Unit-1 Basics of Programming in Java(7hrs)

1.1 Java Architecture, Class paths, Sample program
1.2 Classes, Objects, Constructors
1.3 Packages and Data Types
1.4 Conditional Statements
1.5 Access Modifiers
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1.1 Java Architecture

Java Architecture is a collection of components, i.e., JVM, JRE, and JDK. It integrates the process of interpretation and compilation. It defines all the processes involved in creating a Java program. Java Architecture explains each and every step of how a program is compiled and executed.

Java Architecture can be explained by using the following steps:

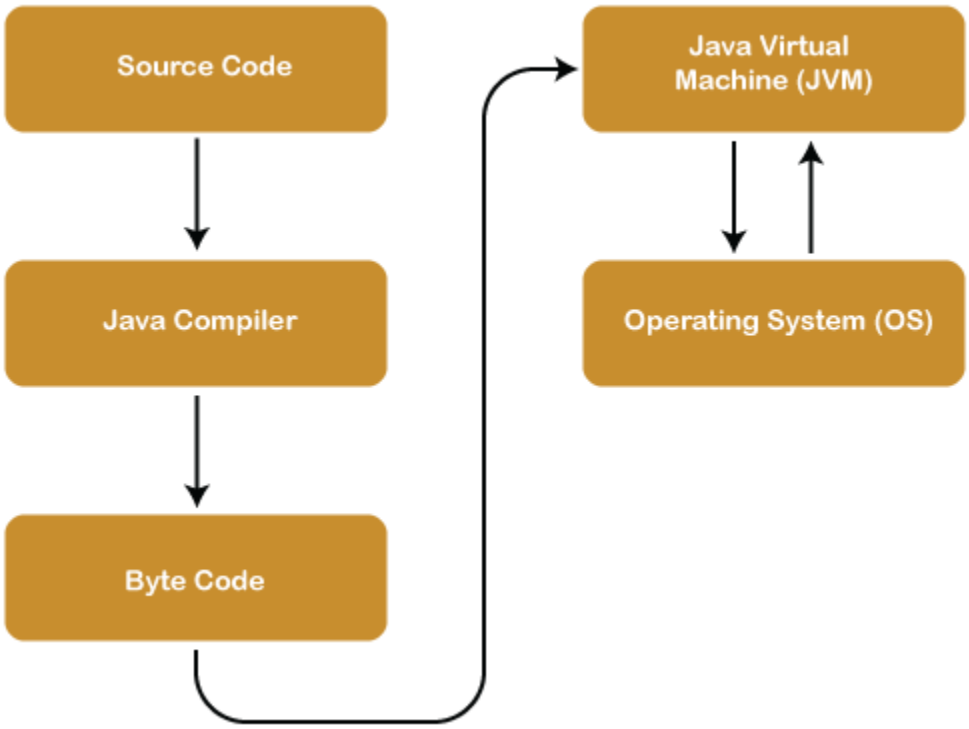
There is a process of compilation and interpretation in Java.

Java compiler converts the Java code into byte code.

After that, the JVM converts the byte code into machine code.

The machine code is then executed by the machine.

The following figure represents the Java Architecture in which each step is elaborate graphically:-



Java Architecture

Now let's dive deep to get more knowledge about Java Architecture. As we know that the Java architecture is a collection of components, so we will discuss each and every component into detail.

Components of Java Architecture

The Java architecture includes the three main components:

- Java Virtual Machine (JVM)
- Java Runtime Environment (JRE)
- Java Development Kit (JDK)

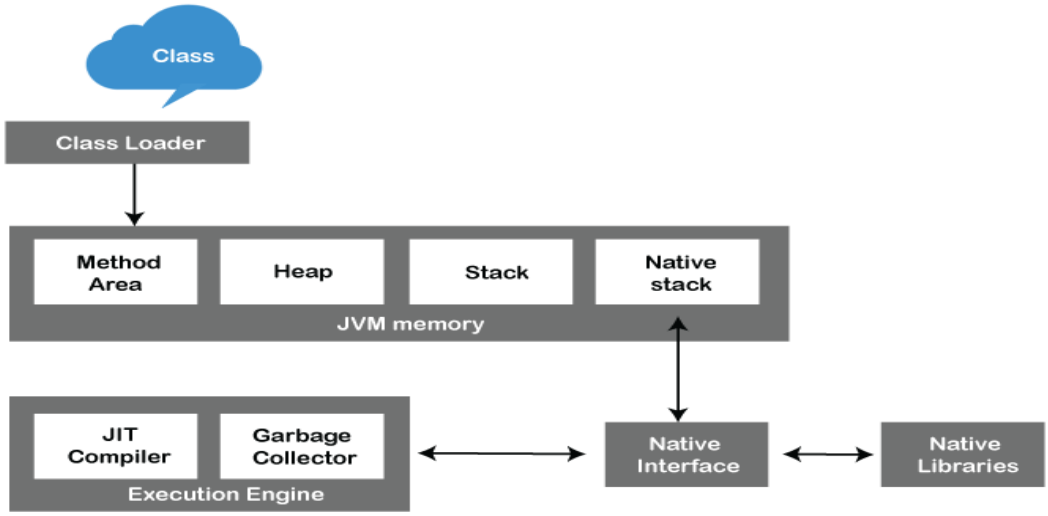
Java Virtual Machine

The main feature of Java is WORA. WORA stands for Write Once Run Anywhere. The feature states that we can write our code once and use it anywhere or on any operating system. Our Java program can run any of the platforms only because of the Java Virtual Machine. It is a Java platform component that gives us an environment to execute java programs. JVM's main task is to convert byte code into machine code.

JVM, first of all, loads the code into memory and verifies it. After that, it executes the code and provides a runtime environment. Java Virtual Machine (JVM) has its own architecture, which is given below:

JVM Architecture

JVM is an abstract machine that provides the environment in which Java bytecode is executed. The figure represents the architecture of the JVM.



Java Architecture

ClassLoader: ClassLoader is a subsystem used to load class files. ClassLoader first loads the Java code whenever we run it.

Class Method Area: In the memory, there is an area where the class data is stored during the code's execution. Class method area holds the information of static variables, static methods, static blocks, and instance methods.

Heap: The heap area is a part of the JVM memory and is created when the JVM starts up. Its size cannot be static because it increase or decrease during the application runs.

Stack: It is also referred to as thread stack. It is created for a single execution thread. The thread uses this area to store the elements like the partial result, local variable, data used for calling method and returns etc.

Native Stack: It contains the information of all the native methods used in our application.

Execution Engine: It is the central part of the JVM. Its main task is to execute the byte code and execute the Java classes. The execution engine has three main components used for executing Java classes.

Interpreter: It converts the byte code into native code and executes. It sequentially executes the code. The interpreter interprets continuously and even the same method multiple times. This reduces the performance of the system, and to solve this, the JIT compiler is introduced.

JIT Compiler: JIT compiler is introduced to remove the drawback of the interpreter. It increases the speed of execution and improves performance.

Garbage Collector: The garbage collector is used to manage the memory, and it is a program written in Java. It works in two phases, i.e., **Mark and Sweep:** Mark is an area where the garbage collector identifies the used and unused chunks of memory. The Sweep removes the identified object from the Mark

Java Native Interface

Java Native Interface works as a mediator between Java method calls and native libraries.

Java Runtime Environment

It provides an environment in which Java programs are executed. JRE takes our Java code, integrates it with the required libraries, and then starts the JVM to execute it. To learn more about the Java Runtime Environment, click here.

Java Development Kit

It is a software development environment used in the development of Java applications and applets. Java Development Kit holds JRE, a compiler, an interpreter or loader, and several development tools in it. To learn more about the Java Development Kit, click here.

These are three main components of Java Architecture. The execution of a program is done with all these three components.

Class paths

The CLASSPATH variable is an environment variable, meaning it's part of the operating system (e.g., Windows). It contains the list of directories.

These directories contain any class you created, plus the delivered Java class file, called the Java Archive (JAR).

Sample Program

The sample program of java is given below:

```
public static void main(String args[])
{
        System.out.println("Hello world!");
}
```

Output:

Hello world!

Program Explanation:

public- this is an access modifier that is visible to any other classes along with its members.

static- 'static' keyword is used in the main() method so that the JVM may call it without having to create an instance of the class that contains the main() function.

void- 'void' is the keyword that tells Java that the main method won't return a value.

String args[]- String[]args in Java, i.e., a command line argument array, is used in Java to retrieve input from the console.

1.2 Classes, Objects , Constructors

- **Classes**
- Java Classes/Objects
- Java is an object-oriented programming language.
- Everything in Java is associated with classes and objects, along with its attributes and methods.

- For example: in real life, a car is an object. The car has **attributes**, such as weight and color, and **methods**, such as drive and brake.
- A Class is like an object constructor, or a "blueprint" for creating objects.

- Create a Class
- To create a class, use the keyword class:
- Main.java
- Get your own Java Server
- Create a class named "Main" with a variable x:

```
public class Main {
  int x = 5;
}
```

- Remember from the Java Syntax chapter that a class should always start with an uppercase first letter, and that the name of the java file should match the class name.

- **Create an Object**
- In Java, an object is created from a class. We have already created the class named Main, so now we can use this to create objects.
- To create an object of Main, specify the class name, followed by the object name, and use the keyword new:

- **Example**
- Create an object called "myObj" and print the value of x:

```
public class Main {
  int x = 5;

  public static void main(String[] args) {
    Main myObj = new Main();
    System.out.println(myObj.x);
  }
}
```

- Try it Yourself »

1.2 Constructor

Constructors in Java

- In Java, a constructor is a block of codes similar to the method. It is called when an instance of the class is created. At the time of calling constructor, memory for the object is allocated in the memory.

- It is a special type of method which is used to initialize the object.

- Every time an object is created using the new() keyword, at least one constructor is called.

- It calls a default constructor if there is no constructor available in the class. In such case, Java compiler provides a default constructor by default.
- There are two types of constructors in Java: no-arg constructor, and parameterized constructor.

Note: It is called constructor because it constructs the values at the time of object creation. It is not necessary to write a constructor for a class.

It is because java compiler creates a default constructor if your class doesn't have any.

Rules for creating Java constructor

There are two rules defined for the constructor.

- Constructor name must be the same as its class name
- A Constructor must have no explicit return type
- A Java constructor cannot be abstract, static, final, and synchronized

Note: We can use access modifiers while declaring a constructor. It controls the object creation. In other words, we can have private, protected, public or default constructor in Java.

Types of Java constructors

There are two types of constructors in Java:

1. **Default constructor (no-arg constructor)**
2. **Parameterized constructor**

Java Default Constructor

A constructor is called "Default Constructor" when it doesn't have any parameter.

Syntax of default constructor:

```
<class_name>()
{
}
```

Example of default constructor

In this example, we are creating the no-arg constructor in the Bike class. It will be invoked at the time of object creation.

```
//Java Program to create and call a default constructor
```

```
class Bike1{
//creating a default constructor
Bike1(){
        System.out.println("Bike is created");}
//main method
public static void main(String args[]){
//calling a default constructor
Bike1 b=new Bike1();
}
}
```

1.3 Packages and Data Types

- A Java package is a set of classes, interfaces, and sub-packages that are similar.
- In Java, it divides packages into two types: built-in packages and user-defined packages.
- Built-in Packages (packages from the Java API) and User-defined Packages are the two types of packages (create your own packages)

Data types

Data Types in Java

Data types specify the different sizes and values that can be stored in the variable. There are two types of data types in Java:

1. **Primitive data types:** The primitive data types include boolean, char, byte, short, int, long, float and double.
2. **Non-primitive data types:** The non-primitive data types include Classes, Interfaces, and Arrays.

Java Primitive Data Types

In Java language, primitive data types are the building blocks of data manipulation. These are the most basic data types available in Java language.

Java is a statically-typed programming language. It means, all ***variables must be declared before its use***. That is why we need to declare variable's type and name.

There are 8 types of primitive data types:

1. boolean data type
2. byte data type
3. char data type
4. short data type
5. int data type
6. long data type
7. float data type
8. double data type

Data Type	Default Value	Default size
boolean	false	**1 bit**
char	'\u0000'	**2 byte**
byte	0	**1 byte**
short	0	**2 byte**
int	0	**4 byte**
long	0L	**8 byte**
float	0.0f	**4 byte**
double	0.0d	**8 byte**

Boolean Data Type

The Boolean data type is used to store only two possible values: true and false. This data type is used for simple flags that track true/false conditions.

The Boolean data type specifies one bit of information, but its "size" can't be defined precisely.

Example:

Boolean one = false

Byte Data Type

The byte data type is an example of primitive data type. It is an 8-bit signed two's complement integer. Its value-range lies between -128 to 127 (inclusive). Its minimum value is -128 and maximum value is 127. Its default value is 0.

The byte data type is used to save memory in large arrays where the memory savings is most required. It saves space because a byte is 4 times smaller than an integer. It can also be used in place of "int" data type.

Example:

byte a = 10, byte b = -20

Short Data Type

The short data type is a 16-bit signed two's complement integer. Its value-range lies between -32,768 to 32,767 (inclusive). Its minimum value is -32,768 and maximum value is 32,767. Its default value is 0.

The short data type can also be used to save memory just like byte data type. A short data type is 2 times smaller than an integer.

Example:

short s = 10000, short r = -5000

Int Data Type

The int data type is a 32-bit signed two's complement integer. Its value-range lies between - 2,147,483,648 (-2^31) to 2,147,483,647 (2^31 -1) (inclusive). Its minimum value is - 2,147,483,648and maximum value is 2,147,483,647. Its default value is 0.

The int data type is generally used as a default data type for integral values unless if there is no problem about memory.

Example:

int a = 100000, int b = -200000

Long Data Type

The long data type is a 64-bit two's complement integer. Its value-range lies between -9,223,372,036,854,775,808(-2^63) to 9,223,372,036,854,775,807(2^63 -1)(inclusive). Its minimum value is - 9,223,372,036,854,775,808and maximum value is 9,223,372,036,854,775,807. Its default value is 0. The long data type is used when you need a range of values more than those provided by int.

Example:

long a = 100000L, long b = -200000L

Float Data Type

The float data type is a single-precision 32-bit IEEE 754 floating point.Its value range is unlimited. It is recommended to use a float (instead of double) if you need to save memory in large arrays of floating point numbers. The float data type should never be used for precise values, such as currency. Its default value is 0.0F.

Example:

float f1 = 234.5f

Double Data Type

The double data type is a double-precision 64-bit IEEE 754 floating point. Its value range is unlimited. The double data type is generally

used for decimal values just like float. The double data type also should never be used for precise values, such as currency. Its default value is 0.0d.

Example:

double d1 = 12.3

Char Data Type

The char data type is a single 16-bit Unicode character. Its value-range lies between '\u0000' (or 0) to '\uffff' (or 65,535 inclusive).The char data type is used to store characters.

Example:

char letterA = 'A'

Why char uses 2 byte in java and what is \u0000 ?

It is because java uses Unicode system not ASCII code system. The \u0000 is the lowest range of Unicode system. To get detail explanation about Unicode visit next page.

1.4 Java Control Statements | Control Flow in Java

Java compiler executes the code from top to bottom. The statements in the code are executed according to the order in which they appear. However, Java provides statements that can be used to control the flow of Java code. Such statements are called control flow statements. It is one of the fundamental features of Java, which provides a smooth flow of program.

Java provides three types of control flow statements.

Decision Making statements

1.if statements

2.switch statement

3.Loop statements

4.do while loop

5.while loop

6.for loop

7.for-each loop

8.Jump statements

9.break statement

10.continue statement

Decision-Making statements:

As the name suggests, decision-making statements decide which statement to execute and when. Decision-making statements evaluate the Boolean expression and control the program flow depending upon the result of the condition provided. There are two types of decision-making statements in Java, i.e., If statement and switch statement.

1) If Statement:

In Java, the "if" statement is used to evaluate a condition. The control of the program is diverted depending upon the specific condition. The condition of the If statement gives a Boolean value, either true or false. In Java, there are four types of if-statements given below.

1 ***Simple if statement***
2 ***if-else statement***
3 ***if-else-if ladder***
4 ***Nested if-statement***

Let's understand the if-statements one by one.

1) Simple if statement:

It is the most basic statement among all control flow statements in Java. It evaluates a Boolean expression and enables the program to enter a block of code if the expression evaluates to true.

Syntax of if statement is given below.

```
if(condition) {
statement 1; //executes when condition is true
}
```

Consider the following example in which we have used the if statement in the java code.

Student.java

```
public class Student {
public static void main(String[] args) {
int x = 10;
int y = 12;
if(x+y > 20) {
System.out.println("x + y is greater than 20");
}
}
}
```

Output:

x + y is greater than 20

2) if-else statement

The if-else statement is an extension to the if-statement, which uses another block of code, i.e., else block. The else block is executed if the condition of the if-block is evaluated as false.

Syntax:

```
if(condition) {
statement 1; //executes when condition is true
}
else{
statement 2; //executes when condition is false
}
```

Consider the following example.

Student.java

```
public class Student {
public static void main(String[] args) {
int x = 10;
int y = 12;
if(x+y < 10) {
System.out.println("x + y is less than      10");
}   else {
System.out.println("x + y is greater than 20");
}
}
```

}

Output:

x + y is greater than 20

3) if-else-if ladder:

The if-else-if statement contains the if-statement followed by multiple else-if statements. In other words, we can say that it is the chain of if-else statements that create a decision tree where the program may enter in the block of code where the condition is true. We can also define an else statement at the end of the chain.

Syntax of if-else-if statement is given below.

```
if(condition 1) {
statement 1; //executes when condition 1 is true
}
else if(condition 2) {
statement 2; //executes when condition 2 is true
}
else {
statement 2; //executes when all the conditions are false
}
```

Consider the following example.

Student.java

```
public class Student {
public static void main(String[] args) {
String city = "Delhi";
```

```
if(city == "Meerut") {
System.out.println("city is meerut");
}else if (city == "Noida") {
System.out.println("city is noida");
}else if(city == "Agra") {
System.out.println("city is agra");
}else {
System.out.println(city);
}
}
}
```

Output:

Delhi

4. Nested if-statement

In nested if-statements, the if statement can contain a if or if-else statement inside another if or else-if statement.

Syntax of Nested if-statement is given below.

```
if(condition 1) {
statement 1; //executes when condition 1 is true
if(condition 2) {
statement 2; //executes when condition 2 is true
}
else{
statement 2; //executes when condition 2 is false
```

```
}
}
```

Consider the following example.

Student.java

```
public class Student {
public static void main(String[] args) {
String address = "Delhi, India";

if(address.endsWith("India")) {
if(address.contains("Meerut")) {
System.out.println("Your city is Meerut");
}else if(address.contains("Noida")) {
System.out.println("Your city is Noida");
}else {
System.out.println(address.split(",")[0]);
}
}else {
System.out.println("You are not living in India");
}
}
}
```

Output:

```
Delhi
```

Switch Statement:

In Java, Switch statements are similar to if-else-if statements. The switch statement contains multiple blocks of code called cases and a single case is executed based on the variable which is being switched. The switch statement is easier to use instead of if-else-if statements. It also enhances the readability of the program.

Points to be noted about switch statement:

- The case variables can be int, short, byte, char, or enumeration. String type is also supported since version 7 of Java Cases cannot be duplicate
- Default statement is executed when any of the case doesn't match the value of expression. It is optional.
- Break statement terminates the switch block when the condition is satisfied.
- It is optional, if not used, next case is executed.

While using switch statements, we must notice that the case expression will be of the same type as the variable. *However, it will also be a constant value.*

The syntax to use the switch statement is given below.

```
switch (expression){
    case value1:
     statement1;
     break;
    .
    .
    .
    case valueN:
     statementN;
```

```
    break;
   default:
    default statement;
}
```

Consider the following example of the switch statement.

Student.java

```
public class Student implements Cloneable {
public static void main(String[] args) {
int num = 2;
switch (num){
case 0:
System.out.println("number is 0");
break;
case 1:
System.out.println("number is 1");
break;
default:
System.out.println(num);
}
}
}
```

Output:

2

Loop Statements

- In programming, sometimes we need to execute the block of code repeatedly while some condition evaluates to true. However, loop statements are used to execute the set of instructions in a repeated order. The execution of the set of instructions depends upon a particular condition.

- In Java, we have three types of loops that execute similarly. However, there are differences in their syntax and condition checking time.

1.for loop

2.while loop

3.do-while loop

Let's understand the loop statements one by one.

Java for loop

In Java, for loop is similar to C and C++. It enables us to initialize the loop variable, check the condition, and increment/decrement in a single line of code. We use the for loop only when we exactly know the number of times, we want to execute the block of code.

for(initialization, condition,increment/decrement) {

//block of statements

}

Control Flow in Java

Consider the following example to understand the proper functioning of the for loop in java.

Calculation.java

```
public class Calculattion {
public static void main(String[] args) {
// TODO Auto-generated method stub
int sum = 0;
for(int j = 1; j<=10; j++) {
sum = sum + j;
}
System.out.println("The sum of first 10 natural numbers is " + sum);
}
}
```

Output:

```
The sum of first 10 natural numbers is 55
```

Java for-each loop

Java provides an enhanced for loop to traverse the data structures like array or collection. We don't need to update the loop variable. The syntax for the for-each loop in java is given below.

```
for(data_type var : array_name/collection_name){
//statements
}
```

Consider the following example of the for-each loop in Java.

Calculation.java

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

```
String[] names = {"Java","C","C++","Python","JavaScript"};
System.out.println("Printing the content of the array names:\n");
for(String name:names) {
System.out.println(name);
}
}
}
```

Output:

Printing the content of the array names:

Java while loop

The while loop is also used to iterate over the number of statements multiple times. However, if we don't know the number of iterations in advance, it is recommended to use a while loop. Unlike for loop, the initialization and increment/decrement doesn't take place inside the loop statement in while loop.

It is also known as the entry-controlled loop since the condition is checked at the start of the loop.

If the condition is true, then the loop body will be executed; otherwise, the statements after the loop will be executed.

The syntax of the while loop is given below.

```
while(condition){
//looping statements
}
```

Control Flow in Java

Consider the following example.

Calculation .java

```
public class Calculation {
public static void main(String[] args) {
// TODO Auto-generated method stub
int i = 0;
System.out.println("Printing the list of first 10 even numbers \n");
while(i<=10) {
System.out.println(i);
i = i + 2;
}
}
}
```

Output:

```
Printing the list of first 10 even numbers
0
2
4
6
8
10
```

Java do-while loop

The do-while loop checks the condition at the end of the loop after executing the loop statements. When the number of iteration is not known and we have to execute the loop at least once, we can use do-while loop.

It is also known as the exit-controlled loop since the condition is not checked in advance.

The syntax of the do-while loop is given below.

```
do
{
//statements
} while (condition);
```

Consider the following example of the do-while loop in Java.

Calculation.java

```
public class Calculation {
public static void main(String[] args) {
// TODO Auto-generated method stub
int i = 0;
System.out.println("Printing the list of first 10 even numbers \n");
do {
System.out.println(i);
i = i + 2;
```

```
}while(i<=10);
}
}
```

Output:

```
Printing the list of first 10 even numbers
0
2
4
6
8
10
```

Jump Statements

Jump statements are used to transfer the control of the program to the specific statements. In other words, jump statements transfer the execution control to the other part of the program. There are two types of jump statements in Java, i.e., break and continue.

Java break statement

- As the name suggests, the break statement is used to break the current flow of the program and transfer the control to the next statement outside a loop or switch statement. However, it breaks only the inner loop in the case of the nested loop.
- The break statement cannot be used independently in the Java program, i.e., it can only be written inside the loop or switch statement.
- The break statement example with for loop

Consider the following example of break statement with for loop.

BreakExample.java

```
public class BreakExample {
public static void main(String[] args) {
// TODO Auto-generated method stub
for(int i = 0; i<= 10; i++) {
System.out.println(i);
if(i==6) {
break;
}
}
}
}
```

Output:

```
0
1
2
3
4
5
6
```

break statement example with labeled for loop

Calculation.java

```
public class Calculation {
public static void main(String[] args) {
```

```
// TODO Auto-generated method stub
a:
for(int i = 0; i<= 10; i++) {
b:
for(int j = 0; j<=15;j++) {
c:
for (int k = 0; k<=20; k++) {
System.out.println(k);
if(k==5) {
break a;
}
}
}
}
}
```

Output:

```
0
1
2
3
4
5
```

Java continue statement

Unlike break statement, the continue statement doesn't break the loop, whereas, it skips the specific part of the loop and jumps to the next iteration of the loop immediately.

Consider the following example of the continue statement in Java.

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

for(int i = 0; i<= 2; i++) {

for (int j = i; j<=5; j++) {

if(j == 4) {
continue;
}
System.out.println(j);
}
}
}

}
```

Output:

0

1

2

3

5

1

2

3

5

2

3

5

1.5 Access Modifiers in Java

There are two types of modifiers in Java: access modifiers and non-access modifiers.

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:

Private: The access level of a private modifier is only within the class. It cannot be accessed from outside the class.

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.

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.

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.

There are many non-access modifiers, such as static, abstract, synchronized, native, volatile, transient, etc. Here, we are going to learn the access modifiers only.

Understanding Java Access Modifiers

Let's understand the access modifiers in Java by a simple table.

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

1.6 Exception Handling in Java

The Exception Handling in Java is one of the powerful mechanism to handle the runtime errors so that the normal flow of the application can be maintained.

In this tutorial, we will learn about Java exceptions, it's types, and the difference between checked and unchecked exceptions.

What is Exception in Java?

Dictionary Meaning: Exception is an abnormal condition.

In Java, an exception is an event that disrupts the normal flow of the program. It is an object which is thrown at runtime.

What is Exception Handling?

Exception Handling is a mechanism to handle runtime errors such as ClassNotFoundException, IOException, SQLException, RemoteException, etc.

What is Exception Handling?

Exception Handling is a mechanism to handle runtime errors such as ClassNotFoundException, IOException, SQLException, RemoteException, etc.

Advantage of Exception Handling

The core advantage of exception handling is **to maintain the normal flow of the application**. An exception normally disrupts the normal flow of the application; that is why we need to handle exceptions. Let's consider a scenario:

1. statement 1;
2. statement 2;
3. statement 3;
4. statement 4;
5. statement 5;//exception occurs
6. statement 6;
7. statement 7;
8. statement 8;
9. statement 9;
10. statement 10;

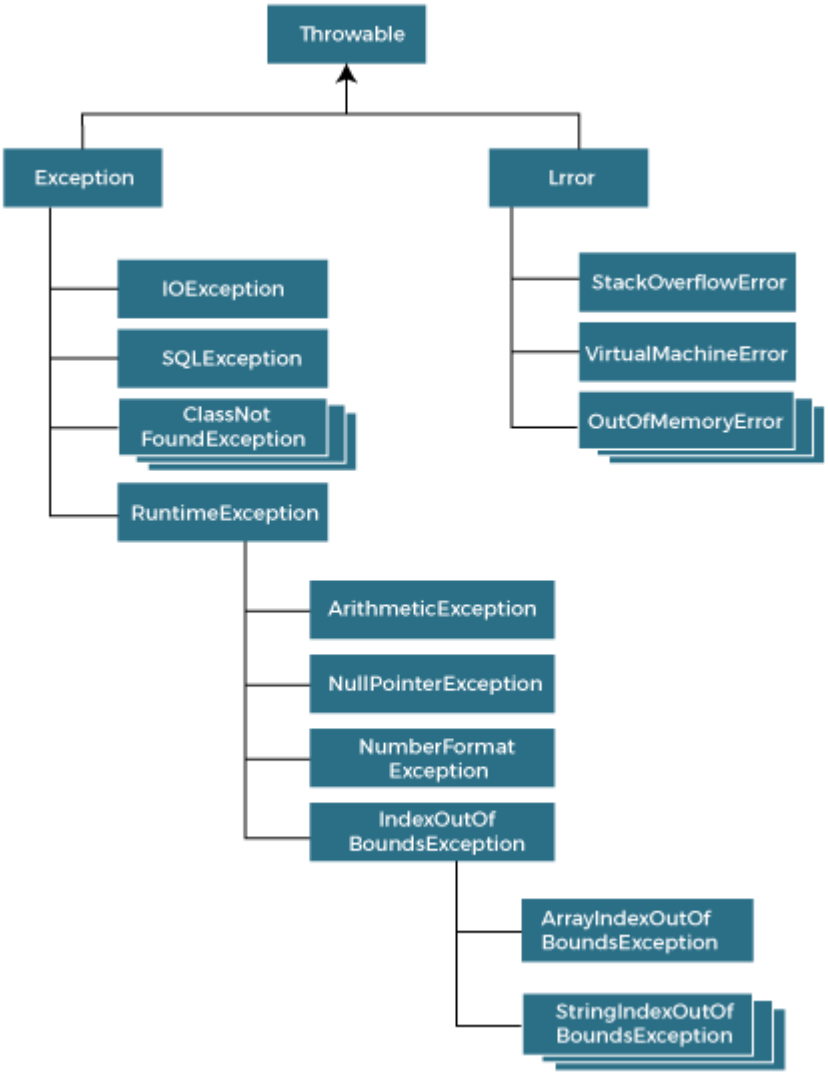
Suppose there are 10 statements in a Java program and an exception occurs at statement 5; the rest of the code will not be executed, i.e., statements 6 to 10 will not be executed. However, when we perform exception handling, the rest of the statements will be executed. That is why we use exception handling in Java.

Do You Know?

- What is the difference between checked and unchecked exceptions?
- What happens behind the code int data=50/0;?
- Why use multiple catch block?
- Is there any possibility when the finally block is not executed?
- What is exception propagation?
- What is the difference between the throw and throws keyword?
- What are the 4 rules for using exception handling with method overriding?

Hierarchy of Java Exception classes

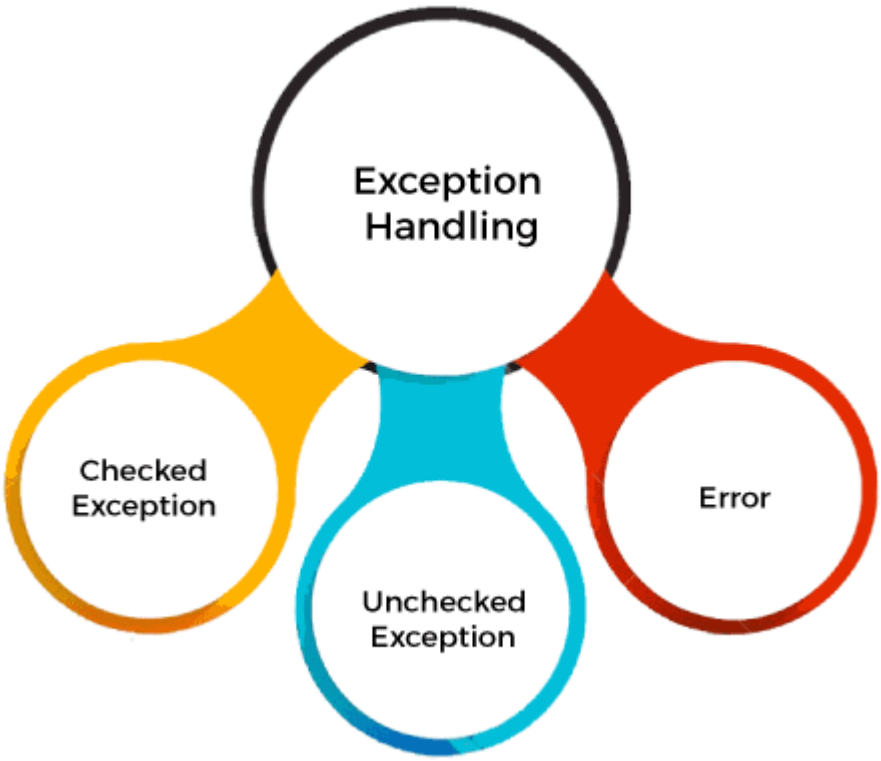
The java.lang.Throwable class is the root class of Java Exception hierarchy inherited by two subclasses: Exception and Error. The hierarchy of Java Exception classes is given below:



Types of Java Exceptions

There are mainly two types of exceptions: checked and unchecked. An error is considered as the unchecked exception. However, according to Oracle, there are three types of exceptions namely:

1. Checked Exception
2. Unchecked Exception
3. Error



Difference between Checked and Unchecked Exceptions

1) Checked Exception

The classes that directly inherit the Throwable class except RuntimeException and Error are known as checked exceptions. For example, IOException, SQLException, etc. Checked exceptions are checked at compile-time.

2) Unchecked Exception

The classes that inherit the RuntimeException are known as unchecked exceptions. For example, ArithmeticException, NullPointerException, ArrayIndexOutOfBoundsException, etc. Unchecked exceptions are not checked at compile-time, but they are checked at runtime.

3) Error

Error is irrecoverable. Some example of errors are OutOfMemoryError, VirtualMachineError, AssertionError etc.

Java Exception Keywords

Java provides five keywords that are used to handle the exception. The following table describes each.

Keyword	Description
try	The "try" keyword is used to specify a block where we should place an exception code. It means we can't use try block alone. The try block must be followed by either catch or finally.
catch	The "catch" block is used to handle the exception. It must be preceded by try block which means we can't use catch block alone. It can be followed by finally block later.
finally	The "finally" block is used to execute the necessary code of the program. It is executed whether an exception is handled or not.
throw	The "throw" keyword is used to throw an exception.
throws	The "throws" keyword is used to declare exceptions. It specifies that there may

	occur an exception in the method. It doesn't throw an exception. It is always used with method signature.

Java Exception Handling Example

Let's see an example of Java Exception Handling in which we are using a try-catch statement to handle the exception.

JavaExceptionExample.java

```
1. public class JavaExceptionExample{
2.   public static void main(String args[]){
3.    try{
4.       //code that may raise exception
5.       int data=100/0;
6.    }catch(ArithmeticException e){System.out.println(e);}
7.    //rest code of the program
8.    System.out.println("rest of the code...");
9.   }
10.}
```

Test it Now

Output:

```
Exception in thread main java.lang.ArithmeticException:/ by zero
rest of the code...
```

In the above example, 100/0 raises an ArithmeticException which is handled by a try-catch block.

Common Scenarios of Java Exceptions

There are given some scenarios where unchecked exceptions may occur. They are as follows:

1) A scenario where ArithmeticException occurs

If we divide any number by zero, there occurs an ArithmeticException.

```
int a=50/0;//ArithmeticException
```

2) A scenario where NullPointerException occurs

If we have a null value in any variable, performing any operation on the variable throws a NullPointerException.

```
1. String s=null;
2. System.out.println(s.length());//NullPointerException
```

3) A scenario where NumberFormatException occurs

If the formatting of any variable or number is mismatched, it may result into NumberFormatException. Suppose we have a string variable that has characters; converting this variable into digit will cause NumberFormatException.

```
1. String s="abc";
2. int i=Integer.parseInt(s);//NumberFormatException
```

4) A scenario where ArrayIndexOutOfBoundsException occurs

When an array exceeds to it's size, the ArrayIndexOutOfBoundsException occurs. there may be other reasons to occur ArrayIndexOutOfBoundsException. Consider the following statements.

```
1. int a[]=new int[5];
2. a[10]=50; //ArrayIndexOutOfBoundsException
```

Java Exceptions Index

1. Java Try-Catch Block
2. Java Multiple Catch Block
3. Java Nested Try
4. Java Finally Block
5. Java Throw Keyword
6. Java Exception Propagation
7. Java Throws Keyword
8. Java Throw vs Throws

9. Java Final vs Finally vs Finalize
10. Java Exception Handling with Method Overriding
11. Java Custom Exceptions

1.7 Java Collections

The **Collection in Java** is a framework that provides an architecture to store and manipulate the group of objects.

Java Collections can achieve all the operations that you perform on a data such as searching, sorting, insertion, manipulation, and deletion.

Java Collection means a single unit of objects. Java Collection framework provides many interfaces (Set, List, Queue, Deque) and classes (ArrayList, Vector, LinkedList, PriorityQueue, HashSet, LinkedHashSet, TreeSet).

What is Collection in Java

A Collection represents a single unit of objects, i.e., a group.

What is a framework in Java

- It provides readymade architecture.
- It represents a set of classes and interfaces.
- It is optional.

What is Collection framework

The Collection framework represents a unified architecture for storing and manipulating a group of objects. It has:

1. Interfaces and its implementations, i.e., classes
2. Algorithm