
package com.jdk8.basics;

import java.util.Scanner;

public class ScannerInput {

	public static void main(String[] args) {

//			Scanner Class [Inbuilt Class for taking input]
			Scanner sc = new Scanner(System.in);

			System.out.println("Enter your Age");// this will go to next line after
printing
			System.out.print("Enter your name");// this will not change the line after
printing
			System.out.println();// blank empty line
//			System.out.print();//Error

//			String next = sc.next();//inputs only one word
			String next = sc.nextLine();// inputs whole sentence
			System.out.println(next);

			float height = sc.nextFloat();
			System.out.println("Height ~> " + height);
			System.out.println("Enter a number to be squared");
			int integer = sc.nextInt();
			int result = findSqr(integer);
			System.out.println(result);

			sc.close();// closing the Scanner resource

	}

	static int findSqr(int x) {// formal parameters
			int result = x * x;
			return result;
	}

}
```

ScannerInputCornerCase.java

```
package com.jdk8.basics;

import java.util.Scanner;

public class ScannerInputCornerCase {

	public static void main(String[] args) {

//			Scanner Class [Inbuilt]
			System.out.println("START");
			Scanner sc = new Scanner(System.in);
```

```
                    System.out.println("Enter the age");
                    int age = sc.nextInt();
                    System.out.println("AGE -> " + age);

                    System.out.println("Enter the name");
                    sc.nextLine();// Flushing
                    String name = sc.nextLine();
                    System.out.println("NAME -> " + name);

                    System.out.println("END");

            }
}
```

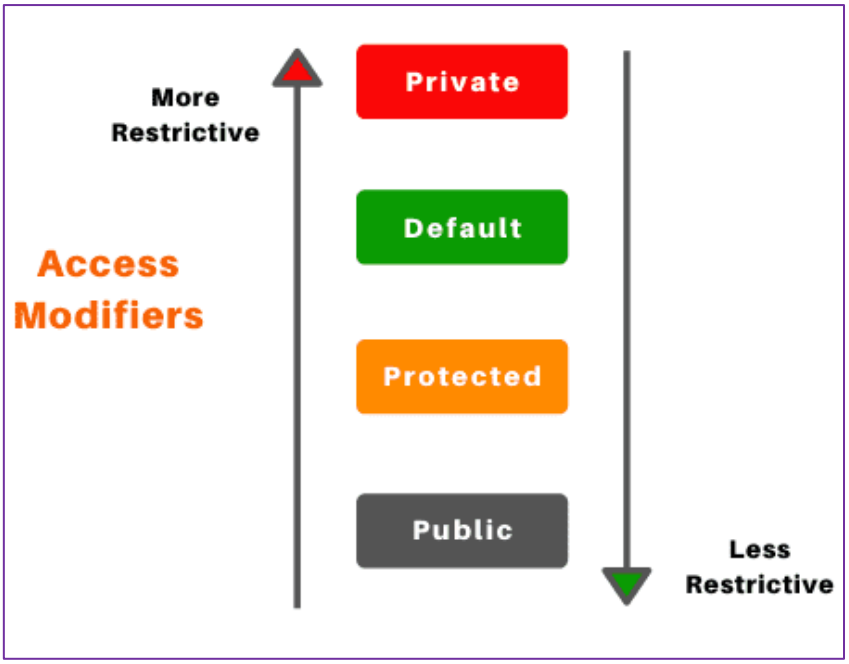
Track 3

Access Modifier

The access modifiers in Java specifies the accessibility or scope of a field, method, constructor, or class. We can change the access level of fields, constructors, methods, and class by applying the access modifier on it.

There are four types of Java access modifiers:

1. **Private**: The access level of a private modifier is only within the class. It cannot be accessed from outside the class.
2. **Default**: The access level of a default modifier is only within the package. It cannot be accessed from outside the package. If you do not specify any access level, it will be the default.
3. **Protected**: The access level of a protected modifier is within the package and outside the package through child class. If you do not make the child class, it cannot be accessed from outside the package.
4. **Public**: The access level of a public modifier is everywhere. It can be accessed from within the class, outside the class, within the package and outside the package.



Modifier	Class	Class Variables	Methods	Method Variables
public	✓	✓	✓	
private		✓	✓	
protected		✓	✓	
default	✓	✓	✓	
final	✓	✓	✓	✓
abstract	✓		✓	
strictfp	✓		✓	
transient		✓		
synchronized			✓	
native			✓	
volatile		✓		
static		✓	✓	

Access Modifier	within class	within package	outside package by subclass only	outside package
Private	Y	N	N	N

Default	Y	Y	N	N
Protected	Y	Y	Y	N
Public	Y	Y	Y	Y

Access Specifiers in Java

		public	private	protected	default
Same Package	Class	YES	YES	YES	YES
	Sub class	YES	NO	YES	YES
	Non sub class	YES	NO	YES	YES
Different Package	Sub class	YES	NO	YES	NO
	Non sub class	YES	NO	NO	NO

Access Specifier ▶ / Item ▼	Default	Public	Protected	Private
Class	Yes	Yes	No	No
Inner Class	Yes	Yes	Yes	Yes
Interface	Yes	Yes	No	No
Interface Inside Class	Yes	Yes	Yes	Yes
enum	Yes	Yes	No	No
enum Inside Class	Yes	Yes	Yes	Yes
enum inside Interface	Yes	No	No	No
Constructor	Yes	Yes	Yes	Yes
methods & data inside class	Yes	Yes	Yes	Yes
methods & data inside Interface	Yes	No	No	No

Access control for members of class and interface in java

Accessibility / Location ⟍ Access Specifier	Same Class	Same Package		Other Package	
		Child class	Non-child class	Child class	Non-child class
Public	Yes	Yes	Yes	Yes	Yes
Protected	Yes	Yes	Yes	Yes	No
Default	Yes	Yes	Yes	No	No
Private	Yes	No	No	No	No