* Sun describes Java as a �simple, object-oriented, distributed, interpreted, robust, secure, architecture neutral, portable, high-performance, multithreaded, and dynamic language�.
* A byte code verifier in the Java interpreter looks at the incoming byte codes and verifies whether the compiled code is strictly language compliant, in case it founds illegal code, the run time system rejects the code and refuses to run it;

Jdk

1.**javac**:The Java compiler. This program compiles Java source codes into byte codes.

2.**java**:The Java interpreter. This program runs Java byte codes.

3.**javadoc**:Generates API documentation in HTML format from Java source code.

4.**appletviewer**:A Java interpreter that executes Java applet (a special kind of Java Program) classes.

5.**jdb**:The Java debugger. Helps us find and fix bugs in Java programs.

6.**javap**:The Java disassembler. Displays the accessible functions and data in a compiled class file. It also displays the meaning of the byte codes.

7.**javah**:Creates C header files that can be used to make C routines, that can call Java routines,or make C routines that can be called by Java programs.

Java Packages

1.**java.applet**: This package includes classes designed for use within an applet. There is one class, Applet and three **interfaces AppletContex, AppletStub, and AudioClip.**

2.**java.awt** :The Abstract Windowing Toolkit (AWT) package, awt, contains classes used to generate widgets and GUI (Graphical User Interface) components. This package includes the **classes: Button, CheckBox, Choice, Component, Graphics, Menu, Panel, TextArea, and TextField.**

3.**java.io**  :The I/O Package include file input and output classes such as the classes FileInputStream and FileOutputStream. File I/O in subject to Security Control in applets.

4.**java.lang**:This package includes the Java language classes, including Object, Thread, Exception, System, Integer, Float, Math, String, and so on.

5.**java.net** :This class supports the TCP/IP networking protocols and includes the Socket, SenverSocket, DatagramPacket, DategramSocket, URL, and URLConnection classes among others.

6.**java.util**:This class packages contains miscellaneons classes that are useful for a variety of programming chores. Those classes include Date, Dictionary, Random (for creating random number), Vector, and Stack (for implementing a last-in-first-out (LIFO) stack).

* static method in a sub class, as long as the original method was not declared final.  
  However, you can't override a static method with a non static method.

|  |  |
| --- | --- |
| **Q:** | **Why java does not support pointers?** |
| **A:** | Because pointers are unsafe, Java uses reference types to hide pointer and programmers feel easier to deal with reference types without pointers. |

There are 4 platforms or editions of Java:

#### **1) Java SE (Java Standard Edition)**

It is a Java programming platform. It includes Java programming APIs such as java.lang, java.io, java.net, java.util, java.sql, java.math etc. It includes core topics like OOPs, [String](https://www.javatpoint.com/java-string), Regex, Exception, Inner classes, Multithreading, I/O Stream, Networking, AWT, Swing, Reflection, Collection, etc.

#### **2) Java EE (Java Enterprise Edition)**

It is an enterprise platform that is mainly used to develop web and enterprise applications. It is built on top of the Java SE platform. It includes topics like Servlet, JSP, Web Services, EJB, [JPA](https://www.javatpoint.com/jpa-tutorial), etc.

#### **3) Java ME (Java Micro Edition)**

It is a micro platform that is dedicated to mobile applications.

#### **4) JavaFX**

It is used to develop rich internet applications. It uses a lightweight user interface API.

* There are three types of variables in java: local, instance and static.

**public** **class** A

{

**static** **int** m=100;//static variable

**void** method()

    {

**int** n=90;//local variable

    }

**public** **static** **void** main(String args[])

    {

**int** data=50;//instance variable

    }

}//end of class

//float =10.f

//int a=int(f); //float to int

* Byte -128 to 127
* byte is 4 times smaller than an integer
* short  -32,768 and maximum value is 32,767
* int - 2,147,483,648 (-2^31) to 2,147,483,647 (2^31 -1) (inclusive). Its minimum value is - 2,147,483,648
* long -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
* The float data type is a single-precision 32-bit IEEE 754 floating-point. Its value range is unlimited
* double data type is a double-precision 64-bit IEEE 754 floating point. Its value range is unlimited
* java uses Unicode system

## **Java Operators(8)**

|  |  |  |
| --- | --- | --- |
| **Operator Type** | **Category** | **Precedence** |
| Unary | postfix | expr++ expr-- |
| prefix | ++expr --expr +expr -expr ~ ! |
| Arithmetic | multiplicative | \* / % |
| additive | + - |
| Shift | shift | << >> >>> |
| Relational | comparison | < > <= >= instanceof |
| equality | == != |
| Bitwise | bitwise AND | & |
| bitwise exclusive OR | ^ |
| bitwise inclusive OR | | |
| Logical | logical AND | && |
| logical OR | || |
| Ternary | ternary | ? : |
| Assignment | assignment | = += -= \*= /= %= &= ^= |= <<= >>= >>>= |

1. **public** **class** OperatorExample{
2. **public** **static** **void** main(String args[]){
3. **int** a=10;
4. **int** b=-10;
5. **boolean** c=**true**;
6. **boolean** d=**false**;
7. System.out.println(~a);//-11 (minus of total positive value which starts from 0)
8. System.out.println(~b);//9 (positive of total minus, positive starts from 0)
9. System.out.println(!c);//false (opposite of boolean value)
10. System.out.println(!d);//true
11. }}

**Output:**

-11

9

false

true

Java Left Shift Operator Example

1. **public** **class** OperatorExample{
2. **public** **static** **void** main(String args[]){
3. System.out.println(10<<2);//10\*2^2=10\*4=40
4. System.out.println(10<<3);//10\*2^3=10\*8=80
5. System.out.println(20<<2);//20\*2^2=20\*4=80
6. System.out.println(15<<4);//15\*2^4=15\*16=240
7. }}

40

80

80

240

Java Right Shift Operator

The Java right shift operator >> is used to move the value of the left operand to right by the number of bits specified by the right operand.

Java Right Shift Operator Example

1. **public** OperatorExample{
2. **public** **static** **void** main(String args[]){
3. System.out.println(10>>2);//10/2^2=10/4=2
4. System.out.println(20>>2);//20/2^2=20/4=5
5. System.out.println(20>>3);//20/2^3=20/8=2
6. }}

**Output:**

2

5

2

1. **public** **class** OperatorExample{
2. **public** **static** **void** main(String args[]){
3. **int** x=10;
4. System.out.println(x++);//10 (11)
5. System.out.println(++x);//12
6. System.out.println(x--);//12 (11)
7. System.out.println(--x);//10
8. }}

**Output:**

10

12

12

10

Java Unary Operator Example 2: ++ and --

1. **public** **class** OperatorExample{
2. **public** **static** **void** main(String args[]){
3. **int** a=10;
4. **int** b=10;
5. System.out.println(a++ + ++a);//10+12=22
6. System.out.println(b++ + b++);//10+11=21
8. }}

**Output:**

22

21

Java Unary Operator Example: ~ and !

1. **public** **class** OperatorExample{
2. **public** **static** **void** main(String args[]){
3. **int** a=10;
4. **int** b=-10;
5. **boolean** c=**true**;
6. **boolean** d=**false**;
7. System.out.println(~a);//-11 (minus of total positive value which starts from 0)
8. System.out.println(~b);//9 (positive of total minus, positive starts from 0)
9. System.out.println(!c);//false (opposite of boolean value)
10. System.out.println(!d);//true
11. }}

**Output:**

-11

9

false

true

Java Assignment Operator Example

1. **public** **class** OperatorExample{
2. **public** **static** **void** main(String args[]){
3. **int** a=10;
4. **int** b=20;
5. a+=4;//a=a+4 (a=10+4)
6. b-=4;//b=b-4 (b=20-4)
7. System.out.println(a);
8. System.out.println(b);
9. }}

**Output:**

14

16

## **List of Java Keywords**

A list of Java keywords or reserved words are given below:

1. [**abstract**](https://www.javatpoint.com/abstract-keyword-in-java)**:** Java abstract keyword is used to declare an abstract class. An abstract class can provide the implementation of the interface. It can have abstract and non-abstract methods.
2. [**boolean:**](https://www.javatpoint.com/boolean-keyword-in-java) Java boolean keyword is used to declare a variable as a boolean type. It can hold True and False values only.
3. [**break**](https://www.javatpoint.com/java-break)**:** Java break keyword is used to break the loop or switch statement. It breaks the current flow of the program at specified conditions.
4. [**byte**](https://www.javatpoint.com/byte-keyword-in-java)**:** Java byte keyword is used to declare a variable that can hold 8-bit data values.
5. [**case**](https://www.javatpoint.com/case-keyword-in-java)**:** Java case keyword is used with the switch statements to mark blocks of text.
6. [**catch**](https://www.javatpoint.com/try-catch-block)**:** Java catch keyword is used to catch the exceptions generated by try statements. It must be used after the try block only.
7. [**char**](https://www.javatpoint.com/char-keyword-in-java)**:** Java char keyword is used to declare a variable that can hold unsigned 16-bit Unicode characters
8. [**class**](https://www.javatpoint.com/class-keyword-in-java)**:** Java class keyword is used to declare a class.
9. [**continue**](https://www.javatpoint.com/java-continue)**:** Java continue keyword is used to continue the loop. It continues the current flow of the program and skips the remaining code at the specified condition.
10. [**default**](https://www.javatpoint.com/default-keyword-in-java)**:** Java default keyword is used to specify the default block of code in a switch statement.
11. [**do**](https://www.javatpoint.com/java-do-while-loop)**:** Java do keyword is used in the control statement to declare a loop. It can iterate a part of the program several times.
12. [**double**](https://www.javatpoint.com/double-keyword-in-java)**:** Java double keyword is used to declare a variable that can hold 64-bit floating-point number.
13. [**else**](https://www.javatpoint.com/java-if-else)**:** Java else keyword is used to indicate the alternative branches in an if statement.
14. [**enum**](https://www.javatpoint.com/enum-in-java)**:** Java enum keyword is used to define a fixed set of constants. Enum constructors are always private or default.
15. [**extends**](https://www.javatpoint.com/inheritance-in-java)**:** Java extends keyword is used to indicate that a class is derived from another class or interface.
16. [**final**](https://www.javatpoint.com/final-keyword)**:** Java final keyword is used to indicate that a variable holds a constant value. It is used with a variable. It is used to restrict the user from updating the value of the variable.
17. [**finally**](https://www.javatpoint.com/finally-block-in-exception-handling)**:** Java finally keyword indicates a block of code in a try-catch structure. This block is always executed whether an exception is handled or not.
18. [**float**](https://www.javatpoint.com/float-keyword-in-java)**:** Java float keyword is used to declare a variable that can hold a 32-bit floating-point number.
19. [**for**](https://www.javatpoint.com/java-for-loop)**:** Java for keyword is used to start a for loop. It is used to execute a set of instructions/functions repeatedly when some condition becomes true. If the number of iteration is fixed, it is recommended to use for loop.
20. [**if**](https://www.javatpoint.com/java-if-else)**:** Java if keyword tests the condition. It executes the if block if the condition is true.
21. [**implements**](https://www.javatpoint.com/interface-in-java)**:** Java implements keyword is used to implement an interface.
22. [**import**](https://www.javatpoint.com/package)**:** Java import keyword makes classes and interfaces available and accessible to the current source code.
23. [**instanceof**](https://www.javatpoint.com/downcasting-with-instanceof-operator)**:** Java instanceof keyword is used to test whether the object is an instance of the specified class or implements an interface.
24. [**int**](https://www.javatpoint.com/int-keyword-in-java)**:** Java int keyword is used to declare a variable that can hold a 32-bit signed integer.
25. [**interface**](https://www.javatpoint.com/interface-in-java)**:** Java interface keyword is used to declare an interface. It can have only abstract methods.
26. [**long**](https://www.javatpoint.com/long-keyword-in-java)**:** Java long keyword is used to declare a variable that can hold a 64-bit integer.
27. **native:** Java native keyword is used to specify that a method is implemented in native code using JNI (Java Native Interface).
28. [**new**](https://www.javatpoint.com/new-keyword-in-java)**:** Java new keyword is used to create new objects.
29. [**null**](https://www.javatpoint.com/null-keyword-in-java)**:** Java null keyword is used to indicate that a reference does not refer to anything. It removes the garbage value.
30. [**package**](https://www.javatpoint.com/package)**:** Java package keyword is used to declare a Java package that includes the classes.
31. [**private**](https://www.javatpoint.com/private-keyword-in-java)**:** Java private keyword is an access modifier. It is used to indicate that a method or variable may be accessed only in the class in which it is declared.
32. [**protected**](https://www.javatpoint.com/protected-keyword-in-java)**:** Java protected keyword is an access modifier. It can be accessible within the package and outside the package but through inheritance only. It can't be applied with the class.
33. [**public**](https://www.javatpoint.com/public-keyword-in-java)**:** Java public keyword is an access modifier. It is used to indicate that an item is accessible anywhere. It has the widest scope among all other modifiers.
34. [**return**](https://www.javatpoint.com/return-keyword-in-java)**:** Java return keyword is used to return from a method when its execution is complete.
35. [**short**](https://www.javatpoint.com/short-keyword-in-java)**:** Java short keyword is used to declare a variable that can hold a 16-bit integer.
36. [**static**](https://www.javatpoint.com/static-keyword-in-java)**:** Java static keyword is used to indicate that a variable or method is a class method. The static keyword in Java is mainly used for memory management.
37. [**strictfp**](https://www.javatpoint.com/strictfp-keyword)**:** Java strictfp is used to restrict the floating-point calculations to ensure portability.
38. [**super**](https://www.javatpoint.com/super-keyword)**:** Java super keyword is a reference variable that is used to refer to parent class objects. It can be used to invoke the immediate parent class method.
39. [**switch**](https://www.javatpoint.com/java-switch)**:** The Java switch keyword contains a switch statement that executes code based on test value. The switch statement tests the equality of a variable against multiple values.
40. [**synchronized**](https://www.javatpoint.com/synchronization-in-java)**:** Java synchronized keyword is used to specify the critical sections or methods in multithreaded code.
41. [**this**](https://www.javatpoint.com/this-keyword)**:** Java this keyword can be used to refer the current object in a method or constructor.
42. [**throw**](https://www.javatpoint.com/throw-keyword)**:** The Java throw keyword is used to explicitly throw an exception. The throw keyword is mainly used to throw custom exceptions. It is followed by an instance.
43. [**throws**](https://www.javatpoint.com/throws-keyword-and-difference-between-throw-and-throws)**:** The Java throws keyword is used to declare an exception. Checked exceptions can be propagated with throws.
44. [**transient**](https://www.javatpoint.com/transient-keyword)**:** Java transient keyword is used in serialization. If you define any data member as transient, it will not be serialized.
45. [**try**](https://www.javatpoint.com/try-catch-block)**:** Java try keyword is used to start a block of code that will be tested for exceptions. The try block must be followed by either catch or finally block.
46. **void:** Java void keyword is used to specify that a method does not have a return value.
47. [**volatile**](https://www.javatpoint.com/volatile-keyword-in-java)**:** Java volatile keyword is used to indicate that a variable may change asynchronously.
48. [**while**](https://www.javatpoint.com/java-while-loop)**:** Java while keyword is used to start a while loop. This loop iterates a part of the program several times. If the number of iteration is not fixed, it is recommended to use the while loop.

Java provides three types of control flow statements.

1. Decision Making statements
   * if statements
   * switch statement
2. Loop statements
   * do while loop
   * while loop
   * for loop
   * for-each loop
3. Jump statements
   * break statement
   * continue statement

### Java do-while loop

The [do-while loop](https://www.javatpoint.com/java-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.

### TyVpes

### 1) Java Single Line Comment

The single-line comment is used to comment only one line of the code. It is the widely used and easiest way of commenting the statements.

Single line comments starts with two forward slashes **(//)**. Any text in front of // is not executed by Java.

Union in C language in Hindi

Keep Watching

**Syntax:**

1. //This is single line comment

Let's use single line comment in a Java program.

**CommentExample1.java**

1. **public** **class** CommentExample1 {
2. **public** **static** **void** main(String[] args) {
3. **int** i=10; // i is a variable with value 10
4. System.out.println(i);  //printing the variable i
5. }
6. }

**Output:**

10

### 2) Java Multi Line Comment

The multi-line comment is used to comment multiple lines of code. It can be used to explain a complex code snippet or to comment multiple lines of code at a time (as it will be difficult to use single-line comments there).

Multi-line comments are placed between /\* and \*/. Any text between /\* and \*/ is not executed by Java.

**Syntax:**

1. /\*
2. This
3. is
4. multi line
5. comment
6. \*/

Let's use multi-line comment in a Java program.

**CommentExample2.java**

1. **public** **class** CommentExample2 {
2. **public** **static** **void** main(String[] args) {
3. /\* Let's declare and
4. print variable in java. \*/
5. **int** i=10;
6. System.out.println(i);
7. /\* float j = 5.9;
8. float k = 4.4;
9. System.out.println( j + k ); \*/
10. }
11. }

**Output:**

10

#### **Note: Usually // is used for short comments and /\* \*/ is used for longer comments.**

### 3) Java Documentation Comment

Documentation comments are usually used to write large programs for a project or software application as it helps to create documentation API. These APIs are needed for reference, i.e., which classes, methods, arguments, etc., are used in the code.

To create documentation API, we need to use the [**javadoc tool**](https://www.javatpoint.com/creating-api-document). The documentation comments are placed between /\*\* and \*/.

**Syntax:**

1. /\*\*
2. \*
3. \*We can use various tags to depict the parameter
4. \*or heading or author name
5. \*We can also use HTML tags
6. \*
7. \*/



### What is the purpose of Constructor class?

Java provides a Constructor class which can be used to get the internal information of a constructor in the class. It is found in the java.lang.reflect package.



inheritance

1. **class** Animal{
2. **void** eat(){System.out.println("eating...");}
3. }
4. **class** Dog **extends** Animal{
5. **void** bark(){System.out.println("barking...");}
6. }
7. **class** TestInheritance{
8. **public** **static** **void** main(String args[]){
9. Dog d=**new** Dog();
10. d.bark();
11. d.eat();
12. }}

When use Aggregation?

* Code reuse is also best achieved by aggregation when there is no is-a relationship.
* Inheritance should be used only if the relationship is-a is maintained throughout the lifetime of the objects involved; otherwise, aggregation is the best choice.
* If a class have an entity reference, it is known as Aggregation. Aggregation represents HAS-A relationship.
* Consider a situation, Employee object contains many informations such as id, name, emailId etc. It contains one more object named address, which contains its own informations such as city, state, country, zipcode etc. as given below.

### Java String class methods

The java.lang.String class provides many useful methods to perform operations on sequence of char values.

|  |  |  |
| --- | --- | --- |
| **No.** | **Method** | **Description** |
| 1 | [char charAt(int index)](https://www.javatpoint.com/java-string-charat) | It returns char value for the particular index |
| 2 | [int length()](https://www.javatpoint.com/java-string-length) | It returns string length |
| 3 | [static String format(String format, Object... args)](https://www.javatpoint.com/java-string-format) | It returns a formatted string. |
| 4 | [static String format(Locale l, String format, Object... args)](https://www.javatpoint.com/java-string-format) | It returns formatted string with given locale. |
| 5 | [String substring(int beginIndex)](https://www.javatpoint.com/java-string-substring) | It returns substring for given begin index. |
| 6 | [String substring(int beginIndex, int endIndex)](https://www.javatpoint.com/java-string-substring) | It returns substring for given begin index and end index. |
| 7 | [boolean contains(CharSequence s)](https://www.javatpoint.com/java-string-contains) | It returns true or false after matching the sequence of char value. |
| 8 | [static String join(CharSequence delimiter, CharSequence... elements)](https://www.javatpoint.com/java-string-join) | It returns a joined string. |
| 9 | [static String join(CharSequence delimiter, Iterable<? extends CharSequence> elements)](https://www.javatpoint.com/java-string-join) | It returns a joined string. |
| 10 | [boolean equals(Object another)](https://www.javatpoint.com/java-string-equals) | It checks the equality of string with the given object. |
| 11 | [boolean isEmpty()](https://www.javatpoint.com/java-string-isempty) | It checks if string is empty. |
| 12 | [String concat(String str)](https://www.javatpoint.com/java-string-concat) | It concatenates the specified string. |
| 13 | [String replace(char old, char new)](https://www.javatpoint.com/java-string-replace) | It replaces all occurrences of the specified char value. |
| 14 | [String replace(CharSequence old, CharSequence new)](https://www.javatpoint.com/java-string-replace) | It replaces all occurrences of the specified CharSequence. |
| 15 | [static String equalsIgnoreCase(String another)](https://www.javatpoint.com/java-string-equalsignorecase) | It compares another string. It doesn't check case. |
| 16 | [String[] split(String regex)](https://www.javatpoint.com/java-string-split) | It returns a split string matching regex. |
| 17 | [String[] split(String regex, int limit)](https://www.javatpoint.com/java-string-split) | It returns a split string matching regex and limit. |
| 18 | [String intern()](https://www.javatpoint.com/java-string-intern) | It returns an interned string. |
| 19 | [int indexOf(int ch)](https://www.javatpoint.com/java-string-indexof) | It returns the specified char value index. |
| 20 | [int indexOf(int ch, int fromIndex)](https://www.javatpoint.com/java-string-indexof) | It returns the specified char value index starting with given index. |
| 21 | [int indexOf(String substring)](https://www.javatpoint.com/java-string-indexof) | It returns the specified substring index. |
| 22 | [int indexOf(String substring, int fromIndex)](https://www.javatpoint.com/java-string-indexof) | It returns the specified substring index starting with given index. |
| 23 | [String toLowerCase()](https://www.javatpoint.com/java-string-tolowercase) | It returns a string in lowercase. |
| 24 | [String toLowerCase(Locale l)](https://www.javatpoint.com/java-string-tolowercase) | It returns a string in lowercase using specified locale. |
| 25 | [String toUpperCase()](https://www.javatpoint.com/java-string-touppercase) | It returns a string in uppercase. |
| 26 | [String toUpperCase(Locale l)](https://www.javatpoint.com/java-string-touppercase) | It returns a string in uppercase using specified locale. |
| 27 | [String trim()](https://www.javatpoint.com/java-string-trim) | It removes beginning and ending spaces of this string. |
| 28 | [static String valueOf(int value)](https://www.javatpoint.com/java-string-valueof) | It converts given type into string. It is an overloaded method. |

**TestStringConcatenation2.java**

1. **class** TestStringConcatenation2{
2. **public** **static** **void** main(String args[]){
3. String s=50+30+"Sachin"+40+40;
4. System.out.println(s);//80Sachin4040
5. }
6. }

**[Test it Now](https://www.javatpoint.com/opr/test.jsp?filename=TestStringConcatenation2" \t "_blank)**

**Output:**

80Sachin4040

# **Java Regex**

The **Java Regex** or Regular Expression is an API to define a pattern for searching or manipulating strings.

It is widely used to define the constraint on strings such as password and email validation. After learning Java regex tutorial, you will be able to test your regular expressions by the Java Regex Tester Tool.

Java Regex API provides 1 interface and 3 classes in **java.util.regex** package.

#### **java.util.regex package**

## **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 **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.

## **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

|  |  |
| --- | --- |
| **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. |



## **ifference 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.

1. **import** java.io.FileNotFoundException;
2. **import** java.io.PrintWriter;
4. **public** **class** TryCatchExample10 {
6. **public** **static** **void** main(String[] args) {

9. PrintWriter pw;
10. **try** {
11. pw = **new** PrintWriter("jtp.txt"); //may throw exception
12. pw.println("saved");
13. }
14. // providing the checked exception handler
15. **catch** (FileNotFoundException e) {
17. System.out.println(e);
18. }
19. System.out.println("File saved successfully");
20. }
21. }

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| --- | --- | --- | --- | --- |
| **Sr. no.** | **Key** | **final** | **finally** | **finalize** |
| 1. | Definition | final is the keyword and access modifier which is used to apply restrictions on a class, method or variable. | finally is the block in Java Exception Handling to execute the important code whether the exception occurs or not. | finalize is the method in Java which is used to perform clean up processing just before object is garbage collected. |
| 2. | Applicable to | Final keyword is used with the classes, methods and variables. | Finally block is always related to the try and catch block in exception handling. | finalize() method is used with the objects. |
| 3. | Functionality | (1) Once declared, final variable becomes constant and cannot be modified. (2) final method cannot be overridden by sub class. (3) final class cannot be inherited. | (1) finally block runs the important code even if exception occurs or not. (2) finally block cleans up all the resources used in try block | finalize method performs the cleaning activities with respect to the object before its destruction. |
| 4. | Execution | Final method is executed only when we call it. | Finally block is executed as soon as the try-catch block is executed.  It's execution is not dependant on the exception. | finalize method is executed just before the object is destroyed. |

### Types of Nested classes

There are two types of nested classes non-static and static nested classes. The non-static nested classes are also known as inner classes.

* Non-static nested class (inner class)
  1. Member inner class
  2. Anonymous inner class
  3. Local inner class
* Static nested class

|  |  |
| --- | --- |
| **Type** | **Description** |
| [Member Inner Class](https://www.javatpoint.com/member-inner-class) | A class created within class and outside method. |
| [Anonymous Inner Class](https://www.javatpoint.com/anonymous-inner-class) | A class created for implementing an interface or extending class. The java compiler decides its name. |
| [Local Inner Class](https://www.javatpoint.com/local-inner-class) | A class was created within the method. |
| [Static Nested Class](https://www.javatpoint.com/static-nested-class) | A static class was created within the class. |
| [Nested Interface](https://www.javatpoint.com/nested-interface) | An interface created within class or interface. |

## **Multitasking**

Multitasking is a process of executing multiple tasks simultaneously. We use multitasking to utilize the CPU. Multitasking can be achieved in two ways:

* Process-based Multitasking (Multiprocessing)
* Thread-based Multitasking (Multithreading)

### ) Process-based Multitasking (Multiprocessing)

* Each process has an address in memory. In other words, each process allocates a separate memory area.
* A process is heavyweight.
* Cost of communication between the process is high.
* Switching from one process to another requires some time for saving and loading [registers](https://www.javatpoint.com/register-memory), memory maps, updating lists, etc.

### 2) Thread-based Multitasking (Multithreading)

* Threads share the same address space.
* A thread is lightweight.
* Cost of communication between the thread is low.

#### **Note: At least one process is required for each thread.**

## **Java Thread Methods**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.N.** | **Modifier and Type** | **Method** | **Description** |
| 1) | void | [start()](https://www.javatpoint.com/java-thread-start-method) | It is used to start the execution of the thread. |
| 2) | void | [run()](https://www.javatpoint.com/java-thread-run-method) | It is used to do an action for a thread. |
| 3) | static void | [sleep()](https://www.javatpoint.com/java-thread-sleep-method) | It sleeps a thread for the specified amount of time. |
| 4) | static Thread | [currentThread()](https://www.javatpoint.com/java-thread-currentthread-method) | It returns a reference to the currently executing thread object. |
| 5) | void | [join()](https://www.javatpoint.com/java-thread-join-method) | It waits for a thread to die. |
| 6) | int | [getPriority()](https://www.javatpoint.com/java-thread-getpriority-method) | It returns the priority of the thread. |
| 7) | void | [setPriority()](https://www.javatpoint.com/java-thread-setpriority-method) | It changes the priority of the thread. |
| 8) | String | [getName()](https://www.javatpoint.com/java-thread-getname-method) | It returns the name of the thread. |
| 9) | void | [setName()](https://www.javatpoint.com/java-thread-setname-method) | It changes the name of the thread. |
| 10) | long | [getId()](https://www.javatpoint.com/java-thread-getid-method) | It returns the id of the thread. |
| 11) | boolean | [isAlive()](https://www.javatpoint.com/java-thread-isalive-method) | It tests if the thread is alive. |
| 12) | static void | [yield()](https://www.javatpoint.com/java-thread-yield-method) | It causes the currently executing thread object to pause and allow other threads to execute temporarily. |
| 13) | void | [suspend()](https://www.javatpoint.com/java-thread-suspend-method) | It is used to suspend the thread. |
| 14) | void | [resume()](https://www.javatpoint.com/java-thread-resume-method) | It is used to resume the suspended thread. |
| 15) | void | [stop()](https://www.javatpoint.com/java-thread-stop-method) | It is used to stop the thread. |
| 16) | void | [destroy()](https://www.javatpoint.com/java-thread-destroy-method) | It is used to destroy the thread group and all of its subgroups. |
| 17) | boolean | [isDaemon()](https://www.javatpoint.com/java-thread-isdaemon-method) | It tests if the thread is a daemon thread. |
| 18) | void | [setDaemon()](https://www.javatpoint.com/java-thread-setdaemon-method) | It marks the thread as daemon or user thread. |
| 19) | void | [interrupt()](https://www.javatpoint.com/java-thread-interrupt-method) | It interrupts the thread. |
| 20) | boolean | [isinterrupted()](https://www.javatpoint.com/java-thread-isinterrupted-method) | It tests whether the thread has been interrupted. |
| 21) | static boolean | [interrupted()](https://www.javatpoint.com/java-thread-interrupted-method) | It tests whether the current thread has been interrupted. |
| 22) | static int | [activeCount()](https://www.javatpoint.com/java-thread-activecount-method) | It returns the number of active threads in the current thread's thread group. |
| 23) | void | [checkAccess()](https://www.javatpoint.com/java-thread-checkaccess-method) | It determines if the currently running thread has permission to modify the thread. |
| 24) | static boolean | [holdLock()](https://www.javatpoint.com/java-thread-holdlock-method) | It returns true if and only if the current thread holds the monitor lock on the specified object. |
| 25) | static void | [dumpStack()](https://www.javatpoint.com/java-thread-dumpstack-method) | It is used to print a stack trace of the current thread to the standard error stream. |
| 26) | StackTraceElement[] | [getStackTrace()](https://www.javatpoint.com/java-thread-getstacktrace-method) | It returns an array of stack trace elements representing the stack dump of the thread. |
| 27) | static int | [enumerate()](https://www.javatpoint.com/java-thread-enumerate-method) | It is used to copy every active thread's thread group and its subgroup into the specified array. |
| 28) | Thread.State | [getState()](https://www.javatpoint.com/java-thread-getstate-method) | It is used to return the state of the thread. |
| 29) | ThreadGroup | [getThreadGroup()](https://www.javatpoint.com/java-thread-getthreadgroup-method) | It is used to return the thread group to which this thread belongs |
| 30) | String | [toString()](https://www.javatpoint.com/java-thread-tostring-method) | It is used to return a string representation of this thread, including the thread's name, priority, and thread group. |
| 31) | void | [notify()](https://www.javatpoint.com/java-thread-notify-method) | It is used to give the notification for only one thread which is waiting for a particular object. |
| 32) | void | [notifyAll()](https://www.javatpoint.com/java-thread-notifyall-method) | It is used to give the notification to all waiting threads of a particular object. |
| 33) | void | [setContextClassLoader()](https://www.javatpoint.com/java-thread-setcontextclassloader-method) | It sets the context ClassLoader for the Thread. |
| 34) | ClassLoader | [getContextClassLoader()](https://www.javatpoint.com/java-thread-getcontextclassloader-method) | It returns the context ClassLoader for the thread. |
| 35) | static Thread.UncaughtExceptionHandler | [getDefaultUncaughtExceptionHandler()](https://www.javatpoint.com/java-thread-getdefaultuncaughtexceptionhandler-method) | It returns the default handler invoked when a thread abruptly terminates due to an uncaught exception. |
| 36) | static void | [setDefaultUncaughtExceptionHandler()](https://www.javatpoint.com/java-thread-setdefaultuncaughtexceptionhandler-method) | It sets the default handler invoked when a thread abruptly terminates due to an uncaught exception. |

# **Life cycle of a Thread (Thread States)**

In Java, a thread always exists in any one of the following states. These states are:

1. New
2. Active
3. Blocked / Waiting
4. Timed Waiting
5. Terminated

## **Implementation of Thread States**

In Java, one can get the current state of a thread using the **Thread.getState()** method. The **java.lang.Thread.State** class of Java provides the constants ENUM to represent the state of a thread. These constants are:

1. **public** **static** **final** Thread.State NEW