**JAVA**

What is Java?

Java is a **programming language** and a **platform**. Java is a high level, robust, object-oriented and secure programming language.

Java was developed by *Sun Microsystems* (which is now the subsidiary of Oracle) in the year 1995. *James Gosling* is known as the father of Java. Before Java, its name was *Oak*. Since Oak was already a registered company, so James Gosling and his team changed the name from Oak to Java.

**Platform**: Any hardware or software environment in which a program runs, is known as a platform. Since Java has a runtime environment (JRE) and API, it is called a platform.

## Java Example

Let's have a quick look at Java programming example. A detailed description of Hello Java example is available in next page.

**Simple.java**

1. **class** Simple{
2. **public** **static** **void** main(String args[]){
3. System.out.println("Hello Java");
4. }
5. }

## Application

According to Sun, 3 billion devices run Java. There are many devices where Java is currently used. Some of them are as follows:

1. Desktop Applications such as acrobat reader, media player, antivirus, etc.
2. Web Applications such as irctc.co.in, javatpoint.com, etc.
3. Enterprise Applications such as banking applications.
4. Mobile
5. Embedded System
6. Smart Card
7. Robotics
8. Games, etc.

## Types of Java Applications

There are mainly 4 types of applications that can be created using Java programming:

#### **1) Standalone Application**

Standalone applications are also known as desktop applications or window-based applications. These are traditional software that we need to install on every machine. Examples of standalone application are Media player, antivirus, etc. AWT and Swing are used in Java for creating standalone applications.

#### **2) Web Application**

An application that runs on the server side and creates a dynamic page is called a web application. Currently, [Servlet](https://www.javatpoint.com/servlet-tutorial)

, [JSP](https://www.javatpoint.com/jsp-tutorial)

, [Struts](https://www.javatpoint.com/struts-2-tutorial)

, [Spring](https://www.javatpoint.com/spring-tutorial)

, [Hibernate](https://www.javatpoint.com/hibernate-tutorial)

, [JSF](https://www.javatpoint.com/jsf-tutorial)

, etc. technologies are used for creating web applications in Java.

#### **3) Enterprise Application**

An application that is distributed in nature, such as banking applications, etc. is called an enterprise application. It has advantages like high-level security, load balancing, and clustering. In Java, [EJB](https://www.javatpoint.com/ejb-tutorial)

is used for creating enterprise applications.

#### **4) Mobile Application**

An application which is created for mobile devices is called a mobile application. Currently, Android and Java ME are used for creating mobile applications.

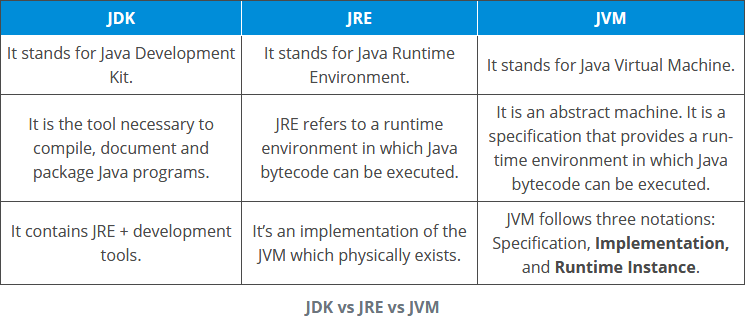
# **Features of Java**

The primary objective of [Java programming](https://www.javatpoint.com/java-tutorial) language creation was to make it portable, simple and secure programming language. Apart from this, there are also some excellent features which play an important role in the popularity of this language. The features of Java are also known as Java buzzwords.

A list of the most important features of the Java language is given below.

1. [Simple](https://www.javatpoint.com/features-of-java#Simple)
2. [Object-Oriented](https://www.javatpoint.com/features-of-java#Object-Oriented)
3. [Portable](https://www.javatpoint.com/features-of-java#Portable)
4. [Platform independent](https://www.javatpoint.com/features-of-java#Platform-independent)
5. [Secured](https://www.javatpoint.com/features-of-java#Secured)
6. [Robust](https://www.javatpoint.com/features-of-java#Robust)
7. [Architecture neutral](https://www.javatpoint.com/features-of-java#Architecture-neutral)
8. [Interpreted](https://www.javatpoint.com/features-of-java#Interpreted)
9. [High Performance](https://www.javatpoint.com/features-of-java#High-Performance)
10. [Multithreaded](https://www.javatpoint.com/features-of-java#Multithreaded)
11. [Distributed](https://www.javatpoint.com/features-of-java#Distributed)
12. [Dynamic](https://www.javatpoint.com/features-of-java#Dynamic)

# **JDK, JRE, and JVM**



## Variable

A variable is the name of a reserved area allocated in memory. In other words, it is a name of the memory location. It is a combination of "vary + able" which means its value can be changed.

### **Types of Variables**

There are three types of variables in [Java](https://www.javatpoint.com/java-tutorial):

* local variable
* instance variable
* static variable

#### **1) Local Variable**

A variable declared inside the body of the method is called local variable. You can use this variable only within that method and the other methods in the class aren't even aware that the variable exists.

A local variable cannot be defined with "static" keyword.

#### **2) Instance Variable**

A variable declared inside the class but outside the body of the method, is called an instance variable. It is not declared as [static](https://www.javatpoint.com/static-keyword-in-java).

It is called an instance variable because its value is instance-specific and is not shared among instances.

#### **3) Static variable**

A variable that is declared as static is called a static variable. It cannot be local. You can create a single copy of the static variable and share it among all the instances of the class. Memory allocation for static variables happens only once when the class is loaded in the memory.

# **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](https://www.javatpoint.com/object-and-class-in-java), [Interfaces](https://www.javatpoint.com/interface-in-java), and [Arrays](https://www.javatpoint.com/array-in-java).

**Primitive data types** T:

here are 8 types of primitive data types:

|  |  |  |
| --- | --- | --- |
| **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 |

# **Operators in Java**

**Operator** in [Java](https://www.javatpoint.com/java-tutorial) is a symbol that is used to perform operations. For example: +, -, \*, / etc.

There are many types of operators in Java which are given below:

* Unary Operator,
* Arithmetic Operator,
* Shift Operator,
* Relational Operator,
* Bitwise Operator,
* Logical Operator,
* Ternary Operator and
* Assignment Operator.
* Java Operator Precedence

|  |  |  |
| --- | --- | --- |
| **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 | = += -= \*= /= %= &= ^= |= <<= >>= >>>= |

# **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](https://www.javatpoint.com/java-tutorial) 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.

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

## OOPs (Object-Oriented Programming System)

**Object** means a real-world entity such as a pen, chair, table, computer, watch, etc. **Object-Oriented Programming** is a methodology or paradigm to design a program using classes and objects. It simplifies software development and maintenance by providing some concepts:

* [Object](https://www.javatpoint.com/object-and-class-in-java)
* Class
* [Inheritance](https://www.javatpoint.com/inheritance-in-java)
* [Polymorphism](https://www.javatpoint.com/runtime-polymorphism-in-java)
* [Abstraction](https://www.javatpoint.com/abstract-class-in-java)
* [Encapsulation](https://www.javatpoint.com/encapsulation)
* Object
* Any entity that has state and behavior is known as an object. For example, a chair, pen, table, keyboard, bike, etc. It can be physical or logical.
* An Object can be defined as an instance of a class. An object contains an address and takes up some space in memory. Objects can communicate without knowing the details of each other's data or code. The only necessary thing is the type of message accepted and the type of response returned by the objects.
* **Example:** A dog is an object because it has states like color, name, breed, etc. as well as behaviors like wagging the tail, barking, eating, etc.
* Class
* *Collection of objects* is called class. It is a logical entity.
* A class can also be defined as a blueprint from which you can create an individual object. Class doesn't consume any space.

### **Inheritance**

When one object acquires all the properties and behaviors of a parent object, it is known as inheritance. It provides code reusability. It is used to achieve runtime polymorphism.

### **Polymorphism**

If one task is performed in different ways, it is known as polymorphism. For example: to convince the customer differently, to draw something, for example, shape, triangle, rectangle, etc.

In Java, we use method overloading and method overriding to achieve polymorphism.

Another example can be to speak something; for example, a cat speaks meow, dog barks woof, etc.

#### **Abstraction**

Hiding internal details and showing functionality is known as abstraction. For example phone call, we don't know the internal processing.

In Java, we use abstract class and interface to achieve abstraction.

### **Encapsulation**

Binding (or wrapping) code and data together into a single unit are known as encapsulation. For example, a capsule, it is wrapped with different medicines.

A java class is the example of encapsulation. Java bean is the fully encapsulated class because all the data members are private here.

## Advantage of OOPs over Procedure-oriented programming language

1) OOPs makes development and maintenance easier, whereas, in a procedure-oriented programming language, it is not easy to manage if code grows as project size increases.

2) OOPs provides data hiding, whereas, in a procedure-oriented programming language, global data can be accessed from anywhere.

# **Method in Java**

In general, a **method** is a way to perform some task. Similarly, the **method in Java** is a collection of instructions that performs a specific task. It provides the reusability of code. We can also easily modify code using **methods**. In this section, we will learn **what is a method in Java, types of methods, method declaration,** and **how to call a method in Java**.

## What is a method in Java?

A **method** is a block of code or collection of statements or a set of code grouped together to perform a certain task or operation. It is used to achieve the **reusability** of code. We write a method once and use it many times. We do not require to write code again and again. It also provides the **easy modification** and **readability** of code, just by adding or removing a chunk of code. The method is executed only when we call or invoke it.

The most important method in Java is the **main()** method. If you want to read more about the main() method.

**Access Specifier:** Access specifier or modifier is the access type of the method. It specifies the visibility of the method. Java provides **four** types of access specifier:

* **Public:** The method is accessible by all classes when we use public specifier in our application.
* **Private:** When we use a private access specifier, the method is accessible only in the classes in which it is defined.
* **Protected:** When we use protected access specifier, the method is accessible within the same package or subclasses in a different package.
* **Default:** When we do not use any access specifier in the method declaration, Java uses default access specifier by default. It is visible only from the same package only.

## Types of Method

There are two types of methods in Java:

* Predefined Method
* User-defined Method

# **Constructors in Java**

In [Java](https://www.javatpoint.com/java-tutorial), a constructor is a block of codes similar to the method. It is called when an instance of the [class](https://www.javatpoint.com/object-and-class-in-java) 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.

### **Rules for creating Java constructor**

There are two rules defined for the constructor.

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

## 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>(){}

The default constructor is used to provide the default values to the object like 0, null, etc., depending on the type.

### **Java Parameterized Constructor**

A constructor which has a specific number of parameters is called a parameterized constructor.

### **Why use the parameterized constructor?**

The parameterized constructor is used to provide different values to distinct objects. However, you can provide the same values also.

# **Java static keyword**

The **static keyword** in [Java](https://www.javatpoint.com/java-tutorial) is used for memory management mainly. We can apply static keyword with [variables](https://www.javatpoint.com/java-variables), methods, blocks and [nested classes](https://www.javatpoint.com/java-inner-class). The static keyword belongs to the class than an instance of the class.

The static can be:

1. Variable (also known as a class variable)
2. Method (also known as a class method)
3. Block
4. Nested class

# **this keyword in Java**

There can be a lot of usage of **Java this keyword**. In Java, this is a **reference variable** that refers to the current object.

Usage of Java this keyword

Here is given the 6 usage of java this keyword.

this can be used to refer current class instance variable.

this can be used to invoke current class method (implicitly)

this() can be used to invoke current class constructor.

this can be passed as an argument in the method call.

this can be passed as argument in the constructor call.

# **Inheritance in Java**

**Inheritance in Java** is a mechanism in which one object acquires all the properties and behaviors of a parent object. It is an important part of [OOPs](https://www.javatpoint.com/java-oops-concepts) (Object Oriented programming system).

The idea behind inheritance in Java is that you can create new [classes](https://www.javatpoint.com/object-and-class-in-java) that are built upon existing classes. When you inherit from an existing class, you can reuse methods and fields of the parent class. Moreover, you can add new methods and fields in your current class also.

Inheritance represents the **IS-A relationship** which is also known as a parent-child relationship.

### **Why use inheritance in java**

* For [Method Overriding](https://www.javatpoint.com/method-overriding-in-java) (so [runtime polymorphism](https://www.javatpoint.com/runtime-polymorphism-in-java) can be achieved).
* For Code Reusability.

## Types of inheritance in java

On the basis of class, there can be three types of inheritance in java: single, multilevel and hierarchical.

# **Difference between abstract class and interface**

Abstract class and interface both are used to achieve abstraction where we can declare the abstract methods. Abstract class and interface both can't be instantiated.

But there are many differences between abstract class and interface that are given below.

|  |  |
| --- | --- |
| **Abstract class** | **Interface** |
| 1) Abstract class can **have abstract and non-abstract** methods. | Interface can have **only abstract** methods. Since Java 8, it can have **default and static methods** also. |
| 2) Abstract class **doesn't support multiple inheritance**. | Interface **supports multiple inheritance**. |
| 3) Abstract class **can have final, non-final, static and non-static variables**. | Interface has **only static and final variables**. |
| 4) Abstract class **can provide the implementation of interface**. | Interface **can't provide the implementation of abstract class**. |
| 5) The **abstract keyword** is used to declare abstract class. | The **interface keyword** is used to declare interface. |
| 6) An **abstract class** can extend another Java class and implement multiple Java interfaces. | An **interface** can extend another Java interface only. |
| 7) An **abstract class** can be extended using keyword "extends". | An **interface** can be implemented using keyword "implements". |
| 8) A Java **abstract class** can have class members like private, protected, etc. | Members of a Java interface are public by default. |
| 9)**Example:** public abstract class Shape{ public abstract void draw(); } | **Example:** public interface Drawable{ void draw(); |

# **Java Package**

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

Package in java can be categorized in two form, built-in package and user-defined package.

There are many built-in packages such as java, lang, awt, javax, swing, net, io, util, sql etc.

## Advantage of Java Package

1) Java package is used to categorize the classes and interfaces so that they can be easily maintained.

2) Java package provides access protection.

3) Java package removes naming collision.

# **Java Arrays**

Normally, an array is a collection of similar type of elements which has contiguous memory location.

**Java array** is an object which contains elements of a similar data type. Additionally, The elements of an array are stored in a contiguous memory location. It is a data structure where we store similar elements. We can store only a fixed set of elements in a Java array

### **Types of Array in java**

There are two types of array.

* Single Dimensional Array
* Multidimensional Array

# **Java String**

In [Java](https://www.javatpoint.com/java-tutorial), string is basically an object that represents sequence of char values. An [array](https://www.javatpoint.com/array-in-java) of characters works same as Java string. For example:

1. **char**[] ch={'j','a','v','a','t','p','o','i','n','t'};
2. String s=**new** String(ch);

is same as:

1. String s="javatpoint";

**Java String** class provides a lot of methods to perform operations on strings such as compare(), concat(), equals(), split(), length(), replace(), compareTo(), intern(), substring() etc.

Generally, String is a sequence of characters. But in Java, string is an object that represents a sequence of characters. The java.lang.String class is used to create a string object.

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

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.

### **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
4. Java Exception Keywords
5. 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. |

# **Collections in Java**

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](https://www.javatpoint.com/java-arraylist), Vector, [LinkedList](https://www.javatpoint.com/java-linkedlist), [PriorityQueue](https://www.javatpoint.com/java-priorityqueue), HashSet, LinkedHashSet, TreeSet).

#### **What is Collection in Java**

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

# **Java JDBC Tutorial**

JDBC stands for Java Database Connectivity. JDBC is a Java API to connect and execute the query with the database. It is a part of JavaSE (Java Standard Edition). JDBC API uses JDBC drivers to connect with the database. There are four types of JDBC drivers:

* JDBC-ODBC Bridge Driver,
* Native Driver,
* Network Protocol Driver, and
* Thin Driver

The **java.sql** package contains classes and interfaces for JDBC API.

# **Java Database Connectivity with 5 Steps**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| There are 5 steps to connect any java application with the database using JDBC. These steps are as follows:   * Register the Driver class * Create connection * Create statement * Execute queries * Close connection  **1) Register the driver class**  |  |  |  |  |  | | --- | --- | --- | --- | --- | | The **forName()** method of Class class is used to register the driver class. This method is used to dynamically load the driver class.  Class.forName("oracle.jdbc.driver.OracleDriver"); **2) Create the connection object**  |  | | --- | | The **getConnection()** method of DriverManager class is used to establish connection with the database. |  **Syntax of getConnection() method**  1. 1) **public** **static** Connection getConnection(String url)**throws** SQLException 2. 2) **public** **static** Connection getConnection(String url,String name,String password) 3. **throws** SQLException  **Example to establish connection with the Oracle database**  1. Connection con=DriverManager.getConnection( 2. "jdbc:oracle:thin:@localhost:1521:xe","system","password");  **3) Create the Statement object**  |  | | --- | | The createStatement() method of Connection interface is used to create statement. The object of statement is responsible to execute queries with the database. |  **Syntax of createStatement() method**  1. **public** Statement createStatement()**throws** SQLException  **Example to create the statement object**  1. Statement stmt=con.createStatement();  **4) Execute the query**  |  | | --- | | The executeQuery() method of Statement interface is used to execute queries to the database. This method returns the object of ResultSet that can be used to get all the records of a table. |  **Syntax of executeQuery() method**  1. **public** ResultSet executeQuery(String sql)**throws** SQLException  **Example to execute query**  1. ResultSet rs=stmt.executeQuery("select \* from emp"); 3. **while**(rs.next()){ 4. System.out.println(rs.getInt(1)+" "+rs.getString(2)); 5. }  **5) Close the connection object**  |  | | --- | | By closing connection object statement and ResultSet will be closed automatically. The close() method of Connection interface is used to close the connection. |  **Syntax of close() method**  1. **public** **void** close()**throws** SQLException  **Example to close connection**  1. con.close(); | |