**Introduction to Software**

Software is collections of programs such as C , C++ , Java, SQL and other programs.

Software basically two categories:

|  |  |
| --- | --- |
| **Software** | |
| **System software** | **Application Software** |
| it interacts with hardware components  Eg:  Device drivers and Operating systems | for the purpose of application development  Eg:  C, C++, Java, .Net , ERP package and others |

**Device Drivers:**

These are programs to communicate with hardware components

Every deice device has it’s own drivers.

Device drivers are supplied by hardware vendors

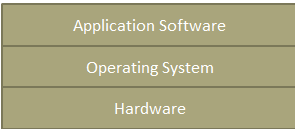
Eg: printer driver, network drivers

**Operating System:**

It is an interface between hardware and application software.

It is a platform where we can run the application software.

Every Operating has its own libraries to communicate between Application software and Hardware components.



Operating Systems are basically two categories

:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Operating Systems** | | | | |
| **Character user interface ( CUI )**  It is command line user interface, where user issues commands | | | **Graphical User Interface ( GUI )**  Here users working with folder and files ICONS | |
| **Single user Operating system** | **Multiuser Operating systems** | | **Single user Operating system** | **Multiuser Operating systems** |
| Only user can use this type of operating system  It is a standalone operating system  Files or data cannot be shred | Multiple users can use this operating system.  It is a server. It works in network  Files and data can be shared by multiple clients. | | Eg:  Win95, Win98 | Eg:  WinNT, Win2000, WinXP, Win2003, Win7,8 and10  LINUX and Solaris |
| Eg:  MS-DOS ( Microsoft Disk Operating System) | Eg: UNIX, LINUX, SOLARIS, IBM-AIX, HP-UX.  The operating systems .  LINUX, SOLARIS, IBM-AIX, HP-UX, are flavours’ of LINUX O/S | |  |  |
| **Application Software** | | | | |
| **Front End Software** | | **Back End Software** | | |
| These are to interacts with end users  Eg:  Languages, Packages ERPs | | These are used to store the data  Eg:  Databases and files | | |

|  |  |
| --- | --- |
| **Front End Software** | |
| **Languages** | **Packages** |
| Programmer has to write coding.  Complexity in development of application  Eg:  C, C++, JAVA, HTML, .Net | Here Developer can use built-in options  Easy to develop the applications  MS-Office, ERP packages, Tally Accounting package |

|  |  |
| --- | --- |
| **Languages** | |
| **Low Level Languages** | **High Level Languages** |
| These are machine ( processor ) understandable languages  Eg:  Machine Language (IGL ) and  Assembly Language (II GL )  Assembly language in the form of pneumonic codes  Assembler converts assembly language into machine language | These are user understandable languages  These are looks likes English language  Easy to understand.  III GL and IV GL are high level languages |

**Generation of Languages**

|  |  |  |
| --- | --- | --- |
| Low Level Languages | I GL | Machine Language , It is in form of binary code ( 0 1 0 1 1 0 1 1 0) |
| II GL | Assembly Language in form of pneumonic codes  Assembler coverts assembly language into binary code |
| High Level Languages | III GL | ( procedure oriented languages ) Cobol, Pascal, Basic, FORTRAN |
| IV GL | ( functional, OOP, Object Based languages ) C, C++, Java, . Net |

Procedure and Function, both are set of statements to perform some task,

The difference is that, **function** returns a value whereas **procedure** does not return a value.

Compliers and interpreters are used to convert high level languages into low level language ( processor understandable language )

**Difference between compiler and interpreter**

|  |  |  |
| --- | --- | --- |
| **S.No** | **Interpreter** | **Compiler** |
| 1 | It interprets line by line and executes | Whole program at a time |
| 2 | It gives the result line by line | It gives whole output at a time |
| 3 | If any error occurs interpreter stops  Hence it shows only one error | It checks all statements in the program and shows all the errors in the program. |
| 4 | It will not generate executable file | If errors in the program then it generates executable file |
| 5 | It always executes only source code | It executes exe file |
| 6 | Eg: all scripting languages such as HTML, PERL, Java Script | Eg: C, C++ and .Net C# |

**Introduction to JAVA**

**Features of Java :**

1) It is an independent of platform.

2) It is a portable ( write once run any where )

3) It is a scalable language.

4) It provides security for local resources.

5) Object Oriented Programming language

Platform:

Any hardware or software environment in which a program runs is known as a platform.

Since Java has its own runtime environment (JRE) and API, it is called platform.

JVM is the responsible to make java application as independent of platform and portable

1) It is an independent of platform

Java application runs any operating system and any Hardware

2) It is a portable ( write once run any where )

Java application can be moved any platform with any changes to current application

3) It is a scalable language

Easy to use without disturbing the existing java functionality

4) It provides security for local resources.

JVM has Security Manger which is responsible to prevent java application to access your private information in your PC.

5) Object Oriented Programming language

In java every transaction handled by object, without object we cannot perform any transactions, hence it is called as Object Oriented Programing ( OOP ) language.

**What is java ?**

Java is compile as well as Interpreter based.

Java compiler coverts source code into byte code file

Java Interpreter converts byte code into binary as per the Operating system and Hardware.

**What is an exe file ?**

Exe file contains binary code,

It is a file with actual program code, application software library, and OS library and hardware information

Exe file is OS dependent as it contains OS library

Exe file is prepared file for specific operating system.

Eg:

Any exe file prepared on windows will not execute on Linux and vice versa

Java byte code files not an exe file.

**Java Editions:**

There are Four Editions in java :

1. **Java SE = Standard Edition**

This is the core Java programming platform. It contains all of the libraries and APIs that any Java programmer should learn (java.lang, java.io, java.math, java.net, java.util, etc...).

1. **Java EE = Enterprise Edition**

It is platform, collection of services. We can develop Web applications and Enterprise applications.

1. **Java ME = Micro Edition / Mobile Edition**

This is the platform for developing applications for mobile devices and embedded systems such as set-top boxes. Java ME provides a subset of the functionality of Java SE, but also introduces libraries specific to mobile devices.

**4 Java FX:**

JavaFX is a Java library used to build Rich Internet Applications ( IoT, Internet of Things ) The applications written using this library can run consistently across multiple platforms. The applications developed using JavaFX can run on various devices such as Desktop Computers, Mobile Phones, TVs, Tablets, etc..

JavaFX, Java programmers can now develop GUI applications effectively with rich content.

**JSE Features:**

1) Object-oriented programming language.

2) Java supports exception Handling

3) File I/O transactions

4) Collections

5) Strings and String Buffer Handling.

6) JDBC ( Java Data Base Connectivity ) to data base applications.

7) Networking

8) Multi-threading

9) Applets for Web applications -- >It was outdated concept.

10) AWT ( Abstract Windowing Tool Kit ) for GUI Applications --> It was outdated concept.

**JEE Features :-**

It is a collections Services such as

1) Servlets

2) JSP

3) RMI ( Remote Method Invocation )

4) EJB ( Enterprise Java Beans )

5) Java Mail API

6) Java Message Service

7) Java Naming and Directory Interface ( JNDI )

8) JTA ( Java Transaction API )

9) XML Parser

10) Web Services

11) Restful Services

**JEE Provides Below Frameworks**

1) Struts Framework

2) Spring Framework

3) Hibernate Framework.

4) Angular JS

5) Node JS

6) Node 2

7) Hadoop Frame work

**Types of Java Applications**

There are mainly 6 types of applications that can be created using java programming:

**1) Standalone Application ( single – tier )**

In this applications, data and application both resides in same memory space.

Eg:

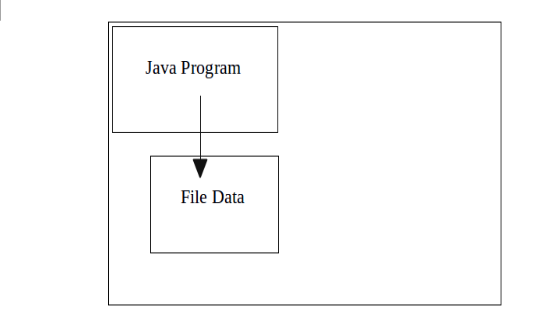
java program processing a file data.

C- program processing a file data.

Any Application processing files data.

It is also known as desktop application or window-based application. An application that we need to install on every machine such as media player, antivirus etc. AWT and Swing are used in java for creating standalone applications.

Java Programme and application in the same memory space



**2) Client and Server Applications: ( Two – Tier )**

These are TCP/IP based application, one to one communication always.

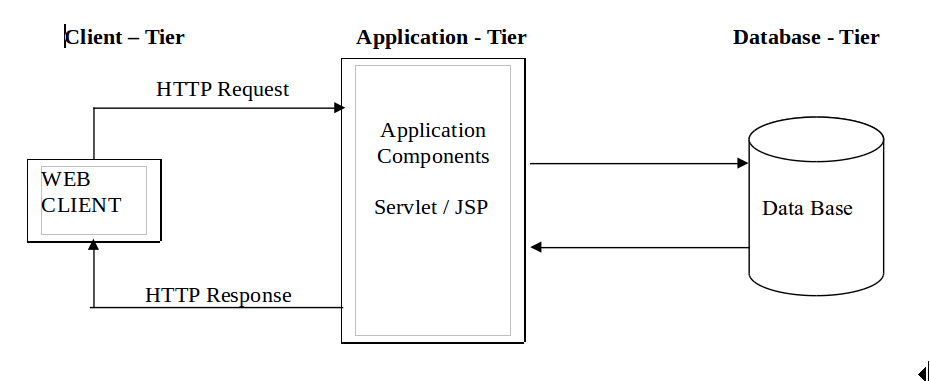
Here no browser and web server.

One server but can be multiple clients, but communication is always one to one, synchronous ( one after another )



**3) Web Application ( three – tier )**

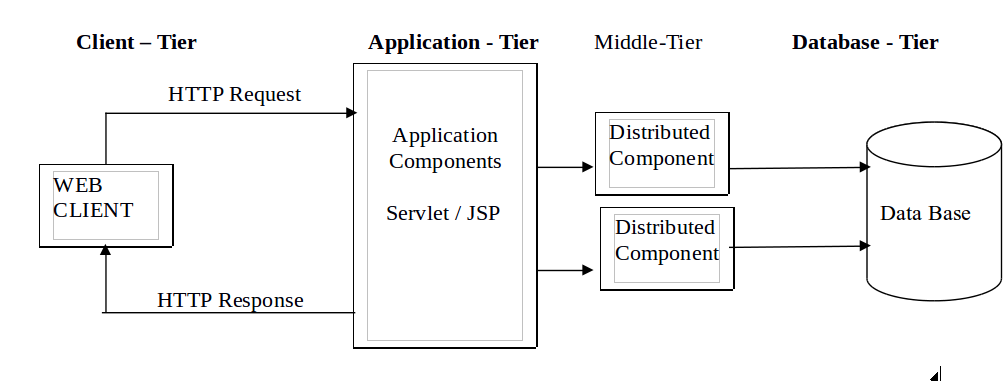
An application that runs on the server side and creates dynamic page, is called web application. Currently, servlet, jsp, struts, jsf etc. technologies are used for creating web applications in java.



**4) Enterprise Application ( N- Tier)**

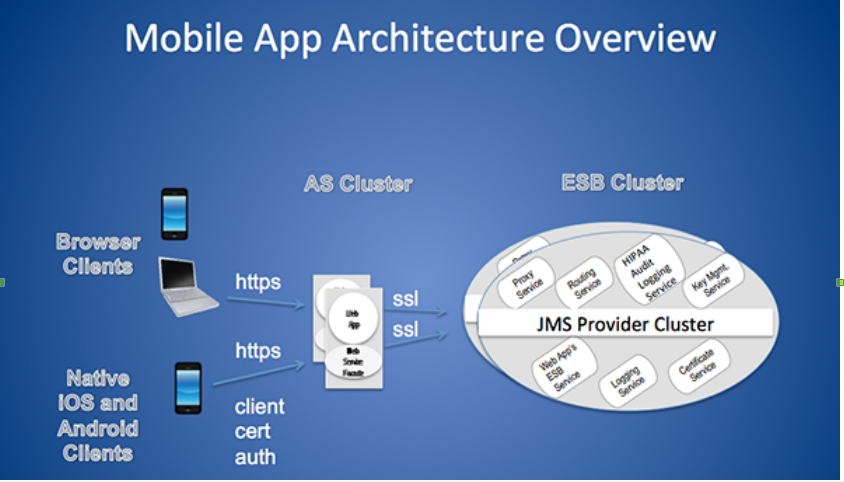
An application that is distributed in nature, such as banking applications etc. It has the advantage of high level security, load balancing and clustering. In java, EJB is used for creating enterprise applications.

It will use middleware distributed components, to improve the performance of application.



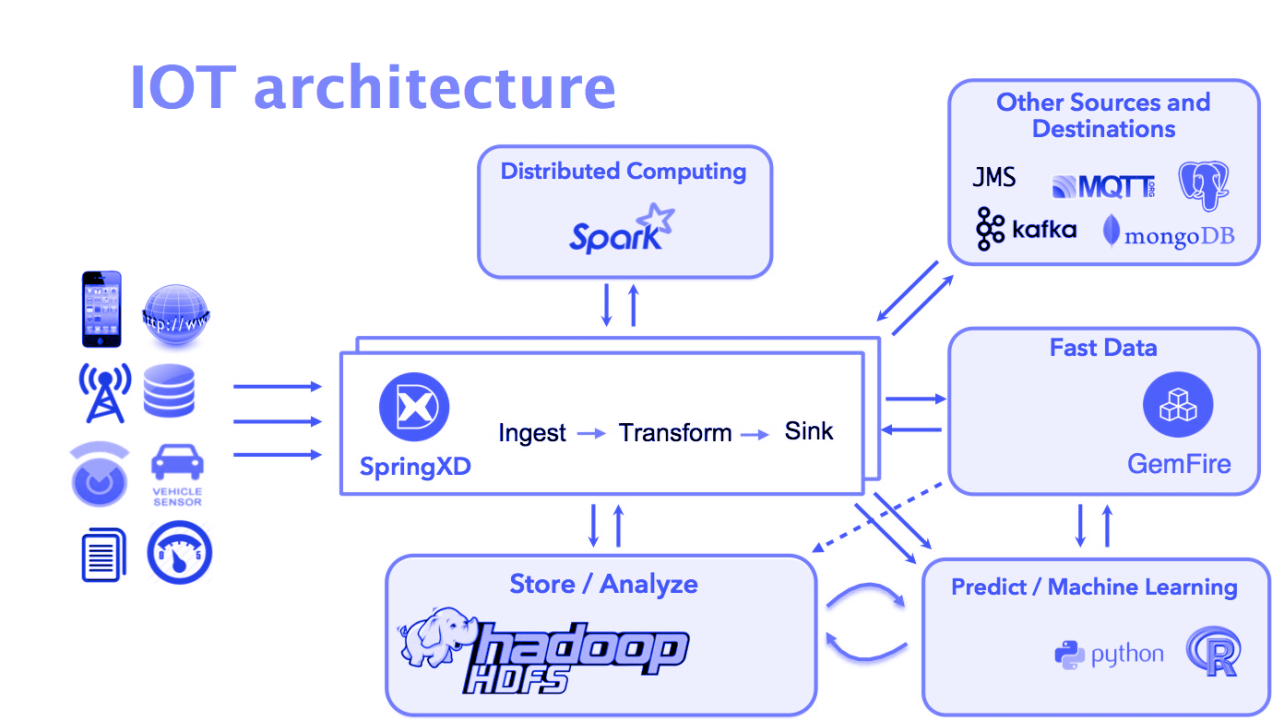
**5) Mobile Application**

An application that is created for mobile devices. Currently Android and Java ME are used for creating mobile applications.



**6) IOT Applications:**

IoT (Internet of Things) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system.



**Difference between C++ and Java :**

1) C++ is complier based, which has exe file,

Java is a compiler as well interpreter based, Java compiler generates .class file, contains byte code, which is independent of platform.

As result of C++ compiler is exe file, it is a platform dependent.

2) Java does not Support C++ pointers

3) No C-Language structures in Java

4) No sizeof operator in java

5) In java every thing is inside of the class.

6) Java is an Object Oriented language whereas C++ is a functional oriented as well as Object oriented language and C – Language is a functional oriented language.

7) Like C++ no friend functions in Java

8) No destructors concept in java

10 ) Java compiler doesn’t interact with OS kernel

11) Java doesn’t provide multiple inheritance

**Different Versions of Java**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No.** | **Version** | **Code Name** | **Year** |
| 1. | JDK Alpha and Beta |  | 1995 |
| 2. | JDK 1.0 | Oak | 1996 |
| 3. | JDK 1.1 | Oak | 1997 |
| 4. | J2SE 1.2 | Playground | 1998 |
| 5. | J2SE 1.3 | Kestrel | 2000 |
| 6. | J2SE 1.4 | Merlin | 2002 |
| 7. | J2SE 5.0/1.5 | Tiger | 2004 |
| 8. | Java SE 6/1.6 | Mustang | 2006 |
| 9. | Java SE 7/1.7 | Dolphin | 2011 |
| 10. | Java SE 8/1.8 | code name culture is dropped | 2014 |
| 11 | Java SE 9/1.9 |  | 2016 |

**How to write sample program in java:**

**Hello World program:**

**D:\>test>notepad Test.java 🡪 windows**

**$gedit Test.java 🡪 linux**

//program to display Hello World

/\*

Developed On :

Developed By :

Modified On :

Modified By :

Reason to Modify :

Description :

Rights reserverd @ NRIT Solutions

\*/

import java.lang.String ;

import java.lang.System ;

public class Test

{

public static void main(String [] args )

{

System.out.println("Hello World");

System.out.println("Hello NRIT");

}

}

Save this file as **Test.java**

Name of program file should be same as the class name in which main method is defined.

To compile: **$javac Test.java**

To execute: **$java Test**

// Single line commenting in java

/\* multiple lines

commenting

in java \*/

**import** is a keyword to import java package,

eg:

java.lang, java.io, java.net, java.util, java.math, java.sql

package is a collection of related classes and interaces.

Import java.lang.\* ,

Here \* 🡪 all the classes from that package

**Below is an individual importing**

import java.lang.String ;

import java.lang.System ;

**Note :** individual importing is recommended

importing **java.lang** is an optional as it is default available package in java applications.

**class** keyword is used to define a classes in java.

**Test** : is name of the class.

**Naming conditions of a class**  :

These are as per the compiler.

1. It contains only alphabets, digits and under score ( \_ )
2. Should not be used space, special char, keyword.
3. Max length can be up to 255 chars

**Naming conventions of a class** :

These are as per coding standards for easy understanding the code.

1) class name should start with upper case alphabet

## 2) If class name contains multiple words then every word should start with upper case alphabets (Camel Case in java naming conventions)

Eg :

MyFirstExample

WordCountExample ( camel case )

ActionEvent, ActionListener

Java follows camel case syntax for naming the class, interface, method and variable.

**public** keyword is an access specifier which represents visibility, it means it is visible to all.

No two classes are public in the same program file.

A class must be public in which main method is declared

**static** is a keyword, if we declare any method as static, it is known as static method. The core advantage of static method is that there is no need to create object to invoke the static method.

**main** method is executed by the JVM, so it doesn't require to create object to invoke the main method. So it saves memory.

**main** represents start up of the program.

To compile java program main() is not compulsory but to execute main() should presented.

Naming conditions of method are same as the class as explained above.

**Naming conventions of method :**

1)Name of the method starts with lowercase alphabets

2) if name contains multiple words, then first word starts with lowercase and subsequent words starts with uppercase alphabet

e.g.

getData(), setData(), getEmpInformation()

actionPerformed(), firstName(), etc.

**void** is the return type of the method, it means it doesn't return any value.

**String[] args** is used for command line argument. We will learn it later.

**System.out.println ()** is used print statement.

print() and println ()

println () inserts a new line char at the end of the data, where print() does not.

System: it is a class from java.lang

It provides three objects

1. System.in : to get data from input buffer
2. System.out : to write data to outpt buffer
3. System.err : to Write JVM implicit error message to output buffer

A blank .java program file can be comiled but not generates .class file

A program file can have multiple classes but not two classes are public

A class must be public, which name is mapped to file name.

**In the following program which main() executes ?**

**Program file is Test.java**

class Sample

{

public static void main(String [] args )

{

System.out.println("Hello NRIT");

}

}

public class Test

{

public static void main(String [] args )

{

System.out.println("Hello World");

}

}

Ans : Test class main()

o/p: Hello World

JVM looks for the main(), in a class which is mapped to the file name.

|  |  |
| --- | --- |
| **Name** | **Convention** |
| class name | should start with uppercase letter and be a noun e.g. String, Color, Button, System, Thread etc. |
| interface name | should start with uppercase letter and be an adjective e.g. Runnable, Remote, ActionListener etc. |
| method name | should start with lowercase letter and be a verb e.g. actionPerformed(), main(), print(), println () etc. |
| variable name | should start with lowercase letter e.g. firstName, orderNumber etc. |
| Object name | should start with lowercase letter e.g. contractEmployee , permanentEmployee etc. |
| package name | should be in lowercase letter e.g. java, lang, sql, util etc. |
| constants name | should be in uppercase letter. e.g. RED, YELLOW, MAX\_PRIORITY etc. |

**What happens at runtime?**

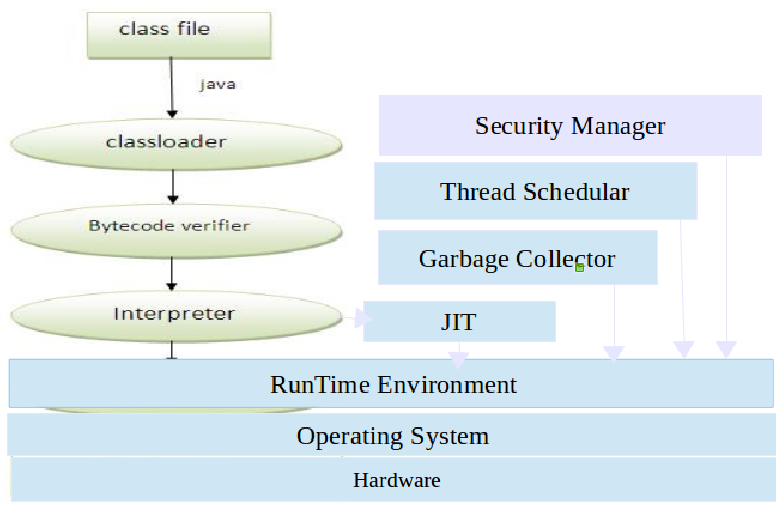
At runtime, following steps are performed:

JVM performs following:

Test.java --> javac --> Test.class --> JVM

**Overview of JVM**

InternalArchitecture, covered at the end of this book.



**Class Loader :** Loading .class file into memory

**Byte code verifier :**

**Byte code Verification**

When a class loader presents the byte codes of a newly loaded Java platform class to the virtual machine, these byte codes are first inspected by a *verifier.* The verifier checks that the instructions cannot perform actions that are obviously damaging. All classes except for system classes are verified.

Here are some of the checks that the verifier carries out:

* Variables are initialized before they are used.
* Method calls match the types of object references.
* Rules for accessing private data and methods are not violated.
* Local variable accesses fall within the runtime stack.
* The runtime stack does not overflow.

**Interpreter :**

It coverts java byte code to binary code and prepares as per the current platform (Hardware ) runtime environment.

**JIT :**

Just-In-Time (JIT) compiler is a component of the Java Runtime Environment that improves the performance of Java applications at run time

The JIT compiler helps improve the performance of Java programs by converting byte code into native machine code at run time.

**Garbage Collector :**

Garbage collector is a daemon thread. CPU is responsible to call Garbage collector. If there are no threads running in the system, then CPU makes a call to Garbage collector.

Java provides facitlity to Java developer for invoking Grabage collector through Runtime.gc() / System.gc()

Task of Garbage Collector is to clear all un-used obejcts ( Garbage objects )

Unreferenced objects are called as Garbage objects.

**Thread Schedular:**

Thread schedular is to manage different states of thread in a multi threaded application.

**Security Managar:**

Security Managar is to provide the security for local system resources from Java Application.

**Interview Questions:**

**1) What is operating system ?**

Ans:

It is a platform, where we can execute application programs and

It is an interface between Hardware and Application software.

**2) What is an exe file ?**

Ans:

exe file is a prepared file for specific OS. It contains binary code.

exe file contains, program code, application software libraries, OS libraries and hardware

exe file is a OS dependent.

**3) can we create exe file in java ?**

Ans :

No we can't create exe file. In java every thing is .class file, it is not an exe file

**4) What is a .class file ?**

Ans;

.class file is byte code file, which contains only java program code and Java libraries.

**5) how java program file is an independent of platform ?**

Ans;

it is independent of Platform since it does not contain any OS libraries and Hardware information.

**6) What is difference between exe file and .class file ?**

Ans:

exe file contains binary code and .class file contains byte code

exe file is prepared file for specific OS and .class is not prepared file.

After moving .class file to OS, then preparation starts as per current OS.

**7) what if the difference between JDK, JRE and JVM**

Ans:

**JVM (Java Virtual Machine)**

It is an abstract machine. It is a specification that provides runtime environment in which java byte code can be executed.

JVM, JRE and JDK are platform dependent because configuration of each OS differs.

But, Java is platform independent.

**JDK ( Java Development Kit ):**

It contains JRE + Development Tools ( javac, java, javap, javadoc, jar, appletviewer, rmic, jps and etc )

**JRE ( Java Runtime Environment )**

It is used to provide runtime environment.

It is the implementation of JVM.

It contains set of libraries ( jar files ) and other files that JVM uses at runtime.

JRE = JVM + Java Packages Classes (like util, math, lang, awt,swing etc)+runtime libraries ( jars ).

The JVM performs following main tasks:

Loads code

Verifies code

Executes code

Provides runtime environment

**8) What is the purpose of JIT Compiler ?**

Ans:

Just-In-Time (JIT) compiler is a feature of the run-time interpreter.

It prepares the binary code ( generated by Interpreter ) as per the current OS Specifications.

**9) Can we compile java program without main() ?**

Ans: yes.

**10) Can we execute java program without main() ?**

**Ans:** No

**11) what does mean, Java is portable ?**

**Ans:**

java application build can be moved from one OS to another OS with out any changes in the application build .

**12) - Can we have multiple classes in same java file?**

Ans : Yes

**13) Can we have two public classes in one java file?**

Ans:

No

A class must be public which name is same as File name.

**14) What is correct syntax for main method of a java class?**

A - public static int main(String[] args)

B - public int main(String[] args)

C - public static void main(String[] args)

D - None of the above.

Ans: C

**15) Is an empty .java file a valid source file?**

Ans:

No, not valid valid file but it can be cmpiled.

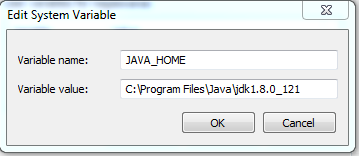
A Java-source file with zero class-declarations will not result in any .class files

**Installing Java and path setting.**

Place the JDK into C-Drive and run as admin  next  Accept agreement  next …… finish.

Set the JAVA\_HOME

Rt.click on Computer Icon  Properites  Advanced system settings  Environment variables  System Variables New



Set the PATH

System Variable,

Edit PATH

Go to end of the path and place ; %JAVA\_HOME%\bin;

Eg:

C:\ProgramData\Oracle\Java\javapath;%PATH%;C:\app\nagaswarao\product\11.2.0\dbhome\_1\bin;%SystemRoot%\system32;%SystemRoot%;%SystemRoot%\System32\Wbem;%SYSTEMROOT%\System32\WindowsPowerShell\v1.0\; **%JAVA\_HOME%\bin;**

**Setting Java Path in Linux OS:**

$gedit ~/.bashc

go to end of .bashrc file and provide following PATH

export JAVA\_HOME=/usr/lib/jvm/java-8-openjdk-i386

export PATH=$PATH: $JAVA\_HOME/bin

**Eclipse setup:**

Take the eclipse zip ( archive ) and place into C-dirve 🡪 rt.click extract here🡪 created short cut on desk for eclipse.

On launching eclipse, it check for the JAVA\_HOME, then integrates jdk with eclise.

**Working with eclipse:**

Eclipse is an IDE

IDE: Integrated Development Environment.

Java Compiler, JRE, JVM are integrated to eclipse automatically, when PATH variable is defined in the OS.

**Hieracrchy of Java Project ( Model )**

1. Workspace
2. Project
3. Package
4. Classes
5. Methods

**Step1:**

**Create Workspace**

Launch eclipse 🡪 Select Work Space location ( browse ) and provide the name , d:\test\SampleWS

SampleWS 🡪 is a workspace name🡪 Ok

Close the welcome screen.

**Step2:**

**Create Project**

Rt.Click on Project Explorer area  new  project  java project next 

provide project name ( test)

execution environment : JavaSE1.8

Finish

**Step3:**

**Create package**

Expand your project 🡪 rt.click on src 🡪 new 🡪 package 🡪

Package name ( lower case ) : <com/org>.<client\_name>.<project\_name>.<module\_name>

com 🡪 Company

org 🡪 Organization

Eg:

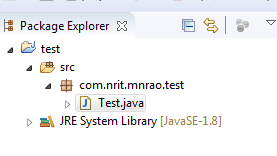
com.nrit.tarck.admin

**Step4:**

**Create a class**

Rt.click on package 🡪 new 🡪 class

Provide the class name : Test



**package** com.nrit.mnrao.test;

**public** **class** Test {

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

System.***out***.println("Hello World");

}

}

**How to run java program**

**Rt.click on main() program file  runAS java Applicaton**

**At Console O/p:**

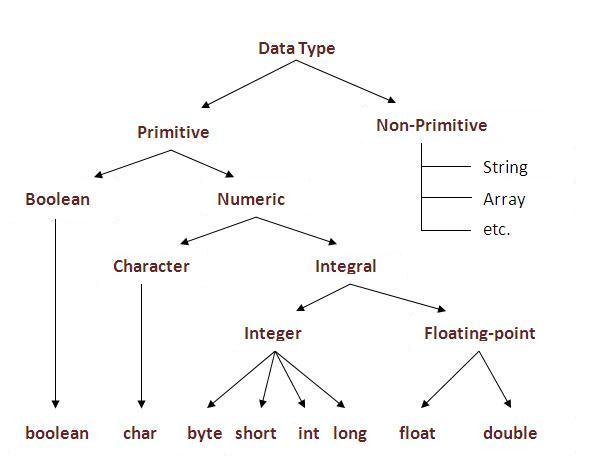
Hello World

**Data Types in Java**

In java, there are two types of data types

primitive data types ( basic data types )

non-primitive data types ( all java classes )



|  |  |  |  |
| --- | --- | --- | --- |
| **Data Type** | **Default Value** | **size** | **Range of data** |
| boolean | false | 1 bit | 1 or 0 |
| byte | 0 | 1 byte | -128 to 127, -27 to (27  - 1) |
| short | 0 | 2 byte | -32,768 to 32,767 , 215 to (215 - 1) |
| int | 0 | 4 byte | -231 to (231 - 1) |
| long | 0L | 8 byte | -263 to (263 - 1) |
| float | 0.0f | 4 byte | 7 significant decimal digits |
| double | 0.0d | 8 byte | 15 significant decimal digits |
| char | '\u0000' | 2 byte | 0 to 65535 ( unsigned char) |

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

Java char is a unicode character. It is because java uses Unicode system than ASCII code system.

ASCII code system accepts only ASCII chars key board set( 0 to 255 ) .

Unicode system accepts any key board set across universe.

Size of ASCII char is one byte.

Size of unicode char is two bytes.

Java is a net based product, to accept all keyboard sets across the universe it is designed with 2 bytes.

Char with 2 bytes can accept the value ranging from 0 to 65535 ( many keyboard sets )

**Program to display size and Range of Values.**

**public** **class** Test

{

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

{

System.***out***.println ("character size :"+Character.***SIZE***+"\tMin Value : "+Character.***MIN\_VALUE***+"\tMax Value : "+Character.***MAX\_VALUE***);

System.***out***.println ("byte size :"+Byte.***SIZE***+"\tMin Value : "+Byte.***MIN\_VALUE***+"\tMax Value : "+Byte.***MAX\_VALUE***);

System.***out***.println ("short size :"+Short.***SIZE***+"\tMin Value : "+Short.***MIN\_VALUE***+"\tMax Value : "+Short.***MAX\_VALUE***);

System.***out***.println ("int size :"+Integer.***SIZE***+"\tMin Value : "+Integer.***MIN\_VALUE***+"\tMax Value : "+Integer.***MAX\_VALUE***);

System.***out***.println ("long size :"+Long.***SIZE***+"\tMin Value : "+Long.***MIN\_VALUE***+"\tMax Value : "+Long.***MAX\_VALUE***);

System.***out***.println ("float size :"+Float.***SIZE***+"\tMin Value : "+Float.***MIN\_VALUE***+"\tMax Value : "+Float.***MAX\_VALUE***);

System.***out***.println ("double size :"+Double.***SIZE***+"\tMin Value : "+Double.***MIN\_VALUE***+"\tMax Value : "+Double.***MAX\_VALUE***);

}

}

**Variable :**

Variable is a name of memory location.

Declaration of a variable.

data\_type variable\_name;

eg :

int eno;

double salary;

char gender;

**Initialization of a variable:**

int eno=1001;

double salary=5000.00;

char gender='M';

**Assigning values to variables:**

int eno;

double salary;

char gender;

eno=1001;

salary=5000.00;

gender='M';

eg1:

**public** **class** Test

{

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

{

**int** eno = 1001;

**double** salary = 5000.00;

**char** gender = 'M';

System.***out***.println ("Initial Details are :");

System.***out***.println ("Emp Number=" + eno + "\tSalary=" + salary + "\tGender:" + gender);

eno = 1002;

salary = 6000.00;

gender = 'F';

System.***out***.println ("After Changing Details are :");

System.***out***.println ("Emp Number=" + eno + "\tSalary=" + salary + "\tGender:" + gender);

}

}

**O/p:**

**Initial Details are :**

Emp Number=1001 Salary=5000.0 Gender:M

After Changing Details are :

Emp Number=1002 Salary=6000.0 Gender:F

**eg2:**

**public** **class** Test

{

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

{

**int** eno=1001;

**double** salary=5000.50;

**int** age=30;

**char** gender='M';

System.***out***.println ("First emp details are ");

System.***out***.println (eno+"\t"+salary+"\t"+age+"\t"+gender);

eno=1002;

salary=6000.50;

age=20;

gender='F';

System.***out***.println ("Second emp details are ");

System.***out***.println (eno+"\t"+salary+"\t"+age+"\t"+gender);

}

}

**Dynamic initialization of a variable:**

**int** a =10;

**int** b =20;

// below is the dynamic initialization

**int** c = a\*b;

**Programme to swap the two variables:**

**public class Test {**

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

**int** a = 10;

**int** b = 20;

**int** temp;

System.***out***.println ("Before swapping");

System.***out***.println ("a=" + a + "\tb=" + b);

temp = a;

a = b;

b = temp;

System.***out***.println ("After swapping");

System.***out***.println ("a=" + a + "\tb=" + b);

}

}

**Before swapping**

a=10 b=20

After swapping

a=20 b=10

**==============**

**Reading data from keyboard**

There are many ways to read data from the keyboard. For example:

InputStreamReader

Console

Scanner

DataInputStream etc.

At this stage, we can focus only on Scanner and others will be discussed in I/O streams.

**Java Scanner class:**

it is class from java.util package:

The Java Scanner class breaks the input into tokens using a delimiter that is whitespace by default.

It provides many methods to read and parse various primitive values.

**Methods of Scanner class**

|  |  |
| --- | --- |
| **Method** | **Description** |
| public String next() | It returns the next token from the scanner. |
| public String nextLine() | it moves the scanner position to the next line and returns the value as a string. |
| public byte nextByte() | it scans the next token as a byte ( max 127) |
| public short nextShort() | it scans the next token as a short value ( max 32767 ) |
| public int nextInt() | it scans the next token as an int value ( upto 8 digits ) |
| public long nextLong() | it scans the next token as a long value. ( upto 12 digits ) |
| public float nextFloat() | it scans the next token as a float value. ( small real number ) |
| public double nextDouble() | it scans the next token as a double value. ( big real number ) |

All methods will read data upto next token ( space or tab or \n, which is coming fisrt), except , nextLine()

nextLine() : it will read input data upto eneter key including space and tab. It will read any type of data.

next() : It will read input data up to space or tab or new line char, which is coming first. It will read any type of data.

All methods, except nextLine() and next(), can read only numeric data.

Eg:

**package** com.nrit.mnrao.test;

**import** java.util.Scanner;

**public** **class** Test {

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

Scanner scanner = **new** Scanner(System.***in***);

System.***out***.println("Enter EMP NO : ");

**int** eno = scanner.nextInt();

System.***out***.println("Enter EMP Name : ");

String name = scanner.next();

System.***out***.println("Enter Salary ");

**double** salary = scanner.nextDouble();

System.***out***.println("Enter Dept : ");

String dept = scanner.next();

System.***out***.println("EMP NO "+eno+"\tEMP NAME "+name+"\tEMP SALARY "+salary+"DEPT "+dept);

scanner.close();

}

}

Enter EMP NO :

1001

Enter EMP Name :

NRIT

Enter Salary

5000

Enter Dept :

dev

EMP NO 1001 EMP NAME NRIT EMP SALARY 5000.0DEPT dev

**Type Casting:**

It is a process of converting one data type to another data type

These are of two types

1) premitive data types casting ( basic to basic )

2) user defined classes type casting( Non-Premitive casting)

**primitive data types casting**

these are

1) Implicit Casting and 2) Explicit casting

1) implicit casting:

it is a conversion of data from small type to big type. It is an implicit process ( automatically/internally )

Eg:

**byte** b=10;

**short** s=b;

here byte type of data converting into short ( type promotion )

**data, type promotion as below.**

byte ===> short ===> int ===> long ==> double

byte ===> short ===> int ==> float ==> double

byte ===> short

char ==> int ==>long

eg1:

byte b=10;

short s = b ; --> valid

eg2:

int a=10;

long b=a; --> valid

eg3:

float a=10.5f;

double b=a; --> valid

Implicit casting is available for the below

1. Small size to bigsize
2. Integer to real number

converting from real number to integer, implicit casting is not applicable.

To convert real to integer type explicit casting required.

2) Explicit casting:

It is conversion of data from big type small type.

Java developer has to convert explicitly .

Eg:

short a=10;

byte b = a; --> invalid, since size of variable “ a” is 2 bytes , which is more than size of variable “b” ( 1 byte )

such of kind of scenarios, we use explicit type casting.

Short a=10;

byte b = (byte ) a ; --> it is valid

same scenario with following

short a=130;

byte b = (byte ) a ; --> it compiles but at run time loss of data. It results in unexpected data ( i.e leads to bugs )

here value of b is -126 .

hence explicit type casting is recommended is only for constants not for variables.

float a= 10.5 ; --> invalid, since in java real numbers by default treats as double.

float a= 10.5f; --> valid

default data type.

integer data ( numbers ) is a int data type not a short and byte.

Real numbers are treated as double type.

**Result of mathematical expressions, with different data types.**

1) byte + byte = int

2) short + short = int

3) int + int = int ( compiles ) but at runtime there is chance of data over flow.

Recommended one is ( int+int = long )

4) long + long = long

5) char + char = int.

6) float + float = double

7) double + double = double

**Java Operators**

1) Unary Operators

2) Binary Operators

3) Ternary Operators

**Binary Operators:**

1) Arithmetic / Mathematical Operators

2) Relational Operators

3) Logical Operators

4) Assignment Operator

5) short hand assignment Operator

6) bitwise operators

**Arithmetic / Mathematical Operators**

|  |  |
| --- | --- |
| **Operator** | **Task** |
| + | Addition |
| - | Subtraction |
| \* | Multiplication |
| / | Division |
| % | Modula’s ( remainder ) |

Eg:

10 % 3 =1

3%10 = 3

9%10 = 9

50%51=50

**Relational Operators:**

|  |  |
| --- | --- |
| **Operator** | **Task** |
| > | Greater than |
| >= | Greater than or equal to |
| < | Less than |
| <= | Less than or equals to |
| == | Is equal to |
| != | Not equal to |

**== --> comparison**

**= --> assignment.**

Relational operators returns either true or false

**Logical Operators:**

|  |  |
| --- | --- |
| **Operator** | **Task** |
| & & | And |
| | | | Or |
| ! | Not |

**Using ( && ) operator:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Condition1** | **Operator** | **Condition2** | **Result** |
| TRUE | **&&** | TRUE | TRUE |
| TRUE | **&&** | FALSE | FALSE |
| FALSE | **&&** | TRUE | FALSE |
| FALSE | **&&** | FALSE | FALSE |

**Using ( | | ) operator:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Condition1** | **Operator** | **Condition2** | **Result** |
| TRUE | **| |** | TRUE | TRUE |
| TRUE | **| |** | FALSE | TRUE |
| FALSE | **| |** | TRUE | TRUE |
| FALSE | **| |** | FALSE | FALSE |

**Using not ( ! ):**

! TRUE --> FALSE

! FALSE --> TRUE

**program to add, subtract and multiply two numbers.**

**public class Test**

{

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

{

**int** a=10;

**int** b=20;

**int** c=a+b;

System.***out***.println ("Addition : "+c);

c=a-b;

System.***out***.println ("Subtraction : "+c);

c=a\*b;

System.***out***.println ("Multiplication : "+c);

}

}

**o/p**

**Addition : 30**

Subtraction : -10

Multiplication : 200

**Control Statements**

1) if statement.

2) switch case statement.

3) loops

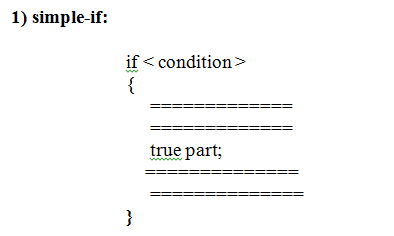
if – statement:

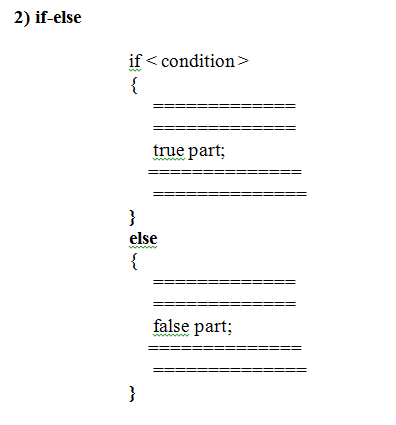
1) simple-if

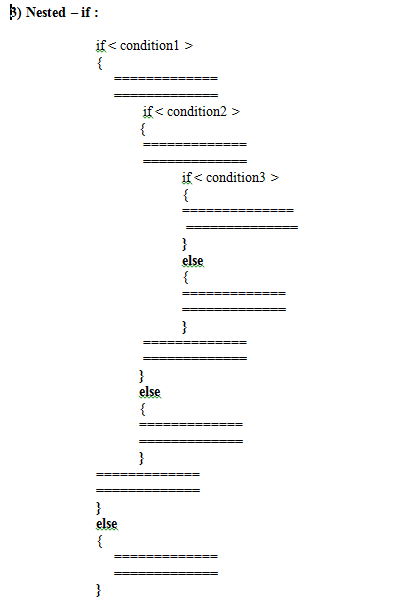
2) if-else

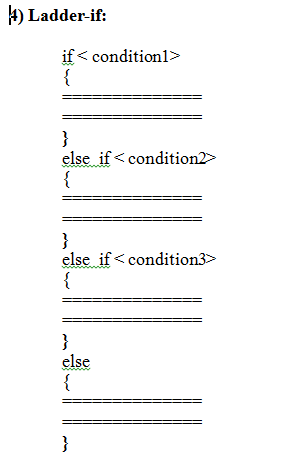
3) Nested – if

4) ladder -if









**Greater of two numbers:**

**public class Test {**

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

**int** a = 30;

**int** b = 20;

**if** (a > b)

{

System.***out***.println (" a is greater");

}

**else**

{

System.***out***.println (" b is greater");

}

}

}

**program to check for equal and greater.**

**public** **class** Test

{

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

{

**int** a=20;

**int** b=30;

**if**(a==b)

{

System.***out***.println ("both are equal");

}

**else** **if**(a>b)

{

System.***out***.println (" a is greater");

}

**else**

{

System.***out***.println ("b is greater");

}

}

}

**program to find greater of three numbers:**

**public** **class** Test {

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

**int** a = 30;

**int** b = 50;

**int** c = 75;

**if** (a > b)

{

**if**(a>c)

{

System.***out***.println (" a is greater");

}

**else**

{

System.***out***.println (" c is greater");

}

}

**else** **if** (b>c)

{

System.***out***.println (" b is greater");

}

**else**

{

System.***out***.println (" c is greater");

}

}

}

**Program to check the student result:**

**if all subject are greater than or equal to 40 then pass otherwise fail.**

**public class Test {**

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

**int** sub1 = 55;

**int** sub2 = 50;

**int** sub3 = 35;

**if**(sub1>=40)

{

**if**(sub2>=40)

{

**if**(sub3>=40)

{

System.***out***.println ("Pass");

}

**else**

{

System.***out***.println ("FAIL");

}

}

**else**

{

System.***out***.println ("FAIL");

}

}

**else**

{

System.***out***.println ("FAIL");

}

}

}

**Another way:**

**public** **class** Test {

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

**int** sub1 = 55;

**int** sub2 = 50;

**int** sub3 = 65;

**if** (sub1 >= 40 && sub2 >= 40 && sub3 >= 40)

{

System.***out***.println ("Pass");

} **else**

{

System.***out***.println ("FAIL");

}

}

}

**Another way:**

**public class Test {**

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

**int** sub1 = 55;

**int** sub2 = 30;

**int** sub3 = 65;

**if** (sub1 < 40 )

{

System.***out***.println ("FAIL");

}

**else** **if**(sub2<40)

{

System.***out***.println ("FAIL");

}

**else** **if**(sub3<40)

{

System.***out***.println ("FAIL");

}

**else**

{

System.***out***.println ("Pass");

}

}

}

**Another way:**

**public class Test {**

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

**int** sub1 = 55;

**int** sub2 = 30;

**int** sub3 = 65;

**if** (sub1 < 40 || sub2<40 ||sub3<40)

{

System.***out***.println ("FAIL");

}

**else**

{

System.***out***.println ("Pass");

}

}

}

**public** **class** Test {

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

**int** sub1=60;

**int** sub2=80;

**int** sub3=85;

**if**(sub1>=40 && sub2>=40 && sub3>=40 )

{

System.***out***.println ("PASS ");

**int** avg = (sub1+sub2+sub3)/3;

**if**(avg >=70)

{

System.***out***.println ("Grade A with Distinction");

}

**else** **if**(avg>=60 )

{

System.***out***.println ("Grade A ");

}

**else** **if**(avg>=50 )

{

System.***out***.println ("Grade B ");

}

**else**

{

System.***out***.println ("Grade c ");

}

}

**else**

{

System.***out***.println ("FAIL ");

}

}

}

**if statement works based on condition return values;**

**eg:**

**if**(**true**)

{

System.***out***.println ("true part");

}

**else**

{

System.***out***.println ("false part");

}

**program to use condition return value:**

**public** **class** Test {

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

{

**int** a=20;

**int** b=30;

**boolean** c;

c=a>b;

**if**(c)

{

System.***out***.println ("true part");

}

**else**

{

System.***out***.println ("else part");

}

c=a<b;

**if**(c)

{

System.***out***.println ("true part");

}

**else**

{

System.***out***.println ("else part");

}

c=(a<=b);

**if**(c)

{

System.***out***.println ("true part");

}

**else**

{

System.***out***.println ("else part");

}

}

}

**o/p:**

**else part**

true part

true part

**import** java.util.Scanner;

**public** **class** Test {

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

Scanner sc = **new** Scanner(System.***in***);

System.***out***.println("Enter the score ");

**int** score =sc.nextInt();

**if**(score<0)

{

System.***out***.println("Invalid Input");

}

**else** **if**(score==0)

{

System.***out***.println("Duck out");

}

**else** **if**(score<50)

{

System.***out***.println("Normal score");

}

**else** **if**(score<100)

{

System.***out***.println("Half Century");

}

**else** **if**(score<200)

{

System.***out***.println("Century");

}

**else**

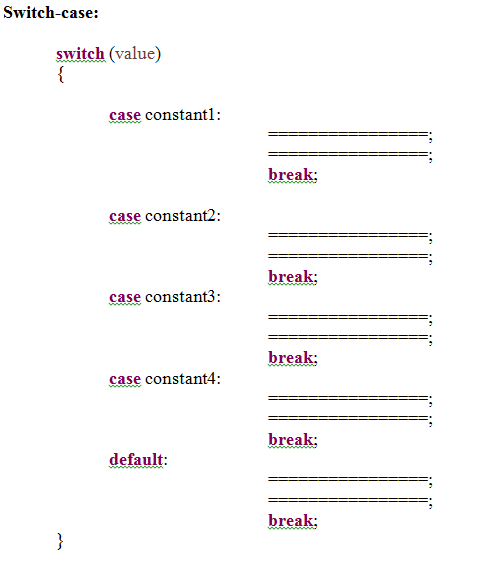
{

System.***out***.println("Double Century");

}

}

}



if **value** matched with **constant**, that case statement executes.

If value is not matching with any of the constants, then default case executes.

**break** statement will take the control out of the switch case.

Use of **break** statement is an optional in default case ( or ) last case block

If **break** is not presented in any of the case block then next case block also executes till next **break**.

**public** **class** Test {

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

**int** a=10;

System.***out***.println ("before switch case");

**switch** (a)

{

**case** 10:

System.***out***.println ("TEN");

**break;**

**case** 20:

System.***out***.println ("Twenty");

**break**;

**case** 30:

System.***out***.println ("Thirty");

**break**;

**case** 40:

System.***out***.println ("Fourty");

**break**;

**default**:

System.***out***.println ("DEFAULT");

**break**;

}

System.***out***.println ("after switch case");

}

}

**import** java.util.Scanner;

**public** **class** Test {

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

Scanner sc = **new** Scanner(System.***in***);

System.***out***.println("Enter first number ");

**int** a=sc.nextInt();

System.***out***.println("Enter Second number ");

**int** b=sc.nextInt();

System.***out***.println("Menu");

System.***out***.println("1.Addition ");

System.***out***.println("2.Subtraction ");

System.***out***.println("3.Multiplication ");

System.***out***.println("Enter your choice 1/2/3 : ");

**int** choice = sc.nextInt();

**switch**( choice )

{

**case** 1:

System.***out***.println("Addition = "+(a+b));

**break**;

**case** 2:

System.***out***.println("Subtraction = "+(a-b));

**break**;

**case** 3:

System.***out***.println("Multilication = "+(a\*b));

**break**;

**default**:

System.***out***.println("Wrong choice");

**break**;

}

}

}

**Unary Operator:**

It works with only one operand.

Eg:

int a=10;

int b = - a; ( unary minus )

here value of b is -10, value of a remains same ( 10 ) no change

int c = a – b ; ( binary minus )

**Increment and decrement operators :**

**Increment Operator ( ++ ) :**

It increases value of it's operand by 1.

**Decrement operator ( - - ):**

It decreases value of it's operand by 1.

**Increment Operator ( ++ ) :**

|  |  |
| --- | --- |
| **Pre – increment** | **Post – increment** |
| 1) syntax :  ++ variable; | 1) syntax :  variable++; |
| 2)It increase value of it's Operand by 1 before executing statement | 2)It increase value of it's Operand by 1 after executing statement |
| 3) eg :  int a=10;  int b = ++a: --> a=11, b=11 | 3) eg :  int a=10;  int b = a++: -->b=10, a=11 |

**public** **class** Test

{

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

{

**int** a=10;

**int** b;

**int** c;

**int** d;

b=++a;

c=b++;

d=++c;

System.***out***.println (a+"\t"+b+"\t"+c+"\t"+d);

}

}

O/p : 11 12 12 12

**public** **class** Test{

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

**int** a=10;

**int** b;

**int** c;

**int** d;

b=a++;

c=++b;

d=c++;

b=d++;

a=++c;

System.***out***.println (a+"\t"+b+"\t"+c+"\t"+d);

}

}

O/P : 13 11 13 12

**public** **class** Test {

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

{

**int** a=10;

**int** b;

**int** c;

**int** d;

d=++a;

b=d++;

a=++b;

c=d++;

d=++c;

System.***out***.println (a+"\t"+b+"\t"+c+"\t"+d);

}

}

O/P :

12 12 13 13

**Decrement Operator ( - - ) :**

|  |  |
| --- | --- |
| **Pre – Decrement** | **Post – Decrement** |
| 1) syntax :  -- variable; | 1) syntax :  variable--; |
| 2)It decreases value of it's Operand by 1 before executing statement | 2)It decreases value of it's Operand by 1 after executing statement |
| 3) eg :  int a=10;  int b = --a: --> a=9, b=9 | 3) eg :  int a=10;  int b = a--: -->b=10, a=9 |

**public** **class** Test

{

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

{

**int** a=10;

**int** b;

**int** c;

**int** d;

b=--a;

c=b++;

d=--c;

a=++b;

d=a--;

System.***out***.println (a+"\t"+b+"\t"+c+"\t"+d);

}

}

O/P :

10 11 8 11

**public** **class** Test

{

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

{

**int** a = 10;

**int** b;

**int** c;

**int** d;

d = a--;

b = ++d;

c = a++;

a = --b;

d = c++;

System.***out***.println (a + "\t" + b + "\t" + c + "\t" + d);

}

}

O/p :

10 10 10 9

**Ternary Operator / Conditional Operator( ? ) :**

Variable = <condition> ? Expr1 : Expr2 ;

if condition is true , Expr1 executes and result return to Variable.

if condition is false , Expr2 executes and result return to Variable.

Eg1:

int a=10;

int b=15;

int c = ( a > b ) ? a-b : **a+b**;

value of c is 25

Eg2:

int a=20;

int b=15;

int c = ( a > b ) ?  **a-b** : a+b;

value of c is 5

**Loops:**

1) while loop

2) do – while loop

3) for – loop

loops are used to execute same statements again and again ( iterative statements )

iterative --> repeatedly

**while loop:**

**Syntax:**

**while( Cond )**

**{**

**=========;**

**========;**

**========;**

**========;**

**}**

**To display 1 to 10**

**public** **class** Test

{

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

**int** i=1;

**while**(i<=10)

{

System.***out***.println (i);

i++;

}

}

}

**To display 10 to 1**

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

{

**int** i=10;

**while**(i>=1)

{

System.***out***.println (i);

i--;

}

}

}

**To display 1 to n**

**public** **class** Test

{

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

{

**int** i=1;

**int** n=20;

**while**(i<=n)

{

System.***out***.println (i);

i++;

}

}

}

**do-while:**

**syntax:**

**do**

**{**

**=======;**

**=======;**

**======;**

**======;**

**}**

**while(cond) ;** --> here semicolon required.

do-while loop executes at least once.

**public** **class** Test

{

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

{

**int** i=1;

**do**

{

System.***out***.println (i);

i++;

}

**while**(i<=10);

}

}

**Even Numbers:**

**public** **class** Test

{

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

{

**int** i=1;

**while**(i<=20)

{

**if**(i%2==0)

{

System.***out***.println (i);

}

i++;

}

}

}

**Odd Numbers :**

**public** **class** Test

{

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

{

**int** i=1;

**while**(i<=20)

{

**if**(i%2!=0)

{

System.***out***.println (i);

}

i++;

}

}

}

**for – loop:**

**syntax:**

**for** (initialization ; condition ; increment or decrement)

{

=======

=======

======

======

}

**public** **class** Test

{

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

**for**(**int** i=1; i<=10; i++)

{

System.***out***.println (i);

}

}

}

**Even Numbers using for loop:**

**public** **class** Test

{

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

{

**for**( **int** i=1; i<=20; i++)

{

**if**(i%2==0)

{

System.***out***.println (i);

}

}

}

}

**program to find sum of the numbers from 1 to 10.**

**public** **class** Test

{

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

{

**int** i=1;

**int** sum=0;

**while**(i<=10)

{

sum=sum+i;

i++;

}

System.***out***.println (sum);

}

}

**using for loop.**

**public** **class** Test

{

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

{

**int** sum=0;

**for**( **int** i=1;i<=10;i++)

{

sum=sum+i;

}

System.***out***.println ("sum value:"+sum);

}

}

**program to find sum of even and odd numbers from 1 to 10.**

**public** **class** Test

{

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

{

**int** i=1;

**int** esum=0;

**int** osum=0;

**while**( i <=10)

{

**if**(i%2==0)

{

esum=esum+i;

}

**else**

{

osum=osum+i;

}

i++;

}

System.***out***.println ("Even sum = "+esum);

System.***out***.println ("Odd sum = "+osum);

}

}

**using for loop:**

**public** **class** Test

{

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

{

**int** esum=0;

**int** osum=0;

**for**( **int** i=1; i<=10; i++)

{

**if**(i%2==0)

{

esum=esum+i;

}

**else**

{

osum=osum+i;

}

}

System.***out***.println ("even sum value:"+esum);

System.***out***.println ("odd sum value:"+osum);

}

}

**Program to print following series**

**1 2 3 5 5 8 7 11 9 14 11 17 13 20**

**public** **class** Test

{

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

{

**int** i;

**int** j;

**int** n = 20;

**for** ( i = 1, j=2; i <= n && j <= n; )

{

System.***out***.print(i + "\t" + j + "\t");

i = i + 2;

j = j + 3;

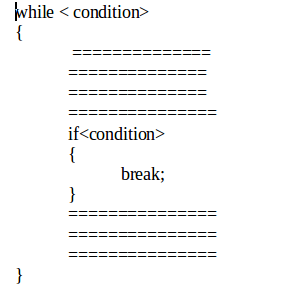
}

}

}

**Loops with break statement:**

break statement is to terminate the loop.



**program to check given number is prime or not**

**public** **class** Test

{

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

{

**int** n=11;

**boolean** flag = **true**;

**int** i=2;

**while**(i<=n/2)

{

**if**(n%i==0)

{

flag=**false**;

**break**;

}

i++;

}

**if**(flag==**true**)

{

System.***out***.println ("prime number");

}

**else**

{

System.***out***.println ("not a prime number");

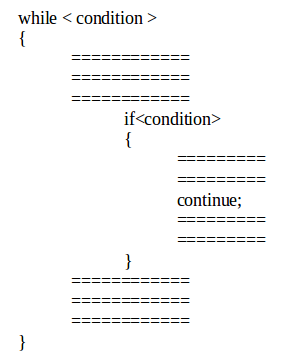
}

}

}

**Loop with continue statement**

it takes the control to beginning of the loop ( condition ) and skips the rest of the loop



in the for loop continue will take to increment or decrement part.

program to skip odd numbers and print only even number 1 to n

**public** **class** Test

{

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

{

**int** i=1;

**int** n=20;

**while**(i<=n)

{

**if**(i%2!=0)

{

i++;

**continue**;

}

System.***out***.println (i);

i++;

}

}

}

**Program to print following**

1 \* 1 = 1

1 \* 2 = 2

1 \* 3 = 3

1 \* 4 = 4

1 \* 5 = 5

1 \* 6 = 6

1 \* 7 = 7

1 \* 8 = 8

1 \* 9 = 9

1 \* 10 = 10

**public** **class** Test

{

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

{

**for**(**int** i=1;i<=10;i++)

{

System.***out***.println ("1 \* "+i+" = "+(1\*i));

}

}

}

**To print tables 1 to 10.**

**public** **class** Test {

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

**for**(**int** i=1;i<=10;i++)

{

System.***out***.println ();

**for**(**int** j=1;j<=10;j++)

{

System.***out***.println (i+" \* "+j+" = "+(i\*j));

}

}

}

}

**Program to print following.**

1

1 2

1 2 3

1 2 3 4

1 2 3 4 5

**public** **class** Test

{

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

**for** (**int** i = 1; i <= 5; i++)

{

System.***out***.println ();

**for** (**int** j = 1; j <= i; j++)

{

System.***out***.print(j + " ");

}

}

}

}

**Program to print following**

1 2 3 4 5

1 2 3 4

1 2 3

1 2

1

**public** **class** Test

{

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

**for** (**int** i = 5; i >= 1; i--)

{

System.***out***.println ();

**for** (**int** j = 1; j <= i; j++)

{

System.***out***.print(j + " ");

}

}

}

}

**Program to print following trianlge**

1

2 3

4 5 6

7 8 9 10

11 12 13 14 15

16 17 18 19 20 21

**public** **class** Test

{

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

{

**int** n=1;

**for** (**int** i = 1; i <= 6; i++)

{

System.***out***.println ();

**for** (**int** j = 1; j <= i; j++)

{

System.***out***.print(n + " ");

n++;

}

}

}

}

**Program to print following trianlge**

\*

\* \*

\* \* \*

\* \* \* \*

\* \* \* \* \*

**public** **class** Test {

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

**for** (**int** i = 1; i <= 5; i++)

{

System.***out***.println ();

**for** (**int** j = 1; j <= i; j++)

{

System.***out***.print("\*" + " ");

}

}

}

}

**Try below example:**

1

1 2

1 2 3

1 2 3 4

1 2 3 4 5

1 2 3 4

1 2 3

1 2

1

**Palindrome number**

**public** **class** Test {

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

**int** r, sum = 0, temp;

**int** n = 454;

temp = n;

**while** (n > 0)

{

r = n % 10; // getting remainder

sum = (sum \* 10) + r;

n = n / 10;

}

**if** (temp == sum)

System.***out***.println ("palindrome number ");

**else**

System.***out***.println ("not palindrome");

}

}

Input: 12321

Output: palindrome number

Input: 329

Output: not palindrome number

**Write a java program to print factorial of a number.**

**public** **class** Test

{

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

{

**int** i, fact = 1;

**int** number = 5;

**for** (i = 1; i <= number; i++)

{

fact = fact \* i;

}

System.***out***.println ("Factorial Value is: " + fact);

}

}

Input: 5

Output: 120

Input: 6

Output: 720

**Try Following triangle**

**1 1**

**1 2 2 1**

**1 2 3 3 2 1**

**1 2 3 4 4 3 2 1**

**1 2 3 4 5 4 3 2 1**

**1 2 3 4 4 3 2 1**

**1 2 3 3 2 1**

**1 2 2 1**

**1 1**

**Below Triangle**

**1 1 1 1 1 1 1 1 1**

**2 2 2 2 2 2 2**

**3 3 3 3 3**

**4 4 4**

**5**

**4 4 4**

**3 3 3 3 3**

**2 2 2 2 2 2 2**

**1 1 1 1 1 1 1 1 1**

**Program for the below.**

**1 2 3 4 5 4 3 2 1**

**1 2 3 4 4 3 2 1**

**1 2 3 3 2 1**

**1 2 2 1**

**1 1**

**1 2 2 1**

**1 2 3 3 2 1**

**1 2 3 4 4 3 2 1**

**1 2 3 4 5 4 3 2 1**

**Arrays**

Array is a collections of similar type of elements

Arrays are objects in java.

**declaration :**

int a[] ; reference to array.

( or )

int []a; reference to array.

a = new int[5]; // dynamic ( runtime ) memory allocation for the array

int []a=new int[5];

assignment of values to array

a[0]=5; a[1]=3; a[2]=8; a[3]=10; a[4]=7;

a[5]=20; // it throws Exception ArrayIndexOutOfBoundsException

initializing an array :

int []a={1,2,3,4,5,6 }; compile time memory allocation.

int []a=new int[]{1,2,3,4,5,6}; run time memory allocation.

int []a=new int[6]{1,2,3,4,5,6}; invalid

int a[10]={1,2,34,5.......};// is not valid in java

int n=a.length --> returns no of elements in array

**length :**

it is a variable provided by JVM . it is not from any pre-package ( such as java.lang)

**Declaration of multiple arrays**

int a[], b[], c[];

a=new int[6];

b=new int[9];

c=new int[8];

int []a,b,c; // b and c are also arrays

int a[], b, c // here b and c are variables not arrays

**program to print array elements**

**public** **class** Test

{

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

{

**int** a[]={1,2,3,4,5};

**for**(**int** i=0; i<a.length;i++)

{

System.***out***.println (a[i]);

}

}

}

**public** **class** Test

{

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

{

**int** a[]=**new** **int**[]{1,2,3,4,5};

**for**(**int** i=0; i<a.length;i++)

{

System.***out***.println (a[i]);

}

}

}

**Different ways of arrays**

**1) int** a[];

a=**new** **int**[5];

a[0]=10;

a[1]=15;

a[2]=21;

a[3]=25;

a[4]=30;

**2) int** a[]=**new** **int**[]{1,2,3,4,5};

**3) int** a[]={1,2,3,4,5};

**Program to find min and max of given elements in array.**

**public** **class** Test

{

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

{

**int** a[]={11,21,32,-14,5,66};

**int** max=a[0];

**int** min=a[0];

**for**(**int** i=1;i<a.length;i++)

{

**if**(a[i]>max)

{

max=a[i];

}

**if**(a[i]<min)

{

min=a[i];

}

}

System.***out***.println ("max ="+max);

System.***out***.println ("min ="+min);

}

}

**Accessing array elements using for-each loop:**

**public** **class** Test

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

{

**int** a[]={10,8,13,18,15,6};

**for** (**int** i : a)

{

System.***out***.println (i);

}

}

}

for loop is for any iterative statements

but for-each loop only for arrays.

with for loop we can skip beginning elements or ending elements .

but for-each loop we should process all elements.

**Array of Strings:**

It is a collection of strings.

String is a class from java.lang package to handle the strings.

**public** **class** Test {

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

{

String [] names={"hadoop","java","html","oracle","hive","sqoop","pig"};

**for**(**int** i=0; i<names.length; i++)

{

System.***out***.println (names[i]);

}

}

}

**Using for-each loop:**

**public** **class** Test {

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

{

String [] names={"hadoop","java","html","oracle","hive","sqoop","pig"};

**for**(String name : names)

{

System.***out***.println (name);

}

}

}

**Searching Techniques:**

1. **Linear search**
2. **Binary search**

**Linear search:**

**It is a searching for the element from the beginning to end .**

**Program for liear search:**

**public** **class** Test {

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

{

**int** [] a={10,18,20,30,35,38,45,49,50,56,65,70,71,80,85,88,90,91,99,100};

**int** num=55;

**boolean** flag=**false**;

**for**(**int** i=0;i<a.length;i++)

{

**if**(num==a[i])

{

flag=**true**;

System.***out***.println ("your num found at a["+i+"]");

**break**;

}

}

**if**(flag==**false**)

{

System.***out***.println ("your number not found");

}

}

}

**Binary Search:**

**It is a searching for the elements in half of the actual number of elements each iteration.**

**public** **class** Test {

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

{

**int** [] a={10,18,20,30,35,38,45,49,50,56,65,70,71,80,85,88,90,91,99,100};

**int** num=86;

**int** l=0, h=a.length-1;

**boolean** flag=**false**;

**while**(l<=h)

{

**int** m=(l+h)/2;

**if**(num==a[m])

{

flag=**true**;

System.***out***.println ("your number found at a["+m+"]");

**break**;

}

**else** **if**(num>a[m])

{

l=m+1;

}

**else**

{

h=m-1;

}

}

**if**(flag==**false**)

{

System.***out***.println ("Your number not found");

}

}

}

Note:

1. In linear search numbers can be random order.
2. In Binary search numbers must be in ascending / descending order.

**Bubble Sorting:**

**public** **class** Test {

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

{

**int** [] a={10,8,12,18,5,3};

System.***err***.println ("before sorting ");

**for**(**int** i=0;i<a.length;i++)

{

System.***out***.print(a[i]+"\t");

}

//bubble sorting

**for**(**int** i=0;i<a.length-1;i++)

{

**for**(**int** j=0;j<a.length-1-i;j++)

{

**if**(a[j]>a[j+1])

{

**int** temp = a[j];

a[j] = a[j+1];

a[j+1]=temp;

}

}

}

System.***err***.println ("After sorting ");

**for**(**int** i=0;i<a.length;i++)

{

System.***out***.print(a[i]+"\t");

}

}

}

# How to sort an Array in Java

ArraySort.java

**package** com.nrit.mnrao.test;

**import** java.util.Arrays;

**public** **class** Sample {

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

**int**[] intArr = {1, 4, 2, 6, 3};

String [] strArr = {"E", "A", "U","O","I"};

//sort int array

Arrays.*sort*(intArr);

Arrays.*sort*(strArr);

System.***out***.println(Arrays.*toString*(intArr));

System.***out***.println(Arrays.*toString*(strArr));

}

}

**Command line parameters**

all command line parameters passes to main( String [] args )

$gedit Test.java

public class Test

{

public static void main( String [] args)

{

int n = args.length;

System.out.println ("No.of elements="+n);

}

}

**compilation:**

$javac Test.java

**execution:**

$java Test hello java world

o/p:

No.of elements=3

**program to display command line parameters.**

$gedit Test.java

public class Test

{

public static void main(String []args)

{

for( int i=0;i<args.length;i++)

{

System.out.println (args[i]);

}//for closing

}//main closing

}//class closing

**compilation:**

$javac Test.java

**execution:**

$java Test hello java world

hello

java

world

**Displaying command line parameters using for-each loop:**

**public** **class** Test

{

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

{

**for** (String word : args) {

System.***out***.println (word);

}

}

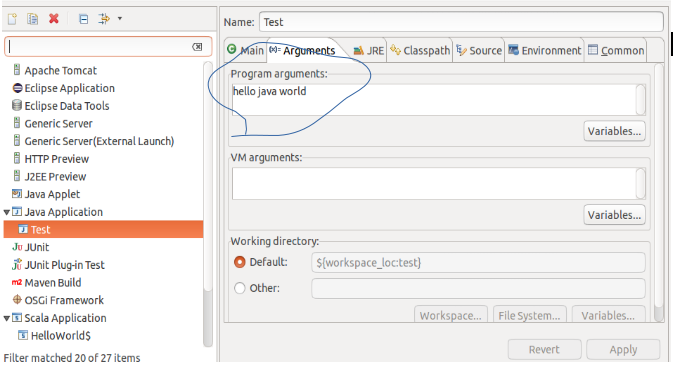
}

**Passing command line parameters in eclipse:**

rt.click --> Runas --> RunConfiguration-->

double click on JavaApplication -->

select name of the class --> Test --> click on arguments Tab -->

then give parameters as below ( hello java world )

**Apply and run**

## 2-Dimensional Array

If you know how to create one dimensional array and fact that multi-dimensional arrays are just array of array in Java, then creating a 2 dimensional array is very easy. Instead of one bracket, you will use two

e.g. int [][] is a [two dimensional integer array](http://java67.blogspot.com/2014/03/how-to-print-array-in-java-example-tutorial.html).

You can define a 2D array in Java as follows :

int [][] matrix = new int[4][2]; // 2D integer array with 4 rows and 2 columns

String [][] cities = new String[3][3]; // OK , 2D String array with 3 rows and 3 columns

String [][] yourArray = new String[5][4]; // OK

int[][] right = new int[2][]; // OK

String [][] myArray = new String[5][]; // OK

String [][] xArray = new String[][4]; //Invalid

int [][] wrong = new int[][]; // Invalid, you must specify 1st dimension

(Base address/reference).length, gives no of elements .

**Eg:**

**int** a[][] = {{1,2,3},{4,5,6},{7,8,9}};// compile time memory allocation

**int** a[][] = **new** **int**[][]{{1,2,3},{4,5,6},{7,8,9}};

// run time memory allocation

a.length 🡪 no of rows

a[0].length : no of elements in 1st row

a[1].length : no of elements in 2nd row

a[2].length : no of elements in 3rd row

a[0][0] : 1st element of 1st row.

a[0][1] : 2nd element of 1st row.

a[0][2] : 3rd element of 1st row.

a[1][0] : 1st element of 2nd row.

a[1][1] : 2nd element of 2nd row.

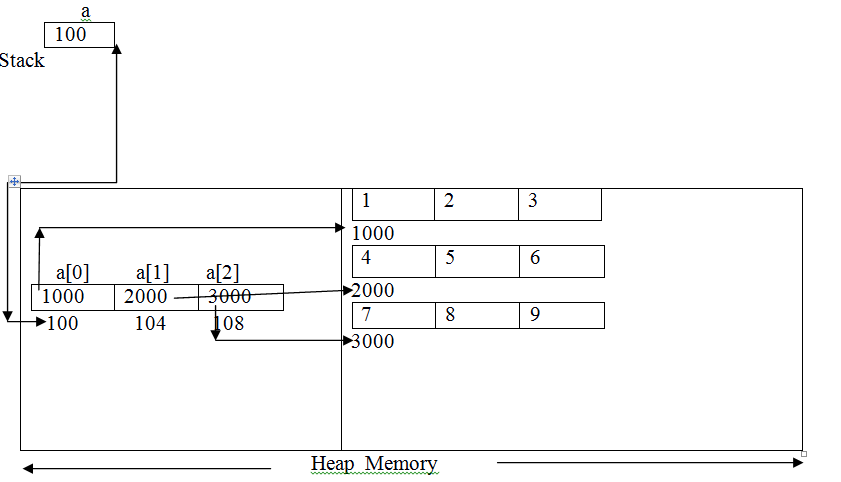
a[1][2] : 3rd element of 2nd row.

a[2][0] : 1st element of 3rd row.

a[2][1] : 2nd element of 3rd row.

a[2][2] : 3rd element of 3rd row.

**Memory Map of Two – Dimensional Arrays**



**Program For the following output :**

1 2 3

4 5 6

7 8 9

**public** **class** Test {

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

**int** [][]a = {{1,2,3},{4,5,6,},{7,8,9}};

**for**(**int** i=0; i<a.length;i++)

{

System.***out***.println ();

**for**(**int** j=0;j<a[i].length;j++)

{

System.***out***.print(a[i][j]+"\t");

}

}

}

}

**public** **class** Test {

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

**int** [][]a = **new** **int** [][]{{1,2,3},{4,5,6},{7,8,9}};

**for**(**int** i=0; i<a.length;i++)

{

System.***out***.println ();

**for**(**int** j=0;j<a[i].length;j++)

{

System.***out***.print(a[i][j]+"\t");

}

}

}

}

**Program For the following output:**

1

1 2

1 2 3

1 2 3 4

1st step:

**int** [][]a;  declaration.

a=**new** **int**[4][];// memory allocation for array of references(rows)

//memory allocation for columns in each row.

**for**(**int** i=0;i<a.length;i++)

{

a[i]= **new** **int**[i+1];

}

//checking for no of rows

System.***out***.println ("no of rows : "+a.length);

//checking for no of cols

System.***out***.println ("1st elements : "+a[0].length);

System.***out***.println ("2nd elements : "+a[1].length);

System.***out***.println ("3rd elements : "+a[2].length);

System.***out***.println ("4th elements : "+a[3].length);

2nd step:

assigning values:

**for**(**int** i=0;i<a.length;i++)

{

**for**(**int** j=0;j<a[i].length;j++)

{

a[i][j]=j+1;

}

}

Display:

**for** (**int** i = 0; i < a.length; i++)

{

System.***out***.println ();

**for** (**int** j = 0; j < a[i].length; j++)

{

System.***out***.print(a[i][j] + "\t");

}

}

**Program for the above**

**public** **class** Test {

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

{

**int** [][] a;

a= **new** **int**[4][];

**for**(**int** i=0;i<a.length;i++)

{

a[i] = **new** **int**[i+1];

}

**for**(**int** i=0;i<a.length;i++)

{

**for**(**int** j=0;j<a[i].length;j++)

{

a[i][j]=j+1;

}

}

System.***out***.println ("elements");

**for**(**int** i=0;i<a.length;i++)

{

System.***out***.println ();

**for**(**int** j=0;j<a[i].length;j++)

{

System.***out***.print(a[i][j]+"\t");

}

}

}

}

**Working with methods**

Method is set of statements to perform some task.

Every statement of method should be terminated with semicolon ( ; )

syntax:

Access\_specifier Return\_type method\_name ( type arg1, type arg2, type arg3, ......)

{

============;

============;

============;

============;

============;

return value;

}

**Access\_specifier :**

1) public

2) protected

3) private.

4) nothing ( default )

**Return\_type:**

depends on return value.

Eg:

return 10; --> return type is  **int.**

Return 10.5; --> return type is  **double.**

No return value --> return type is **void**

**eg:**

**Method with no args and no return value**

public void display()

{

============;

============;

============;

============;

============;

}

**Calling a method:**

**public** **static** **void** main(String[] args) // calling method

{

============;

============;

display(); // calling a method.

============;

============;

}

**public** **void** display()// called method.

{

============;

============;

============;

============;

============;

}

eg:

**public** **class** Test

{

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

{

System.***out***.println ("main start");

*display*();

System.***out***.println ("main end");

}

**public** **static** **void** display()

{

System.***out***.println ("I am in display");

}

}

O/p:

main start

I am in display

main end

**public** **class** Test

{

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

{

System.out.println ("Main start");

System.out.println ("Before display");

display();

System.out.println ("After display");

System.out.println ("Before show");

show();

System.out.println ("after show");

System.out.println ("Main End");

}

**public** **static** **void** display()

{

System.out.println ("I am in display");

}

**public** **static** **void** show()

{

System.out.println ("I am in show");

}

}

Main start

Before display

I am in display

After display

Before show

I am in show

after show

Main End

**public** **class** Test

{

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

{

System.***out***.println ("main start");

System.***out***.println ("before display");

*display*();

System.***out***.println ("after display");

System.***out***.println ("before show");

*show*();

System.***out***.println ("after show");

System.***out***.println ("main end");

}

**public** **static** **void** display()

{

System.***out***.println ("display start");

*show*();

System.***out***.println ("display end");

}

**public** **static** **void** show()

{

System.***out***.println ("I am in show");

}

}

O/P:

main start

before display

display start

I am in show

display end

after display

before show

I am in show

after show

main end

**Recursive method:**

method calling itself is a recursive method:

eg:

**public** **void** display()

{

System.***out***.println ("I am in display");

*display*();

System.***out***.println ("display end");

}

Recursive methods are not recommended. There is a chance of raising stack over flow error.

**Method with parameters /arguments:**

**public** **class** Test

{

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

{

**int** a=10;

**int** b=20;

System.***out***.println ("Main start");

*display*(a,b);

System.***out***.println ("After display");

System.***out***.println ("Before show");

*show*(50,60);

System.***out***.println ("after show");

System.***out***.println ("Main End");

}//main close

**public** **static** **void** display(**int** x, **int** y)

{

System.***out***.println ("I am in display");

System.***out***.println ("args are "+x+"\t"+y);

}//display close

**public** **static** **void** show(**int** x, **int** y)

{

System.***out***.println ("I am in show");

System.***out***.println ("args are "+x+"\t"+y);

//show close

}

}//class close

Main start

I am in display

args are 10 20

After display

Before show

I am in show

args are 50 60

after show

Main End

**Note :** arguments are local to method

**Method with return values :**

**public** **class** Test

{

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

{

**int** a=10;

**int** b=20;

**long** c = *addNum*(a, b);

System.***out***.println ("addition "+c);

c = *subNum*(a, b);

System.***out***.println ("substraction "+c);

c = *mulNum*(a,b);

System.***out***.println ("multiplication "+c);

}//main close

**public** **static** **long** addNum(**int** x, **int** y)

{

**long** temp=x+y;

**return** (temp);

}

**public** **static** **long** subNum(**int** x, **int** y)

{

**long** temp = x-y;

**return** temp;

}

**public** **static** **long** mulNum(**int** x ,**int** y)

{

**long** temp = x\*y;

**return** temp;

}

}//class close

addition 30

substraction -10

multiplication 200

**Return key word without return value:**

This is to terminate the method.

Eg:

**public** **void** display(**int** x, **int** y)

{

================

================

if(cond)

{

**return** ;

}

================

================

}

**Sample program.**

**public** **class** Test

{

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

{

**int** a;

**int** b;

System.***out***.println ("Main start");

a=30;

b=20;

*greater*(a,b);

System.***out***.println ("after *greater* one");

a=20;

b=30;

*greater* (a,b);

System.***out***.println ("after *greater* two");

System.***out***.println ("Main end");

}//main close

**public** **static** **void** *greater* (**int** x, **int** y)

{

System.***out***.println ("*greater* start");

**if**(x>y)

{

**return** ;

}

System.***out***.println ("*greater* end");

}

}//class close

O/P;

Main start

*greater* start

after *greater* one

*greater* start

*greater* end // only one time as condition is true for the first time.

after *greater* two

Main end

**Interview Questions**

1.Why Java has most popularity in software development:

Ans: Independent of Plat form and portabaility

2.can we execute exe file on any plat form ?

Ans : No , exe file is plat form dependent.

3.can we create exe file in Java

Ans : No, can not be created. In java .class is not an exe.

4.How can we achieve independent of plat form and portability in Java

Ans: JVM, is responsible to execute java .class file on any OS.

5.what is the difference between C-Language array and Java array.

Ans: in C-language, array is a variable, whereas in Java it is an Object.

8. What is the difference between continue and break statement?

Ans: break and continue are two important keywords used in Loops. When a break keyword is used in a loop, loop is broken instantly while when continue keyword is used, current iteration is broken and loop continues with next iteration.

9.What are Java Packages? What’s the significance of packages?

Ans: In Java, package is a collection of classes and interfaces which are bundled together as they are related to each other. Use of packages helps developers to modularize the code and group the code for proper re-use. Once code has been packaged in Packages, it can be imported in other classes and used.

10.which is default available package in Java application

Ans:

java.lang package is a default available package in the java applications, hence import not required.

11.can we execute java program with out main method.

Ans: No, we can't

**12.Can we use String with switch case?**

One of the Java 7 feature was improvement of switch case of allow Strings. So if you are using Java 7 or higher version, you can use String in switch-case statements.

**13.What is difference between Heap and Stack Memory?**

Major difference between Heap and Stack memory are as follows:

Heap memory is used by all the parts of the application whereas stack memory is used only by one thread of execution.

Whenever an object is created, it’s always stored in the Heap space and stack memory contains the reference to it. Stack memory only contains local primitive variables and reference variables to objects in heap space.

Memory management in stack is done in LIFO manner whereas it’s more complex in Heap memory because it’s used globally.

**14.Java Compiler is stored in JDK, JRE or JVM?**

The task of java compiler is to convert java program into bytecode, we have javac executable for that. So it must be stored in JDK, we don’t need it in JRE and JVM is just the specs.

**15) What do you mean by platform independence of Java?**

Platform independence means that you can run the same Java Program in any Operating System. For example, you can write java program in Windows and run it in Mac OS.

**16) What is JVM and is it platform independent?**

Java Virtual Machine (JVM) is the heart of java programming language. JVM is responsible for converting byte code into machine readable code. JVM is not platform independent, thats why you have different JVM for different operating systems. We can customize JVM with Java Options, such as allocating minimum and maximum memory to JVM. It’s called virtual because it provides an interface that doesn’t depend on the underlying OS.

**17) What is the difference between JDK and JVM?**

Java Development Kit (JDK) is for development purpose and JVM is a part of it to execute the java programs.

JDK provides all the tools, executables and binaries required to compile, debug and execute a Java Program. The execution part is handled by JVM to provide machine independence.

**18) What is the difference between JVM and JRE?**

Java Runtime Environment (JRE) is the implementation of JVM. JRE consists of JVM and java binaries and other classes to execute any program successfully. JRE doesn’t contain any development tools like java compiler, debugger etc. If you want to execute any java program, you should have JRE installed.

**19) What is difference between path and classpath variables?**

PATH is an environment variable used by operating system to locate the executables. That’s why when we install Java or want any executable to be found by OS, we need to add the directory location in the PATH variable.

Classpath is specific to java and used by java executables to locate class files. We can provide the classpath location while running java application and it can be a directory, ZIP files, JAR files etc.

**20) What is ternary operator in java?**

[Java ternary operator](https://www.journaldev.com/963/java-ternary-operator) is the only conditional operator that takes three operands. It’s a one liner replacement for if-then-else statement and used a lot in java programming. We can use ternary operator if-else conditions or even switch conditions using nested ternary operators.

that have similar functionality at the same time, and hence reduces the amount of time needed for compilation.Here the term “compiler” refers to a translator from the instruction set of a Java virtual machine (JVM) to the instruction set of a specific CPU.

**21) Is Empty .java file name a valid source file name?**

Yes, save your java file by .java only, compile it by **javac .java** and run by **java yourclassname** Let's take a simple example:

//save by .java only

class A{

public static void main(String [] args){

System.out.println ("Hello java");

}

}

**22) What is JIT compiler?**

**Just-In-Time(JIT) compiler:**It is used to improve the performance. JIT compiles parts of the byte code

**23) If I don't provide any arguments on the command line, then the String array of Main method will be empty or null?**

It is empty. But not null.

**24) What if I write static public void instead of public static void?**

Program compiles and runs properly.

**25) What is the default value of the local variables?**

The local variables are not initialized to any default value, neither primitives nor object references.

**26) Why Java does not support pointers?**

Pointer is a variable that refers to the memory address. They are not used in java because they are unsafe(unsecured) and complex to understand.

**OOP's Concept**

Object Oriented Programming was introduced to overcome the dis advantages of C-Language.

**C-Language dis-advantages:**

In Language every thing is global. Data and functions are global.

Data can be accessed from anywhere in the application.

Any function can be called from anywhere.

Since everything is global, there is no security for data. Chance of corrupting data in C-Language.

**OOP ( Object Oriented Programming ) is a concept, it not a language. it provides following features.**

1. Encapsulation
2. Data abstraction

3) Method overloading

4) Constructors

5) Inheritance

6) polymorphism

Any language which supports all the above features, that language is called as Object Oriented Programming Language.

Eg: C++, Java, .Net C# , Scala ( Analytics ) , Python (Analytics)

**Encapsulation** :

It is a binding ( wrapping ) of data and methods in a single unit (called as class ).

Purpose of Encapsulation is to achieve data abstraction.

**Data abstraction** :

It is a hiding data from the outside environment; it can be achieved through the encapsulation.

Purpose of data abstraction is for data security.

**Method Overloading :**

Class with same methods with different signature.

**Constructors:**

It is way of initializing an Object with required values

**Inheritance:**

It an acquiring properties from parent to child. It is for code reusability.

**Polymorphism:**

Same one behaving differently for different purpose.

**Classes and Objects**

**class :** class is an abstract idea or blue print of some thing.

Defining a class :

public class Sample

{

private int a;

private float b; // both are data members (or) instance variables.

public void setData()

{

--------------------

-------------------

-------------------

}// end of setData method

public void display()

{

-------------------

-------------------

-------------------

}/ end of display method

} // end of the class

**Data member :** it holds data of an item and called as field of a record.

**Method :** It defines current state and behavior of an object

Methods are to perform some transaction on data.

Methods are to perform CRUD Operations on data.

**CRUD :** Create, Read , Update and Delete.

class members does not acquire memory with out creating an object.

Object :- It is an instance of the class. When object is created all the members of the class acquires memory. It is collection of data members and methods to manipulate or update the data.

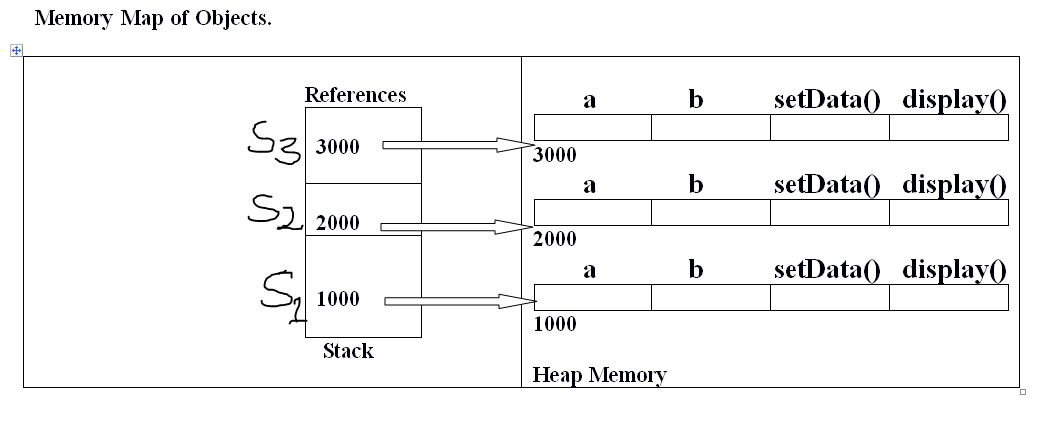
**Creating an object :**

Sample s1 ; // Just it is reference of an Object, not an Object

s1 = new Sample(); // it creates an object

Sample s2=new Sample();

Sample s3=new Sample();



**Invoking methods :**

s1.setData();

s2.setData();

--------------

s1.display();

s2.display();

if any method is invoking through object, then it must be a member of that class.

eg:

**public** **class** Sample

{

**private** **int** a;

**private** **float** b;

**public** **void** setData()

{

a=10;

b=30.5f;

}

**public** **void** display()

{

System.***out***.println ("a="+a+"\tb="+b);

}

}

**public** **class** Test

{

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

{

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3 = **new** Sample();

s1.setData();

s2.setData();

s3.setData();

s1.display();

s2.display();

s3.display();

}

}

O/p:

a=10 b=30.5

a=10 b=30.5

a=10 b=30.5

**Different ways to create an object in Java**

There are five ways to create an object in java.

They are:

By new keyword

By newInstance() method

By clone() method

By deserialization

By factory method etc.

**Anonymous object**

Anonymous simply means nameless. An object which has no reference is known as anonymous object. It can be used at the time of object creation only.

Eg:

**new** Sample().setData();

**new** Sample().display();

**creating multiple objects:**

Sample s1= **new** Sample(), s2=**new** Sample();

**Class methods with arguments :**

**public class Sample**

{

**private** **int** a;

**private** **int** b;

**public** **void** setData(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println ("a="+a+"\tb="+b);

}

}

**public** **class** Test

{

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

{

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3 = **new** Sample();

s1.setData(10,20);

s2.setData(30,40);

s3.setData(25,35);

System.***out***.println ("First Object Details are ");

s1.display();

System.***out***.println ("Second Object Details are ");

s2.display();

System.***out***.println ("Third Object Details are ");

s3.display();

}

}

**Students information:**

**public** **class** Student{

**private** **int** studentId;

**private** String studentName;

**private** **int** studentAge;

**private** **double** studentFee;

**public** **void** setData(**int** id, String name, **int** age, **double** fee)

{

studentId = id;

studentName = name;

studentAge = age;

studentFee = fee;

}

**public** **void** display()

{

System.***out***.println ("STUDENT DETAILS ARE");

System.***out***.println ("ID="+studentId);

System.***out***.println ("NAME="+studentName);

System.***out***.println ("AGE="+studentAge);

System.***out***.println ("FEE="+studentFee);

}

}

**public** **class** Test

{

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

{

Student st1 = **new** Student();

Student st2 = **new** Student();

Student st3 = **new** Student();

st1.setData(1001,"xyz",23,1500);

st2.setData(1002,"abc",24,2000);

st3.setData(1003, "ijk",25,2500);

st1.display();

st2.display();

st3.display();

}

}

**Emplyee information:**

**public** **class** Employee

{

**private** **int** empNumber;

**private** String empName;

**private** **double** empSalary;

**private** String empDept;

**public** **void** setData(**int** eno, String name, **double** salary, String dept)

{

empNumber = eno;

empName = name;

empSalary = salary;

empDept = dept;

}

**public** **void** display()

{

System.***out***.println ("EMP NUMBER : "+empNumber);

System.***out***.println ("EMP NAME: "+empName);

System.***out***.println ("EMP SALARY: "+empSalary);

System.***out***.println ("EMP DEPT: "+empDept);

}

}

**public** **class** Test {

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

Employee e1 = **new** Employee();

Employee e2 = **new** Employee();

Employee e3 = **new** Employee();

e1.setData(1001,"nrit1",5000,"dev");

e2.setData(1002, "abc", 5500, "Testing");

e3.setData(1003, "xyz",6500, "admin");

System.***out***.println ("Emp1 details are");

e1.display();

System.***out***.println ("Emp2 details are");

e2.display();

System.***out***.println ("Emp3 details are");

e3.display();

}

}

**Class with setter methods:**

**public** **class** Employee {

**private** **int** empId;

**private** String empName;

**private** **double** empSalary;

**private** String empDept;

**public** **void** setEmpId(**int** id)

{

empId=id;

}

**public** **void** setEmpName(String name)

{

empName=name;

}

**public** **void** setEmpSalary(**double** salary)

{

empSalary=salary;

}

**public** **void** setEmpDept(String dept)

{

empDept=dept;

}

**public** **void** display()

{

System.***out***.println(empId+"\t"+empName+"\t"+empSalary+"\t"+empDept);

}

}

**public** **class** Test

{

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

{

Employee employee = **new** Employee();

employee.setEmpNum(1001);

employee.setEmpName("NRIT1");

employee.setEmpSalary(5000);

employee.setEmpDept("dev");

employee.display();

employee.setEmpName("NRIT2");

employee.setEmpDept("Admin");

employee.display();

employee.setEmpSalary(7000);

employee.display();

}

}

**Method Overloading**

Method overloading takes place between the same method with different signature

Method signature defines, name of the method, no.of args, type of args and return type of the method.

Method overloading is a compile time process.

First compiler checks no.of arguments, if no.of args are matched then cheks for type of arguments, if type is also matched then ambiguity b/w methods and compiler shows error massage.

Method over loading is compile time binding (or) static binding.

Eg:

Overloading based of no.of arguments :

**public** **class** Sample

{

**public** **void** display()

{

System.***out***.println ("No args");

}

**public** **void** display(**int** x)

{

System.***out***.println ("one args");

}

**public** **void** display(**int** x, **int** y)

{

System.***out***.println ("two args");

}

**public** **void** display(**int** x, **int** y, **int** z)

{

System.***out***.println ("three args");

}

}

**public** **class** Test{

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

Sample s1 = **new** Sample();

s1.display();

s1.display(10);

s1.display(20, 30);

s1.display(10, 20, 30);

}

}

**Method overloading with data :**

**public** **class** Sample

{

**private** **int** a;

**private** **int** b;

**private** **int** c;

**public** **void** setData() {

a=0;

b=0;

c=0;

}

**public** **void** setData(**int** x) {

a = x;

b = 0;

c = 0;

}

**public** **void** setData(**int** x, **int** y) {

a = x;

b = y;

c = 0;

}

**public** **void** setData(**int** x, **int** y, **int** z) {

a = x;

b = y;

c = z;

}

**public** **void** display() {

System.***out***.println ("a="+a+"\tb="+b+"\tc="+c);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3 = **new** Sample();

Sample s4 = **new** Sample();

s1.setData();

s2.setData(15);

s3.setData(10,20);

s4.setData(15,25,30);

System.***out***.println ("First Object");

s1.display();

System.***out***.println ("Second Object");

s2.display();

System.***out***.println ("Third Object");

s3.display();

System.***out***.println ("Fourth Object");

s4.display();

}

}

**Overloading based on type of arguments ( parameters ) :**

**public** **class** Sample

{

**private** **int** a;

**private** **float** b;

**private** **char** ch;

**public** **void** setData()

{

a=0;

b=0.0f ;

ch='\0';

}

**public** **void** setData(**int** x, **float** y)

{

a=x;

b=y;

}

**public** **void** setData(**int** x, **char** y)

{

a=x;

ch=y;

}

**public** **void** setData(**float** x, **char** y )

{

b=x;

ch=y;

}

**public** **void** display()

{

System.***out***.println ("a="+a+"\tb="+b+"\tch="+ch);

}

}

**public** **class** Test

{

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

{

**int** i=10;

**float** f=30.5f;

**char** c='a';

Sample s1 = **new** Sample();

s1.setData();

System.***out***.println ("Initial Details");

s1.display();

s1.setData(i,f);

System.***out***.println ("After first time change");

s1.display();

s1.setData(i,c);

System.***out***.println ("After second time change");

s1.display();

}

}

Note :

Method Overloading never check for return type.

**Method Overloading and Type Promotion**

any data can be passed to any type of argument, if size of data is less than the size of argument.

Real number cannot be promoted as integer.

char, byte, short and int can be passed to int type of argument.

char type of data, can also be passed to int type of argument.

Integer type of data can be promoted as real number ( float / double )

Q1.What is data encapsulation and what’s its significance?

Ans: Encapsulation is a concept in Object Oriented Programming for combining properties and methods in a single unit.

Encapsulation helps programmers to follow a modular approach for software development as each object has its own set of methods and variables and serves its functions independent of other objects. Encapsulation also serves data hiding purpose.

**Java static**

Static is an access modifier in java

The static keyword in java is used for memory management mainly. We can apply java static keyword with variables, methods, blocks and nested class. The static keyword belongs to the class than instance of the class.

**The static can be used with:**

1) static Data member (also known as class variable)

2) static method (also known as class method)

3) static block

4) static inner classes

5) static import.

**1) Class Data member as static**

If you declare any data member as static, it is known static data member.

The static variable can be used to refer the common property of all objects (that is not unique for each object) e.g. company name of employees, college name of students etc.

The static variable gets memory only once in class area at the time of class loading.

Default value of static data member is 0.

All static members of the class acquire memory without creating an object. These are not part of object.

For static data members only one copy will be created and that can be shared by all objects of the class.

It is a sharable memory.

These members can be shared by all objects of the class.

These can accessed eighther by class name or through the object.

Eg:

class Test {

int a, b ;

static int n :

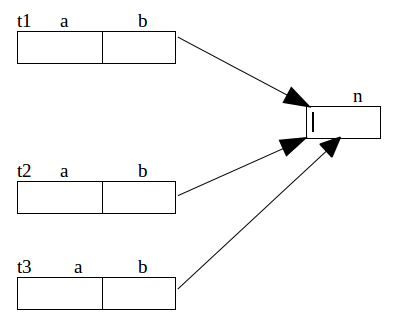
}

there are three objects created for the above class, for static data member 'n' only one copy is created but for non static member 'a' and 'b' separate copy is created for ever object ( three copies ).

Test t1 = new Test();

Test t2 = new Test();

Test t3 = new Test();



**Program to count the number of objects created.**

**public** **class** Sample {

**private** **int** n;

**private** **static** **int** *counter*;

**public** **void** setData() {

n = ++*counter*;

}

**public** **void** display() {

System.***out***.println ("Current Object " + n);

System.***out***.println ("Total Objects " + *counter*);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3 = **new** Sample();

s1.setData();

s2.setData();

s3.setData();

s1.display();

s2.display();

s3.display();

}

}

O/p:

current Object : 1

Total Objects : 3

current Object : 2

Total Objects : 3

current Object : 3

Total Objects : 3

What is output of the following program.

**public** **class** Sample

{

**private** **int** n;

**private** **int** counter;

**public** **void** setData()

{

n=++counter;

}

**public** **void** display()

{

System.***out***.println ("Current Object : "+n);

System.***out***.println ("Total no of Objects : "+counter);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3 = **new** Sample();

s1.setData();

s2.setData();

s3.setData();

s1.display();

s2.display();

s3.display();

}

}

**O/P:**

Current Object : 1

Total no of Objects : 1

Current Object : 1

Total no of Objects : 1

Current Object : 1

Total no of Objects : 1

All static members of the class acquire memory with reference of class name without creating an object.

These members can be accessed either through object or by the class name.

Accessing static data by the name of the class --> classname.member ,

Eg :

in the Test class

Test.n;

Since static data members acquire memory with reference of the class, these are called as class variable.

Static data member is class level.

Instance variable is a instance level.

**Accessing static data member without object.**

**public** **class** Sample

{

**private** **int** n;

**static** **int** *counter*;

**public** **void** setData()

{

n=++*counter*;

}

**public** **void** display()

{

System.***out***.println ("Current Object : "+n);

System.***out***.println ("Total no of Objects : "+*counter*);

}

}

**public** **class** Test {

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

System.***out***.println (Sample.*counter*);

Sample.*counter*=Sample.*counter*+10;

Sample.*counter*=Sample.*counter*+20;

System.***out***.println (Sample.*counter*);

}

}

**O/p: 0 30**

**Types of variables :**

there are three types of variables:

1) local variables

2) instance variables

3) class variables

eg:

**public** **class** Sample

{

**int** a; // instance variable

**static** **int** *n*; //class variable

**public** **void** display()

{

**int** x; // local variable.

}

}

**Static data members are used in the following situations/scenarios :**

1) To maintain common data for all the instances

2) To provide auto increment in application

3) To act like a counter variable in the application ( at the server side )

eg: to count no. of clients login into a server.

In real time applications data members are private to achieve data security .

To access these private members, public methods are introduced.

Public methods are acting as interface between private data and outside environment.

Eg:

**public** **class** Sample {

**private** **int** a;

**private** **int** b;

**public** **void** setData(**int** x, **int** y) {

a = x;

b = y;

}

**public** **void** display() {

System.***out***.println (a + "\t" + b);

}

}

**public** **class** Test {

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

// below data is a public data.

**int** a=10;

**int** b=20;

Sample s1 = **new** Sample();

// below statement is to make public data as private.

//here setData() takes the public data and stores into object.

s1.setData(a,b);

s1.display();

}

}

**Static method :**

Static methods also like a static data members, it acquires memory without creating an object.

All static members acquires memory by the name of the class without creating an object.

**Declaration of static method :**

class Test

{

public static void display()

{

=============;

=============;

}

}

static method acquires memory as soon as class gets loaded into the memory (without any class instance)

Static method can be called by the reference of class name or though the object.

Eg :

calling by the class name --> Test.display();

main purpose of static method is to access private static data member.

**Counting no.of objects created using static method**

**public** **class** Sample

{

**private** **int** n;

**private static** **int** *counter*;

**public** **void** setData()

{

n = ++*counter*;

}

**public** **void** display()

{

System.***out***.println ("Current Object " + n);

}

**public** **static** **void** showCount()

{

System.***out***.println ("Total Objects " + *counter*);

}

}

**public** **class** Test

{

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

{

Sample.*showCount*();

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3 = **new** Sample();

s1.setData();

s2.setData();

s3.setData();

s1.display();

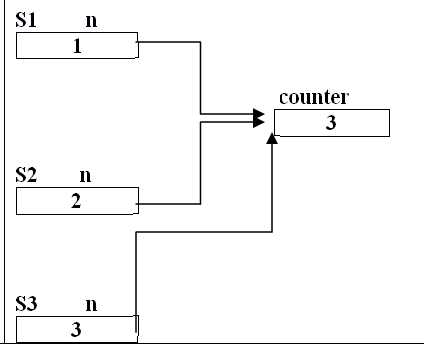
s2.display();

s3.display();

Sample.*showCount*();

}

}



Static method can access only static data members and static methods

Reason:

Static method acquires memory without any object but for non static members object is required.

non static method can access any member ( static or non static members )

**public** **class** Sample

{

**private** **int** x;

**public** **void** setData(**int** x)

{

x=x;

}

**public** **void** display()

{

System.***out***.println (x);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

s1.setData(10);

s1.display();

}

}

**O/p: 0**

**Using this keyword we can get correct output**

**1.Can we overload main method?**

Yes, we can have multiple methods with name “main” in a single class. However if we run the class, java runtime environment will look for main method with syntax as public static void main(String [] args).

**2.What is static keyword?**

static keyword can be used with class level variables to make it global i.e all the objects will share the same variable.

static keyword can be used with methods also. A static method can access only static variables of class and invoke only static methods of the class.

Read more in detail at java static keyword.

**3.Can we declare a class as static?**

We can’t declare a top-level class as static however an inner class can be declared as static. If inner class is declared as static, it’s called static nested class.

Static nested class is same as any other top-level class and is nested for only packaging convenience.

**4.What is static block?**

Java static block is the group of statements that gets executed when the class is loaded into memory by Java ClassLoader. It is used to initialize static variables of the class. Mostly it’s used to create static resources when class is loaded.

**5. What is the importance of main method in Java?**

main() method is the entry point of any standalone java application. The syntax of main method is public static void main(String [] args).

main method is public and static so that java can access it without initializing the class. The input parameter is an array of String through which we can pass runtime arguments to the java program.

**6) Can we declare a class as static?**

We can’t declare a top-level class as static however an inner class can be declared as static. If inner class is declared as static, it’s called static nested class.  
Static nested class is same as any other top-level class and is nested for only packaging convenience.

**7) What is static import?**

If we have to use any static variable or method from other class, usually we import the class and then use the method/variable with class name.

import java.lang.Math;

//inside class

double test = Math.PI \* 5;

We can do the same thing by importing the static method or variable only and then use it in the class as if it belongs to it.

import static java.lang.Math.PI;

//no need to refer class now

double test = PI \* 5;

Use of static import can cause confusion, so it’s better to avoid it. Overuse of static import can make your program unreadable and unmaintainable.

**8) What is difference between object oriented programming language and object based programming language?**

Object based programming languages follow all the features of OOPs except Inheritance. Examples of object based programming languages are JavaScript, VBScript etc.

**9) What if the static modifier is removed from the signature of the main method?**

Program compiles. But at runtime throws an error "NoSuchMethodError".

**10) What is difference between static (class) method and instance method?**

|  |  |
| --- | --- |
| **static or class method** | **instance method** |
| 1)A method i.e. declared as static is known as static method. | A method i.e. not declared as static is known as instance method. |
| 2)Object is not required to call static method. | Object is required to call instance methods. |
| 3)Non-static (instance) members cannot be accessed in static context (static method, static block and static nested class) directly. | static and non-static variables both can be accessed in instance methods. |
| 4)For example: public static int cube(int n){ return n\*n\*n;} | For example: public void msg(){...}. |
| **11.What will happen if static modifier is removed from the signature of the main method?** |  |

**12. How we can execute any code even before main method?**

Ans: If we want to execute any statements before even creation of objects at load time of class, we can use a static block of code in the class. Any statements inside this static block of code will get executed once at the time of loading the class even before creation of objects in the main method.

**This keyword in java**

**What is this in java ?**

In java, this is a reference variable ( pointer ) that refers to the current object.

this key word to refer to Current object.

Current object --> it is an object, which is responsible to invoke a method.

When object is created, for each and every object this pointer generates and stores address of same object.

Hence this pointer refer to the current object.

**Usage of java this keyword**

Here is given usages of java this keyword.

1. this keyword can be used to refer current class instance variable.
2. if class data member name and method argument names are same, to access class data member we can use this keyword.
3. if class data member name and local variable name is same, to access class data member we can use this keyword.
4. this keyword can also be used to return the current class instance.
5. this() can be used to invoke current class constructor.
6. this keyword can be used to invoke current class method (implicitly)
7. this can be passed as an argument in the method call.

When over object is created for every object reference variable will be created.

Accessing :

this.member;

if class data member name and method argument name are same, to access class data member we can use this keyword.

eg:

**public** **class** Sample {

**private** **int** x;

**public** **void** setData(**int** x)

{

**this**.x = x;

}

**public** **void** display()

{

System.***out***.println (x);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

s1.setData(10);

s1.display();

}

}

**Another use of this.**

if class data member name and local variable name is same, to access class data member we can use this keyword.

**public** **class** Sample

{

**private** **int** a;

**public** **void** setData(**int** x)

{

a = x;

}

**public** **void** display()

{

**int** a = 50;

System.***out***.println ("local a " + a);

System.***out***.println ("class a " + **this**.a);

}

}

**public** **class** Test

{

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

{

Sample s1 = **new** Sample();

s1.setData(10);

s1.display();

}

}

When object is created, for each and every object this pointer generates and stores the address of same object.

i.e this pointer referring to current Object.

**Memory map of this reference variable.**

**public** **class** Sample

{

**private** **int** a;

**private** **int** b;

**public** **void** setData()

{

a=10;

b=20;

}

**public** **void** display()

{

System.***out***.println ("a="+a+"\tb="+b);

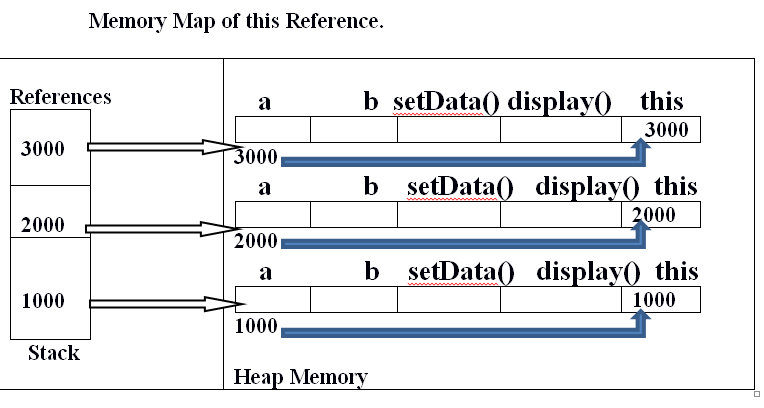
}

}

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3 = **new** Sample();

****

**class with setter and getter methods :**

**public** **class** Employee

{

**private** **int** empNum;

**private** String empName;

**private** **double** empSalary;

**private** **char** empGender;

**public** **int** getEmpNum()

{

**return** empNum;

}

**public** **void** setEmpNum(**int** empNum)

{

**this**.empNum = empNum;

}

**public** String getEmpName()

{

**return** empName;

}

**public** **void** setEmpName(String empName)

{

**this**.empName = empName;

}

**public** **double** getEmpSalary()

{

**return** empSalary;

}

**public** **void** setEmpSalary(**double** empSalary)

{

**this**.empSalary = empSalary;

}

**public** **char** getEmpGender()

{

**return** empGender;

}

**public** **void** setEmpGender(**char** empGender)

{

**this**.empGender = empGender;

}

}// Sample class end.

**public** **class** Test {

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

Employee employee1 = **new** Employee();

employee1.setEmpNum(1001);

employee1.setEmpName("nrit1");

employee1.setEmpSalary(5000);

employee1.setEmpGender('M');

**int** eno = employee1.getEmpNum();

String name = employee1.getEmpName();

**double** salary = employee1.getEmpSalary();

**char** gender = employee1.getEmpGender();

System.***out***.println(eno + "\t" + name + "\t" + salary + "\t" + gender);

Employee employee2 = **new** Employee();

employee2.setEmpNum(1002);

employee2.setEmpName("nrit2");

employee2.setEmpSalary(6000);

employee2.setEmpGender('F');

System.***out***.println(employee2.getEmpNum() + "\t" + employee2.getEmpName() + "\t" + employee2.getEmpSalary()

+ "\t" + employee2.getEmpGender());

}

}// end of Test class.

=======================

Class with setter and getter methods is called POJO class or bean class or model class.

POJO 🡪 Plain Old Java Object.

POJO 🡪 Core java related.

bean class or model class🡪 related to MVC frame works.

**public** **class** Sample {

**int** a;

**int** b;

**public** **void** setData(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println(a+"\t"+b);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

s1.setData(10, 20);

Sample s2 = s1;

s1.display();

s2.display();

}

}

O/p: 10 20

10 20

same for both, since they are referring to same location.

**Call by value and Call by reference in Java:**

**Call by value methods:**

Passing variable to method is a call by value. For variables no call by reference concept in java.

**public** **class** Test

{

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

**int** a=10;

**int** b=20;

System.***out***.println("before call to swap method");

System.***out***.println(a+"\t"+b);

*swap*(a,b);

System.***out***.println("After call to swap method");

System.***out***.println(a+"\t"+b);

}

**public** **static** **void** swap(**int** x, **int** y)

{

**int** temp;

temp=x;

x=y;

y=temp;

}

}

O/P:

before call to swap method

10 20

After call to swap method

10 20

In call by value the changes made on the arguments will not be reflected on the actual variables ( passing variables)

**Call by reference method:**

**Passng object to method is a call by reference in java. There is no call by value concept for objects.**

**public** **class** Test

{

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

Sample s1 = **new** Sample();

s1.setData(10, 20);

System.***out***.println("before call to updateData method");

s1.display();

*updateData*(s1);

System.***out***.println("After call to updateData method");

s1.display();

}

**public** **static** **void** updateData(Sample x)

{

x.setData(50, 60);

}

}

**=============================**

Another eg:

**public** **class** Employee {

**private** **int** empNum;

**private** String empName;

**private** **double** salary;

**private** String empDept;

**public** **int** getEmpNum() {

**return** empNum;

}

**public** **void** setEmpNum(**int** empNum) {

**this**.empNum = empNum;

}

**public** String getEmpName() {

**return** empName;

}

**public** **void** setEmpName(String empName) {

**this**.empName = empName;

}

**public** **double** getSalary() {

**return** salary;

}

**public** **void** setSalary(**double** salary) {

**this**.salary = salary;

}

**public** String getEmpDept() {

**return** empDept;

}

**public** **void** setEmpDept(String empDept) {

**this**.empDept = empDept;

}

}

**public** **class** Test

{

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

Employee employee = **new** Employee();

employee.setEmpNum(1001);

employee.setEmpName("nrit");

employee.setSalary(5000);

employee.setEmpDept("admin");

System.***out***.println("data delivering....");

*sendData*(employee);

System.***out***.println("data delivered");

}

**public** **static** **void** sendData(Employee emp)

{

**int** empNum = emp.getEmpNum();

String empName = emp.getEmpName();

**double** salary = emp.getSalary();

String empDept = emp.getEmpDept();

System.***out***.println(empNum+"\t"+empName+"\t"+salary+"\t"+empDept);

}

}

Another eg:

**public** **class** Test

{

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

Employee employee = **new** Employee();

System.***out***.println("data receiving....");

*recvData*(employee);

System.***out***.println("data received");

**int** empNum = employee.getEmpNum();

String empName = employee.getEmpName();

**double** salary = employee.getSalary();

String empDept = employee.getEmpDept();

System.***out***.println(empNum+"\t"+empName+"\t"+salary+"\t"+empDept);

}

**public** **static** **void** recvData(Employee emp)

{

emp.setEmpNum(1001);

emp.setEmpName("nrit");

emp.setSalary(6000);

emp.setEmpDept("dev");

}

}

**Another Eg:**

**public** **class** Test

{

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

Employee employee = **new** Employee();

System.***out***.println("data receiving....");

*recvData1*(employee);

System.***out***.println("data received");

**int** empNum = employee.getEmpNum();

String empName = employee.getEmpName();

**double** salary = employee.getSalary();

String empDept = employee.getEmpDept();

System.***out***.println(empNum+"\t"+empName+"\t"+salary+"\t"+empDept);

}

**public** **static** **void** recvData1(Employee employee)

{

*recvData2*(employee);

employee.setSalary(6000);

employee.setEmpDept("dev");

}

**public** **static** **void** recvData2(Employee employee)

{

employee.setEmpNum(1001);

employee.setEmpName("nrit");

}

}

**Method returning current object:**

**public** **class** Sample {

**private** **int** a;

**private** **int** b;

**public** **void** setData(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println(a+"\t"+b);

}

**public** Sample myCopy()

{

**return** **this**;

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

s1.setData(10, 20);

Sample s2 = s1.myCopy();

s1.display();

s2.display();

}

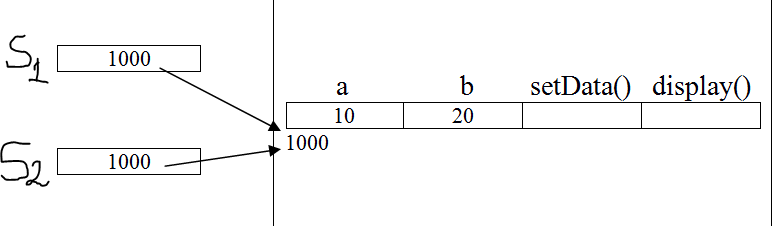
}

O/p: 10 20

10 20

same for both, since they are referring to same location.

Memory map for the above.



This keyword (pointer ) should not be used in the static methods, because static method acquires memory without creating an object but **“this”** reference will not be created without any object.

Since static method do not have current object, this key word should not be used with static methods.

Eg:

public class Sample {

private int a;

public void setData(int x) {

a = x;

}

public void display() {

System.*out*.println(a);

this.a = 10;

}

public static void showData() {

int a = 50;

***System.out.println(this.a);// invalid***

}

}

**1.What is this keyword?**

this keyword provides reference to the current object and it’s mostly used to make sure that object variables are used, not the local variables having same name.

**2.What is the default value of an object reference declared as an instance variable?**

Null, unless it is defined explicitly.

**Constructors**

Constructor is a member of the class, it is like a method, which is invoked automatically when object is created.

The purpose of the constructor is to initialize objects with required values.

Constructor invoking implicitly when object is created.

Whereas method to be invoked by the developer explicitly.

**Rules to define a constructor :**

1) Name of the constructor should be the same as the class name.

2) Constructor must me public

3) Constructor should not have any return type not even void also. Implicitly it returns its own type.

4) constructor can have arguments like a method

5) constructor can be overloaded

6) constructor should not be static, abstract, final, synchronize, transient, native and volatile

7) constructors can not be inherited.

8) constructor cannot be overridden.

**Types of constructors :**

There are two types of constructors in java

1) default constructor --> it is a constructor without any parameters

2) parameterized constructor --> it is a constructor with parameters .

**Working with default constructor :**

**public** **class** Sample {

**public** Sample()

{

System.***out***.println ("Constructor called");

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3=null; //it is reference, object not created.

}

}

O/P;

Constructor called

Constructor called

**Initializing an object :**

**public** **class** Sample {

**private** **int** a;

**private** **float** b;

**private** **char** ch;

**public** Sample()

{

a=10;

b=20.6f;

ch='a';

}

**public** **void** display()

{

System.***out***.println (a);

System.***out***.println (b);

System.***out***.println (ch);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

Sample s2 = **new** Sample();

Sample s3=**null**;

s1.display();

s2.display();

s3.display();//throws NullPointerException.

}

}

default constructors are used to initialize all objects with same values.

Method can not be invoked through the null reference. It throws NullPointerException

Eg: min balance in bank account and min age of employment is same for all.

Company name is same for all employes

Another example :

empNum and salary auto initialization.

**public** **class** Employee {

**private** **int** empNum;

**private** String empName;

**private** **double** empSalary;

**private** **char** empGender;

**private** **static** **int** *counter*=1000;

**public** Employee()

{

empNum=++*counter*; // assigning empnum automatically

empSalary=5000;// default salary for any employee.

}

**public** **int** getEmpNum() {

**return** empNum;

}

**public** String getEmpName() {

**return** empName;

}

**public** **void** setEmpName(String empName) {

**this**.empName = empName;

}

**public** **double** getEmpSalary() {

**return** empSalary;

}

**public** **void** setEmpSalary(**double** empSalary) {

**this**.empSalary = empSalary;

}

**public** **char** getEmpGender() {

**return** empGender;

}

**public** **void** setEmpGender(**char** empGender) {

**this**.empGender = empGender;

}

@Override

**public** String toString() {

**return** "Employee [empNum=" + empNum + ", empName=" + empName + ", empSalary=" + empSalary + ", empGender="

+ empGender + "]";

}

}

**public** **class** Test {

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

Employee employee1 = **new** Employee();

employee1.setEmpName("nrit1");

employee1.setEmpGender('M');

Employee employee2 = **new** Employee();

employee2.setEmpName("nrit2");

employee2.setEmpGender('F');

Employee employee3 = **new** Employee();

employee3.setEmpName("nrit3");

employee3.setEmpGender('M');

Employee employee4 = **new** Employee();

employee4.setEmpName("nrit4");

employee4.setEmpGender('F');

System.***out***.println(employee1);

System.***out***.println(employee2);

System.***out***.println(employee3);

System.***out***.println(employee4);

}

}

Eg:

**Another example:**

**public** **class** DatabaseServer {

**private** String dbHost;

**private** String dbName;

**private** String dbUid;

**private** String dbPasswd;

**public** DatabaseServer()

{

dbHost="localhost";

dbName="nrit";

dbUid="scott";

dbPasswd="tiger";

}

**public** String getDbHost() {

**return** dbHost;

}

**public** **void** setDbHost(String dbHost) {

**this**.dbHost = dbHost;

}

**public** String getDbName() {

**return** dbName;

}

**public** **void** setDbName(String dbName) {

**this**.dbName = dbName;

}

**public** String getDbUid() {

**return** dbUid;

}

**public** **void** setDbUid(String dbUid) {

**this**.dbUid = dbUid;

}

**public** String getDbPasswd() {

**return** dbPasswd;

}

**public** **void** setDbPasswd(String dbPasswd) {

**this**.dbPasswd = dbPasswd;

}

**public** **void** display() {

System.***out***.println ("Server :" + getDbHost());

System.***out***.println ("Database : " + getDbName());

System.***out***.println ("Db user id : " + getDbUid());

System.***out***.println ("Db password " + getDbPasswd());

}

}

**public** **class** Test {

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

DatabaseServer db = **new** DatabaseServer();

System.***out***.println ("Connecting to server:");

db.display();

db.setDbHost("192.10.20.1");

db.display();

db.setDbUid("java");

db.setDbPasswd("java123");

db.display();

System.***out***.println ("currecnt uid:"+db.getDbUid());

System.***out***.println ("currecnt server location :"+db.getDbHost());

}

}

**Working with parameterized constructor :**

**public** **class** Sample {

**private** **int** a;

**private** **int** b;

**public** Sample() {

a = 10;

b = 20;

}

**public** Sample(**int** x, **int** y) {

a = x;

b = y;

}

**public** **void** display() {

System.***out***.println (a);

System.***out***.println (b);

}

}

**public** **class** Test {

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

Sample s1= **new** Sample();

Sample s2= **new** Sample(40,50);

Sample s3= **new** Sample(70,80);

s1.display();

s2.display();

s3.display();

}

}

parameterized constructor is used to initialize the object with different values .

**Class with default and parameterized constructors.**

class Test {

private int a, b ;

public Test() {

a=0;

b=0;

}

public Test(intx, int y) {

a=x;

b=y;

}

void display() {

System.out.println ( “ a= “ + a + “ b= “ +b);

}

}

public class MultiConstructorTest {

public static void main( String [] args ) {

Test t1 = new Test(); // if default constructor is not defined then it is a compilation error.

Test t2 = new Test( 10,15);

t1.display();

t2.display();

}

}

if default constructor is not defined, then compiler generates a default constructor for every class.

If class contains at least one user defined constructor, then compiler will not generate default constructor.

If class contains constructors then one of the constructors must be a default constructor.

**Eg:**

**public** **class** Sample {

**private** **int** a;

**private** **int** b;

**public** Sample(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println(a+"\t"+b);

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample(); // compile time error as compiler not generating

any default constructor.

Sample s2 = **new** Sample(10,20);

Sample s3 = **new** Sample(50,60);

s1.display();

s2.display();

s3.display();

}

}

**Constructor overloading :**

This is similar to method overloading,

it takes place based no.of arguments and type of arguments.

At compile time compiler first check for the no.of args, if no.of args are matched then checks for the type args, if type is also matched between constructors then ambiguity between the constructors and compilation error.

**Overloading is based on number of arguments.**

**public class** Test {

**private** **int** a;

**private** **int** b;

**private** **int** c ;

**public** Test() {

a=0;

b=0;

c=0;

}

**public** Test(**int** x) {

a=x;

b=0;

c=0;

}

**public** Test(**int** x, **int** y) {

a=x;

b=y;

c=0;

}

**public** Test(**int** x, **int** y, **int** z) {

a=x;

b=y;

c=z;

}

**void** display() {

System.out.println ( “ a= “ + a + “ b= “ +b+” c= “ +c);

}

}

**public** **class** ConstructorOverLoadTest {

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

Test t1 = **new** Test();

Test t2 = **new** Test( 10, 15);

Test t3 = **new** Test(1,2,3);

t1.display();

t2.display();

t3.display();

}

}

**Constructor Overloading based on type of arguments**

**class** Test {

**private** **int** a;

**private** **float** b;

**private** **char** ch;

**public** Test() {

a=0;

b=0.0f;

ch=0;

}

**public** Test(**int** x, **float** y ) {

a=x;

b=y;

}

**public** Test(**int** x, **char** y) {

a=x;

ch=y;

}

**public** Test(**float** x, **char** y) {

b=x;

ch=y;

}

**void** display() {

System.out.println (“ a= “+a”+ b= “+b+” ch= “+ch );

}

}// end of class Test

public class ConstructorOverLoadTypeTest {

public static void main(String [] args ) {

Test t1 = new Test();

int i=10;

float f = 11.5f;

char c1 = 'a';

Test t2 = new Test(i,f);

Test t3 = new Test(f,c1);

t1.display();

t2.display();

t3.display();

}

}

An Object can be initialized in three ways

1. Class Level
2. Initialize block
3. Constructor

**class level initialization :**

class Test {

private int a = 10;

private float b = 15.5f;

}

Test t1 = new Test();

**initialize block :**

class Test {

{

======;

======;

======;

}

}

Initialize block executes before going to execute a constructor.

**public** **class** Sample

{

{

System.***out***.println ("Initialize block1");

}

**public** Sample()

{

System.***out***.println ("constructor");

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

}

}

**Class with multiple initialize blocks**.

**public** **class** Sample

{

{

System.***out***.println ("Initialize block1");

}

**public** Sample()

{

System.***out***.println ("constructor");

}

{

System.***out***.println ("Initialize block2");

}

**public** **void** display()

{

System.***out***.println ("I am in display");

}

{

System.***out***.println ("Initialize block3");

}

}

**public** **class** Test {

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

Sample s1 = **new** Sample();

}

}

init block executes for every Object.

There is no order of writing initialize blocks, it can be written anywhere in the class.

A class can have multiple initialize blocks

If class contains multiple initialize blocks then order of execution is top to bottom.

Purpose of initialize block is to initialize constants;

Purpose of Multiple initialize blocks are to segregate constants for easy understanding code ( as per coding standards )

Segregate 🡪 grouping.

**Static block :**

class Test {

static {

========;

========;

}

}

Eg:

class Test {

static

{

System.out.println ( “ Static block “);

}

{

System.out.println ( “ Init block “);

}

public Test() {

System.out.println (“ Constructor “);

}

}

public class StaticInitBlockTest {

public static void main( String [] arg ) {

Test t1 = new Test();

Test t2 = new Test();

}

}

O/p :

Static block.

Init block

constructor

init block

constructor

Static block is executed only for the first time created object. Because it is common for all the objects.

Static block can be defined any where in the class.

A class can have multiple static blocks. The order of execution is from top to bottom.

The purpose of static block is to initialize the static constants.

Purpose multiple static blocks are to segregate mutilple static constants.

**Invoking current class constructor:**

**public** **class** Sample {

**public** Sample()

{

System.***out***.println("default constructor");

}

**public** Sample(**int** x, **int** y)

{

**this**();

System.***out***.println("two args");

}

**public** Sample(**int** x, **int** y, **int** z)

{

**this**(10,20);

System.***out***.println("three args");

}

}

**public** **class** Test {

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

{

Sample s1 = **new** Sample(1,2,3);

}

}

O/P:

default constructor

two args

three args

the statement, which makes a call to another constructor must be 1st statement inside the constructor.

Eg:

**public** **class** Sample {

**public** Sample()

{

System.***out***.println("default constructor");

}

**public** Sample(**int** x, **int** y)

{

System.***out***.println("two args");

**this**();// invalid compile time error.

}

**public** Sample(**int** x, **int** y, **int** z)

{

System.***out***.println("three args");

**this**(10,20);// invalid compile time error.

}

}

**Method can be a recursive but constructor can not be called recursively.**

**public** **class** Sample {

**public** Sample()

{

System.***out***.println("default constructor");

}

**public** Sample(**int** x, **int** y)

{

System.***out***.println("two args");

}

**public** Sample(**int** x, **int** y, **int** z)

{

**this**(10,20,30); **// Recursive caling is not valid for constructors.**

System.***out***.println("three args");

}

}

1. When the constructor of a class is invoked?

Ans: The constructor of a class is invoked every time an object is created with new keyword.

2. Can a class have multiple constructors?

Ans: Yes, a class can have multiple constructors with different parameters. Which constructor gets used for object creation depends on the arguments passed while creating the objects.

3. How objects of a class are created if no constructor is defined in the class?

Ans: Even if no explicit constructor is defined in a java class, objects get created successfully as a default constructor is implicitly used for object creation. This constructor has no parameters.

4. Can we call the constructor of a class more than once for an object?

Ans: Constructor is called automatically when we create an object using new keyword. It’s called only once for an object at the time of object creation and hence, we can’t invoke the constructor again for an object after its creation.

5. Can we have two methods in a class with the same name?

Ans: We can define two methods in a class with the same name but with different number/type of parameters. Which method is to get invoked will depend upon the parameters passed.

**Inheritance**

It is an acquiring parent properties into child.

Def. : It is a creation of new classes from existing classes. It as an acquiring old class properties into new class.

Old class is a parent class and new class is child class.

It is a reusability of existing resources.

**Types of inheritance :**

**Java provides three types of inheritance:**

1) Single inheritance

2) Multi level inheritance

3) Hierarchical Inheritance

**1) Single inheritance**

|  |
| --- |
| Super / Parent class |

|  |
| --- |
| Sub / Child class |

extends is a keyword to create child class from the parent class :

**Syntax :**

class Parent {

=============;

=============;

=============;

}

class Child extends Parent {

=============;

=============;

=============;

}

A class can extend from only single class, since java does not support multiple inheritance

Dis-advantage of multiple inheritance, chance creating duplicate copies at the child class level.

Eg:

**public** **class** Sample {

**int** a;

**int** b;

**public** **void** setAB(int x, int y)

{

a=x;

b=y;

}

**public** **void** dispAB()

{

System.***out***.println (a+"\t"+b);

}

}

**public** **class** Test **extends** Sample {

**int** c;

**int** d;

**public** **void** setData(int x, int y, int z, int k)

{

setAB(x,y);

c=z;

d=k;

}

**public** **void** display()

{

dispAB();

System.***out***.println (c+"\t"+d);

}

}

**public** **class** InheritTest {

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

Test t1 = **new** Test();

t1.setData(10,20,30,40);

t1.display();

}

}

Eg:

**Super class and sub class with same methods :**

Parent class and child class contains same methods with same signature then method Overriding takes place.

Method overriding is a redefining parent class method in the child class.

Purpose of method overriding is to changing or extending functionality of existing methods ( parent class methods )

**public** **class** Sample {

**public** **void** display()

{

System.***out***.println ("Sample");

}

}

**public** **class** Test **extends** Sample {

**public** **void** display()

{

System.***out***.println ("Test");

}

}

**public** **class** InheritTest {

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

Test t1 = **new** Test();

t1.display();

}

}

o/p : Test

reason, method overriding .

**Invoking super class method :**

**Super is a key word to invoke parent class methods.**

**public** **class** Sample {

**public** **void** display()

{

System.***out***.println ("Sample");

}

}

**public** **class** Test **extends** Sample {

**public** **void** display()

{

**super**.display(); // to invoke parent method.

System.***out***.println ("Test");

}

}

**public** **class** InheritTest {

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

Test t1 = **new** Test();

t1.display();

}

}

Super class method can be called from anywhere from the child class Method.

Eg:

**public** **void** display()

{

System.***out***.println ("Test");

**super**.display();

}

**Another example :**

Invoking current class methods and parent class methods.

**public** **class** Sample {

**public** **void** show() {

System.***out***.println("Sample show");

}

**public** **void** display() {

System.***out***.println("Sample display");

}

}

**public** **class** Test **extends** Sample {

**public** **void** show() {

System.***out***.println("Test show");

}

**public** **void** display() {

**super**.show();// to call to parent class method

**this**.show();// to call to current class method

show();// to call to current class method

System.***out***.println("Test display");

}

}

**public** **class** IheritTest {

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

Test t = **new** Test();

t.display();

}

}

Eg:

Another example

**public** **class** Sample {

**int** a;

**int** b;

**public** **void** setData(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println (a+"\t"+b);

}

}

**public** **class** Test **extends** Sample {

**int** c;

**int** d;

**public** **void** setData(**int** x, **int** y, **int** z, **int** k)

{

setData(x,y); // in this case super key work not required as the signature

//is not matching

c=z;

d=k;

}

**public** **void** display()

{

**super**.display();

System.***out***.println (c+"\t"+d);

}

}

**public** **class** InheritTest {

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

Test t1 = **new** Test();

t1.setData(1,2,3,4);

t1.display();

}

}

**Difference between method overloading and method overriding :**

|  |  |
| --- | --- |
| **Method Overloading** | **Method Overriding** |
| Passing of same message for different functionality | Redefining parent class method in child class |
| It is between the same methods with different signature | It is between the same methods with same signature |
| Method overloading is in the same class | Method overriding is between parent and child classes |
| It doesn't check for the return type | It checks for the return type |
| It is a static binding ( compile time ) | It is dynamic binding ( run time ) |

class Test {

void display() {

System.out.println ( “ Test display “ );

}

}

class TestOne extends Test {

void display() {

// display(); it is recursive calling, calling itself, it thorws StackOverFlowException

super.display();

System.out.println ( “ TestOne display “ );

}

}

public class SuperMethodTest {

public static void main ( String [] args )

{

TestOne t1 = new TestOne();

t1display();

}

}

**Super class and sub class with same data members :**

class Test {

int a;

int b;

}

class TestOne extends Test {

int a;

int b;

void setData() {

super.a=10;

super.b=20;

a=30;

b=40;

}

void display() {

System.out.println ( “ Super class : a = “+super.a+” b = “ +super.b );

System.out.println ( “ Sub class : a = “+a+” b = “ +b );

}

}

public class SuperDataTest {

public static void main ( String [] args )

{

TestOne t1 = new TestOne();

t1.setData();

t1.display();

}

}

Directly we can't access super class data members using object, if super class and sub class has same data members.

t.super.a --> is not valid.

class Person {

int id;

int age ;

char sex;

void setData() {

pid=1001;

age = 25;

sex = 'M”

}

void display() {

System.out.println ( “ Id : “ +pid );

System.out.println ( “ Age : “+age);

System.out.println ( “Sex : “ +sex);

}

}

class Emp extends Person {

float salary;

void setData() {

super.setData();

salary = 20000.0f

}

void display() {

super.display();

System.out.println ( “ salary : “+sal );

}

}

public class EmpPersonTest {

public static void main( String [] args ) {

Emp e1 = new Emp();

e1.setData();

e1.display();

}

}

**Private access specifier.**

Private members can be accessed in the same class only . Can not be accessed from sub / child class.

**public** **class** Sample {

**private** **int** a;

**private** **int** b;

**public** **void** setData(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println(a+"\t"+b);

}

}

**public** **class** Test **extends** Sample{

**private** **int** a;

**private** **int** b;

**public** **void** setData(**int** x, **int** y , **int** z, **int** k)

{

setData(x,y);

//super.a=x; invalid, since these are private members

//super.b=y; invalid, since these are private members

a=z; //its own members

b=k; //its own members

}

**public** **void** display()

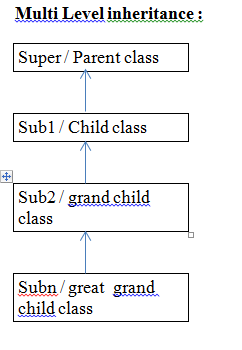
{

**super**.display();

System.***out***.println(a+"\t"+b);

}

}



**Multi Level Inheritance Example:**

**public** **class** Test

{

**public** **void** display()

{

System.***out***.println ("Test display");

}

}

**public** **class** TestOne **extends** Test

{

**public** **void** display()

{

System.***out***.println ("TestOne display begining");

**super**.display();

System.***out***.println ("TestOne display end");

}

}

**public** **class** TestTwo **extends** TestOne

{

**public** **void** display()

{

System.***out***.println ("TestTwo Display Beg");

**super**.display();

System.***out***.println ("TestTwo Display end");

}

}

**public** **class** InheritanceTest {

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

TestTwo t = **new** TestTwo();

t.display();

}

}

**Multilevel Inheritance with data members**

**public** **class** Test {

**int** a;

**int** b;

**public** **void** setData(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println(a+"\t"+b);

}

}

**public** **class** TestOne **extends** Test {

**int** c;

**int** d;

**public** **void** setData(**int** x, **int** y, **int** z, **int** k )

{

setData(x,y);

c=z;

d=k;

}

**public** **void** display()

{

**super**.display();

System.***out***.println(c+"\t"+d);

}

}

**public** **class** TestTwo **extends** TestOne {

**int** i;

**int** j;

**public** **void** setData(**int** x, **int** y, **int** z, **int** k, **int** l, **int** m)

{

setData(x,y,z,k);

i=l;

j=m;

}

**public** **void** display()

{

**super**.display();

System.***out***.println(i+"\t"+j);

}

}

**public** **class** MultiLevelTest {

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

TestTwo t = **new** TestTwo();

t.setData(10, 20);

t.display();

System.***out***.println("===============");

t.setData(1, 2, 3, 4);

t.display();

System.***out***.println("===============");

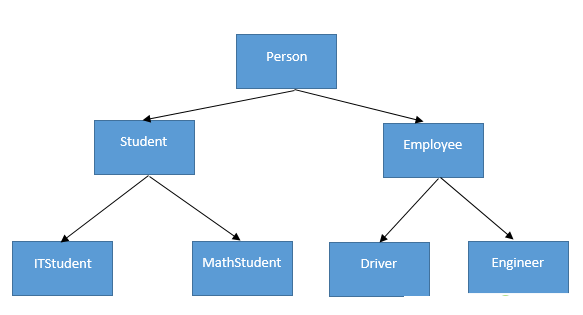
t.setData(5, 15, 25, 35, 45, 55);

t.display();

}

}

Hierarchial Inheritance:



eg:

**package** com.nrit.mnrao.hierarchial;

**public** **class** Person {

**private** **int** pid;

**private** String name;

**private** String gender;

**private** **int** age;

**public** **void** setData(**int** pid, String name, String gender, **int** age) {

**this**.pid = pid;

**this**.name = name;

**this**.gender = gender;

**this**.age = age;

}

**public** **void** display() {

System.***out***.println(pid + "\t" + name + "\t" + gender + "\t" + age);

}

}

**package** com.nrit.mnrao.hierarchial;

**public** **class** Student **extends** Person {

String course;

**double** feePaid;

**double** feeDue;

**char** grade;

**public** **void** setData(**int** pid, String name, String gender, **int** age, String course, **double** feePaid, **double** feeDue, **char** grade) {

setData(pid, name, gender, age);

**this**.course = course;

**this**.feePaid = feePaid;

**this**.feeDue = feeDue;

**this**.grade = grade;

}

**public** **void** display() {

**super**.display();

System.***out***.println(course + "\t" + feePaid + "\t" + feeDue + "\t" + grade);

}

}

**package** com.nrit.mnrao.hierarchial;

**public** **class** Employee **extends** Person {

String dept;

**double** salary;

String desg;

**public** **void** setData(**int** pid, String name, String gender, **int** age, String dept, **double** salary, String desg) {

setData(pid, name, gender, age);

**this**.dept = dept;

**this**.salary = salary;

**this**.desg = desg;

}

**public** **void** display() {

**super**.display();

System.***out***.println(dept + "\t" + salary + "\t" + desg);

}

}

**package** com.nrit.mnrao.hierarchial;

**public** **class** HierachialTest {

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

Student student = **new** Student();

student.setData(1001, "abc", "male", 25, "java", 10000, 5000, 'A');

student.display();

Employee employee = **new** Employee();

employee.setData(101, "Mohan", "Male", 40, "IT", 25000, "admin");

employee.display();

}

}

if method names are different then we can call from main method by using object.

**Inheritance with constructors:**

Constructors invokes from bottom to top **BUT** executes from top to bottom.

Default constructors are invoked automatically  **( implicitly )**

**public** **class** Test

{

**public** Test()

{

System.***out***.println ("Test");

}

}

**public** **class** TestOne **extends** Test

{

**public** TestOne()

{

System.***out***.println ("Test One");

}

}

**public** **class** TestTwo **extends** TestOne

{

**public** TestTwo()

{

System.***out***.println ("Test Two");

}

}

**public** **class** InheritConstructorTest

{

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

TestTwo t = **new** TestTwo();

}

}

o/p:

Test

Test One

Test Two

**Invoking parent class constructors with parameters.**

**public** **class** Test {

**int** a;

**int** b;

**public** Test()

{

a=0;

b=0;

}

**public** Test(**int** x, **int** y)

{

a=x;

b=y;

}

**public** **void** display()

{

System.***out***.println(a+"\t"+b);

}

}

**public** **class** TestOne **extends** Test {

**int** c;

**int** d;

**public** TestOne()

{

c=0;

d=0;

}

**public** TestOne(**int** x, **int** y, **int** z, **int** k)

{

**super**(x,y);

c=z;

d=k;

}

**public** **void** display()

{

**super**.display();

System.***out***.println(c+"\t"+d);

}

}

**public** **class** TestTwo **extends** TestOne {

**int** i;

**int** j;

**public** TestTwo()

{

i=0;

j=0;

}

**public** TestTwo(**int** x, **int** y, **int** z, **int** k, **int** l, **int** m)

{

**super**(x,y,z,k);

i=l;

j=m;

}

**public** **void** display()

{

**super**.display();

System.***out***.println(i+"\t"+j);

}

}

**public** **class** MultiLevelTest {

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

TestTwo t1 = **new** TestTwo();

t1.display();

TestTwo t2 = **new** TestTwo(1,2,3,4,5,6);

t2.display();

}

}

The statement, which makes a call to parent class constructor must be a first statement in the child class constructor.

**Calling same class constructors**

**public class TestOne extends Test**

{

**private** **int** c;

**private** **int** d;

**public** TestOne()

{

c=0;

d=0;

}

**public** TestOne(**int** x, **int** y)

{

c=x;

d=y;

}

**public** TestOne(**int** x, **int** y, **int** z, **int** k)

{

//calling a same class constructor.

**this**(z,k);

a=x;

b=y;

}

**public** **void** display()

{

**super**.display();

System.***out***.println (c+"\t"+d);

}

}

**Access Specifiers**

It defines scope of classes and its members.

These are

public, protected, default and private.

Default access specifier is default

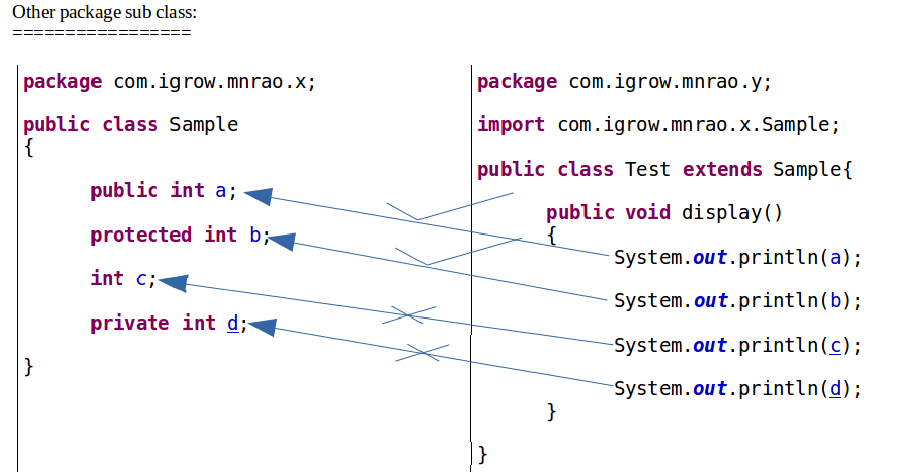
Public is having more scope;

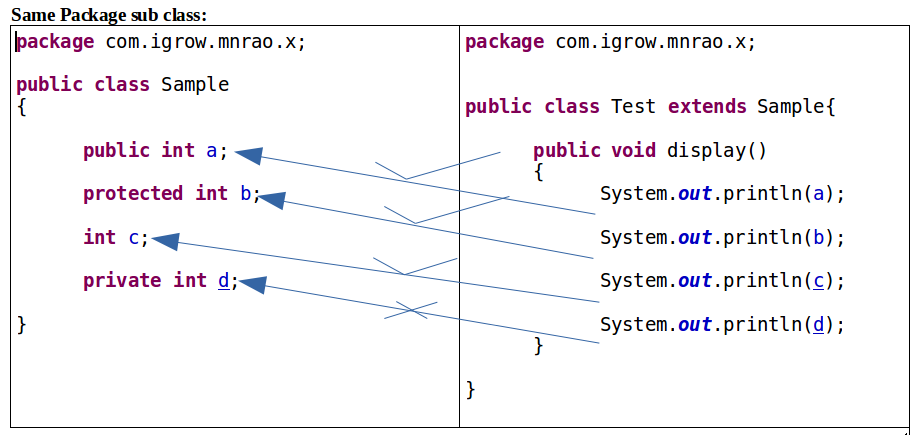
**Descending order is**

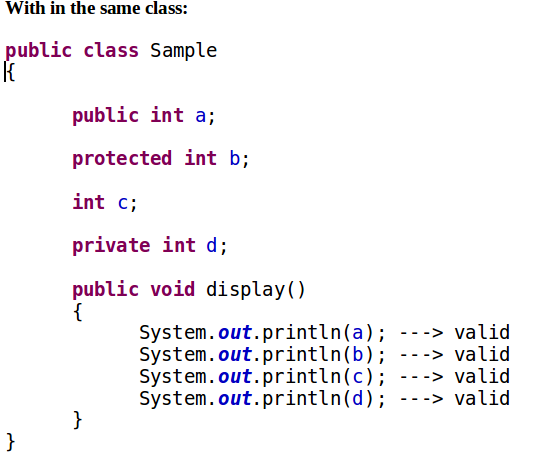
public, protected, default and private.

**Declaration:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Outside the Java application world** | **From other packages**  **( sub class )** | **Same package**  **( sub class)** | **Within the same class** |
| **public** | Yes | Yes | Yes | Yes |
| **protected** | No | Yes | Yes | Yes |
| **default** | No | N o | Yes | Yes |
| **private** | No | N o | No | Yes |







**Access Modifiers**

It defines behaviour of classes and it’s members.

1) static

2) final

3) abstract

4) synchronize.

5) transient.

6) native

7) volatile

**Static:**

**static can be used with following**

1) class data members.

2) methods

3) static blocks.

4) Inner classes or Nested classes.

5) static import

**Static import ;**

if any class importing as static, then it's static members can be accessed directly with out using class name .

**eg:**

**package** com.durga.mnrao.x;

**public** **class** Sample {

**public** **static** **int** *a*=10;

**public** **static** **int** *b*=20;

**public** **static** **void** display()

{

System.***out***.println("i am in sample display");

}

**public** **void** show()

{

System.***out***.println("i am in sample show");

}

}

**package** com.durga.mnrao.y;

**import** **static** com.durga.mnrao.x.Sample.\*;

**public** **class** Test {

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

System.***out***.println(*a*); 🡪 valid

System.***out***.println(*b*); 🡪 valid

*display*();🡪 valid

*show*(); 🡪 invalid , as it is not a static

}

}

Eg:

System class as static import:

====================

if System imported as static then, it's static members such as in, out and err can be accessed directly with out using System class refernce.

**package** com.durga.mnrao.y;

**import** **static** java.lang.System.\*;

**import** java.util.Scanner;

**public** **class** Test {

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

***out***.println("hello world");

***out***.println("hello java");

Scanner sc =**new** Scanner(***in***);

}

}

**final :**

It can be used with following

1) local variables

2) class data members ( instance variable / class variable )

3) methods

4) classes.

**abstract:**

It can be used with classes and methods.

**Final:**

**local variable as final ( constant ):**

this is to declare local variable as constant.

Eg1:

**public** **class** Sample

{

**public** **void** display()

{

//below is the local variable.

**final** **int** A=10;

A=20;// invalid, since A is a constant.

}

}

eg2:

**public** **class** Sample

{

**public** **void** display()

{

**final** **int** A;

A=20;// valid sinced A is not initialized.

A=30;// invalid, final variable doesn't take second time assignment.

}

}

**class data member as final:**

**public** **class** Sample

{

**final** **int** A=10;

**public** **void** display()

{

A=20;//invalid,final data member can not be modified from the methods.

}

}

Final data member must be initialized.

final data member can be initialized at the class level or inside the constructor or initialize block.

**Class Level:**

**public** **class** Sample

{

**final** **int** A=10;

}

Below is not valid one. Since method may be invoking many times.

**public** **class** Sample {

**final** **int** A;

**public** **void** setData()

{

A=10;

}

}

**using inilize block.**

**public** **class** Sample

{

**final** **int** A;

{

A=20; // valid since initialize block invoking only once.

}

}

**public** **class** Sample

{

**final** **int** A=10;

{

A=20;//Invalid as final data member takes only one time assignment.

}

}

**Inside the constructor:**

**eg1:**

**public** **class** Sample

{

**final** **int** A;

**public** Sample()

{

A=10;

}

}

eg2:

**public** **class** Sample

{

**final** **int** A=10;

**public** Sample()

{

A=20;// Invalid as final data member takes only one time assignment.

}

}

**Using both init block and constructor.**

**public** **class** Sample {

**final** **int** A=5;

{

A=10; // not valid

}

**public** Sample()

{

A=10; // not valid

}

}

**Eg:**

**public** **class** Sample

{

**final** **int** A;

{

A=10;//valid

}

**public** Sample()

{

A=20;//Invalid as final data member takes only one time assignment.

}

}

In the above first initialize bock executes and then constructor.

**public** **class** Sample {

**final** **int** A;

{

A=10;

}

{

A=20;// Invalid

}

}

Purpose of constructor is used to initialize variable data members ( its value can be changed )

Purpose of initiailize block is used to initialize final data members ( its value can not be changed )

A Class can have multiple initialize blocks.

Purpose of multiple initialize blocks is used to segregate the constants, in the scenario where Java application is connecting to different external servers ( resources ).

Class data member as final and static :

**public** **class** Sample {

**final** **int** A=10;

**int** x;

**int** y;

}

In the above case, every object contains final data member A ( read only but not modify ).

For every instance separate copy creates.

**public** **class** Sample {

**static** **final** **int** ***A***=10;

**int** x;

**int** y;

}

In the above case, final and static data member A is not a part of object, it is a separate copy, it can be shared by all objects of the class ( only read can not modify ).

**static and final** is a read only sharable data.

Initializing static and final data member.

1. Class level
2. Using static block.
3. Class Level

**public** **class** Sample {

**static** **final** **int** ***A***=10;

}

**Using static block:**

**public** **class** Sample {

**static** **final** **int** ***A***;

**static**

{

***A***=20;

}

}

**public** **class** Sample {

**static** **final** **int** ***A***=10;

**static**

{

***A***=20;// invalid as final data member does not take second time assignment.

}

}

Purpose of static block is used to initiailize final and static data memebrs.

A Class can have multiple static blocks.

Purpose of multiple static blocks are used to segregate the static constants, in the scenario where Java application is connecting to different external servers ( resources ).

**method as final:**

it prevents from overriding in the child class:

**eg:**

**public** **class** Sample

{

**final** **public** **void** display()

{

}

}

**public** **class** Test **extends** Sample

{

//below method is not valid ( error ), can not override in the child class.

**public** **void** display()

{

}

}

**Static method can override but it should be static in both classe, parent as well as child.**

**Static and final should not override , both are static and final in both classe, parent as well as child.**

**class as final :**

**it prevents from the inheritance. Final class members can not be inherited into child class.**

**Eg:**

final public class Sample

{

}

// in the below, **extends Sample** is not valid

public class Test **extends Sample**

{

}

**Abstract :**

**It is an access modifier**

It can be used with following

1) classes

1. methods

**Abstract class:**

**classes are of two types**

1. Abstract class  it is partially qualified ( partially implemented )
2. Concrete class  fully qualified class.

**Defining abstract class:**

**public** **abstract** **class** Sample

{

**public** **void** display()

{

}

**public** **void** show()

{

}

}

Abstract class does not allow to create insatance. Abstract class can have only abstract methods (or) all concrete mothods (or) it can have both.

Concrete class allows to create instance. Concreate class contains all concrete methods

Abstract it is a partially implemented class.

abstract class does not allow to create an object but allows to declare reference .

purpose of abstract class reference variable is to refer to child class instance (used in polymorphism )

Eg:

Sample s1 = **new** Sample(); ---> Invalid, does not allow to create an object

Sample s1; 🡪 valid since only reference.

purpose of abstract class is to provide members for the child classes.

**Method as an abstract :**

Methods are of two types :

1. abstract method  does not have functionality
2. concrete method  it is a method with functionality
3. **abstract method:**

**declaration.**

**public** **abstract** **void** display();

it does not allow to define ( does not have body )

**Below definition is invalid.**

**public** **abstract** **void** display()

{

}

1. concrete method

**public** **void** display()

{

}

if class contains atleast one abstract method, then class becomes as an abstract class.

**public** **abstract** **class** Sample

{

**public** **abstract void** display();

**public** **void** show()

{

}

}

implementing abstract method in child class.

**public** **class** Test extends Sample

{

@Override

**public**  **void** display()

{

}

}

Abstract method should be implemented in the child class, otherwise child class also become as an abstract class.

An abstract class can have all concrete methods.

It is not mandatory to have abstract method.

Eg:

Below abstract class contains all concrete methods. It is valid one.

**public** **abstract** **class** Sample

{

**public** **void** display()

{

}

**public** **void** show()

{

}

}

**Interface**

interface is similar to class

interface by default, it is public

interface data members are by default public , static and final.

Interface methods are by default public and abstract.

**Declaration:**

**public interface MyInterface**

{

**public** **static** **final** **int** ***A***=10; // here **public** **static** **final is an optional.**

**public** **static** **final** **int** ***B***=20;

**public** **abstract** **void** display(); // here abstract is optional .

**public** **abstract** **void** show();

}

Interface does not allow to create an object.

MyInterface i1 = **new** MyInterface();// invalid.

implements is a keyword to inherit interface members into child class.

**public** **class** Sample **implements** MyInterface

{

@Override

**public** **void** display()

{

}

@Override

**public** **void** show()

{

}

}

all methods of an interface should be implemented in the child class, otherwise child class becomes as an abstract class.

Eg:

**public** **interface** MyInterface {

**public** **static** **final** **int** ***A***=80;

**public** **static** **final** **int** ***B***=90;

**public** **abstract** **void** setData(**int** x, **int** y);

**public** **abstract** **void** display();

}

**public** **class** Sample **implements** MyInterface{

**int** x;

**int** y;

@Override

**public** **void** setData(**int** x, **int** y) {

**this**.x = x;

**this**.y = y;

}

@Override

**public** **void** display() {

System.***out***.println(x+"\t"+y);

System.***out***.println(***A***+"\t"+***B***);

}

}

**public** **class** Test

{

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

Sample s1 = **new** Sample();

s1.setData(10, 20);

Sample s2 = **new** Sample();

s2.setData(30, 40);

s1.display();

s2.display();

}

}

Interface data members are Global data, hence these can be used any where in the project by importing interface.

Eg:

package com.nrit.mnrao.test;

**public** **interface** MyInterface {

**public** **static** **final** **int** ***A***=80;

**public** **static** **final** **int** ***B***=90;

**public** **abstract** **void** setData(**int** x, **int** y);

**public** **abstract** **void** display();

}

**package** com.nrit.mnrao.test1;

**import** com.nrit.mnrao.test.MyInterface;

**public** **class** MyTest {

**public** **void** display()

{

System.***out***.println(MyInterface.***A***);

}

}

An interface can give the reference to its child class instance .

Eg:

**public** **interface** MyInterface {

**public** **abstract** **void** show();

**public** **abstract** **void** display();

}

**public** **class** Sample **implements** MyInterface{

@Override

**public** **void** show() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** display() {

// **TODO** Auto-generated method stub

}

}

**public** **class** Test

{

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

MyInterface i1 = **new** Sample();

i1.show();

i1.display();

}

}

Another eg:

**public** **class** Test

{

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

MyInterface i1 = **new** Sample(); //it is a parent reference and child instance

i1.show();

i1.display();

i1.setData();// invalid since it is not member of MyInterface.

}

}

**Example program for interface:**

**public** **interface** MyInterface

{

**public** **static** **int** ***A***=10;

**public** **static** **final** **int** ***B***=20;

**public** **abstract** **void** display();

**public** **abstract** **void** show();

}

**public** **class** Sample **implements** MyInterface

{

@Override

**public** **void** display()

{

System.***out***.println ("display");

System.***out***.println (***A***);

System.***out***.println (***B***);

}

@Override

**public** **void** show()

{

System.***out***.println ("show");

System.***out***.println (***A***);

System.***out***.println (***B***);

}

}

**public** **class** Test

{

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

{

MyInterface i1 = **new** Sample();

i1.display();

i1.show();

}

}

**An interface can extends of another interface but not implements**

Public interface MyInterface1

{

}

Public interface MyInterface2 extends MyInterface1

{

}

A class can implement multiple interfaces but extends only one class.

**final syntax of the class:**

**public** **class** MyChildClass **extends** MyParentClass **implements** MyInterface1, MyInterface2, MyInterface3

{

}

Eg:

**public** **interface** MyInter1 {

**public** **static** **final** **int** ***A***=10;

}

**public** **interface** MyInter2 {

**public** **static** **final** **int** ***A***=20;

}

**public** **interface** MyInter3 {

**public** **static** **final** **int** ***A***=30;

}

**public** **class** Sample **implements** MyInter1, MyInter2, MyInter3 {

**public** **void** display() {

System.***out***.println(A);// invalid, there is conflict in accessing parent members, as creating multiple copies.

System.***out***.println(MyInter1.***A***);//valid

System.***out***.println(MyInter2.***A***); //valid

System.***out***.println(MyInter3.***A***); //valid

}

}

**Adapter class:**

It provides empty implementation for all methods of interface.

Eg:

Below interface provides all services of an application.

**public** **interface** MyInterface {

**public** **void** m1();

**public** **void** m2();

**public** **void** m3();

**public** **void** m4();

**public** **void** m5();

**public** **void** m6();

**public** **void** m7();

**public** **void** m8();

**public** **void** m9();

**public** **void** m10();

}

**Below is the adapter class.**

**public** **class** Temp **implements** MyInterface{

@Override

**public** **void** m1() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m2() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m3() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m4() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m5() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m6() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m7() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m8() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m9() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m10() {

// **TODO** Auto-generated method stub

}

}

B**elow A , B and C are actual classes to implement different services for different usage.**

**public** **class** A **extends** Temp {

@Override

**public** **void** m1() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m2() {

// **TODO** Auto-generated method stub

}

}

**public** **class** B **extends** Temp {

@Override

**public** **void** m3() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m4() {

// **TODO** Auto-generated method stub

}

}

**public** **class** C **extends** Temp {

@Override

**public** **void** m5() {

// **TODO** Auto-generated method stub

}

@Override

**public** **void** m6() {

// **TODO** Auto-generated method stub

}

}

main purpose of interface is to achieve the polymorphism:

**Polymorphism**

Poly --> many

Morphism --> forms

def:

same method, behaving differently for different purpose is called as polymorphism.

**public** **interface** Picture

{

**public** **abstract void** draw();

}

**public** **class** Rectangle **implements** Picture{

@Override

**public** **void** draw() {

System.***out***.println ("Rectangle");

}

}

**public** **class** Square **implements** Picture {

@Override

**public** **void** draw() {

System.***out***.println ("Square");

}

}

**public** **class** Triangle **implements** Picture {

@Override

**public** **void** draw() {

System.***out***.println ("Triangle");

}

}

**public** **class** PolyTest

{

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

{

Picture p1;

p1=**new** Rectangle();

p1.draw();

p1=**new** Triangle();

p1.draw();

p1=**new** Square();

p1.draw();

}

}

**Another way of main()**

**public** **class** PolyTest

{

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

{

*dispaly*(**new** Rectangle());

*dispaly*(**new** Triangle());

*dispaly*(**new** Square());

}

**public** **static** **void** dispaly(Picture x)

{

x.draw();

}

}

**Another example:**

**package** com.visix;

**public** **interface** Bank {

**public** **int**  getRateOfInterest();

}

**The Bank interface has a method to calculate Rate Of Interest.**

CitiBank.java:

**package** com.visix;

**public** **class** CitiBank **implements** Bank {

**public** **int** getRateOfInterest() {

**return** 15;

}

}

HdfcBank.java:

**package** com.visix;

**public** **class** HdfcBank **implements** Bank {

**public** **int** getRateOfInterest() {

**return** 13;

}

}

The CitiBank and HdfcBank classes implement the Bank interface and the classes generate interest rate related to CitiBank and HdfcBank.

**public** **class** BankApplication

{

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

{

Bank bank = **new** CitiBank();

System.***out***.println (bank.getRateOfInterest());

bank = **new** HdfcBank();

System.***out***.println (bank.getRateOfInterest());

}

}

**Interview Questions**

1.What is an abstract class.

Ans: abstract class, partially implented class, if class contains atleast one abstract method, then class becomes abstract,

abstract class doesn't allow to create object.

2. Can we declare a class as Abstract without having any abstract method?

Ans: Yes we can create an abstract class by using abstract keyword before class name even if it doesn’t have any abstract method. However, if a class has even one abstract method, it must be declared as abstract otherwise it will give an error.

3.What’s the difference between an Abstract Class and Interface in Java?

Ans: The primary difference between an abstract class and interface is that an interface can only possess declaration of public static methods with no concrete implementation while an abstract class can have members with any access specifiers (public, private etc) with or without concrete implementation.

Another key difference in the use of abstract classes and interfaces is that a class which implements an interface must implement all the methods of the interface while a class which inherits from an abstract class doesn’t require implementation of all the methods of its super class.

A class can implement multiple interfaces but it can extend only one abstract class.

4.Does Importing a package imports its sub-packages as well in Java?

Ans: In java, when a package is imported, its sub-packages aren’t imported and developer needs to import them separately if required.

For example, if a developer imports a package university.\*, all classes in the package named university are loaded but no classes from the sub-package are loaded. To load the classes from its sub-package ( say department), developer has to import it explicitly as follows:

Import university.department.\*

5.Can we declare the main method of our class as private?

Ans: In java, main method must be public static in order to run any application correctly. If main method is declared as private, developer won’t get any compilation error however, it will not get executed and will give a runtime error.

6. Can we override static methods of a class?

Ans: We cannot override static methods. Static methods belong to a class and not to individual objects and are resolved at the time of compilation (not at runtime).Even if we try to override static method,we will not get an complitaion error,nor the impact of overriding when running the code.

7. Can a class be a super class and a sub-class at the same time? Give example.

Ans: If there is a hierarchy of inheritance used, a class can be a super class for another class and a sub-class for another one at the same time.

8. There are two classes named classA and classB. Both classes are in the same package. Can a private member of classA can be accessed by an object of classB?

Ans: Private members of a class aren’t accessible outside the scope of that class and any other class even in the same package can’t access them.

9. What’s the benefit of using inheritance?

Ans: Key benefit of using inheritance is reusability of code as inheritance enables sub-classes to reuse the code of its super class. Polymorphism (Extensibility ) is another great benefit which allow new functionality to be introduced without effecting existing derived classes.

10. Give an example of use of Pointers in Java class.

Ans: There are no pointers in Java. So we can’t use concept of pointers in Java.

11.How can we restrict inheritance for a class so that no class can be inherited from it?

Ans: If we want a class not to be extended further by any class, we can use the keyword Final with the class name.

12.What’s the access scope of Access specifiers?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Outside the Java world** | **From other packages**  **( sub class )** | **Same package**  **( sub class)** | **Within the same class** |
| **public** | Yes | Yes | Yes | Yes |
| **protected** | No | Yes | Yes | Yes |
| **default** | No | N o | Yes | Yes |
| **private** | No | N o | No | Yes |

**13.What is overloading and overriding in java?**

When we have more than one method with same name in a single class but the arguments are different, then it is called as method overloading.

Overriding concept comes in picture with inheritance when we have two methods with same signature, one in parent class and another in child class. We can use @Override annotation in the child class overridden method to make sure if parent class method is changed, so as child class.

**14.What is final keyword?**

final keyword is used with Class to make sure no other class can extend it, for example String class is final and we can’t extend it.

We can use final keyword with methods to make sure child classes can’t override it.

final keyword can be used with variables to make sure that it can be assigned only once. However the state of the variable can be changed, for example we can assign a final variable to an object only once but the object variables can change later on.

Java interface variables are by default final and static.

**15.What is an interface?**

Interfaces are core part of java programming language and used a lot not only in JDK but also java design patterns, most of the frameworks and tools. Interfaces provide a way to achieve abstraction in java and used to define the contract for the subclasses to implement.

Interfaces are good for starting point to define Type and create top level hierarchy in our code. Since a java class can implements multiple interfaces, it’s better to use interfaces as super class in most of the cases

**16.What is an abstract class?**

Abstract classes are used in java to create a class with some default method implementation for subclasses. An abstract class can have abstract method without body and it can have methods with implementation also.

abstract keyword is used to create a abstract class. Abstract classes can’t be instantiated and mostly used to provide base for sub-classes to extend and implement the abstract methods and override or use the implemented methods in abstract class.

**17.What is the difference between abstract class and interface?**

What is the difference between abstract class and interface?

abstract keyword is used to create abstract class whereas interface is the keyword for interfaces.

Abstract classes can have method implementations whereas interfaces can’t.

A class can extend only one abstract class but it can implement multiple interfaces.

We can run abstract class if it has main() method whereas we can’t run an interface.

**18.Can an interface implement or extend another interface?**

Interfaces don’t implement another interface, they extend it. Since interfaces can’t have method implementations, there is no issue of diamond problem. That’s why we have multiple inheritance in interfaces i.e an interface can extend multiple interfaces.

**19.What is instanceof keyword?**

We can use instanceof keyword to check if an object belongs to a class or not. We should avoid it’s usage as much as possible. Sample usage is:

public static void main(String [] args)

{

Object str = new String("abc");

if(str instanceof String){

System.out.println ("String value:"+str);

}

if(str instanceof Integer){

System.out.println ("Integer value:"+str);

}

}

**20.Java is Pass by Value or Pass by Reference?**

This is a very confusing question, we know that object variables contain reference to the Objects in heap space. When we invoke any method, a copy of these variables is passed and gets stored in the stack memory of the method.

Passing object is call by reference where as passing variable is a call by value.

**21.What is Polymorphism?**

Polymorphism is the ability of an object to take on many forms. The most common use of polymorphism in OOP occurs when a parent class reference is used to refer to a child class object.

**22.Can a constructor be made final?**

No, this is not possible

**23.What is Dynamic Binding(late binding)?**

Binding refers to the linking of a procedure call to the code to be executed in response to the call. Dynamic binding means that the code associated with a given procedure call is not known until the time of the call at run-time.

**24.Can constructor be inherited?**

No, constructor cannot be inherited.

**25.Can we instantiate an interface?**

You can’t instantiate an interface directly, but you can instantiate a class that implements an interface.

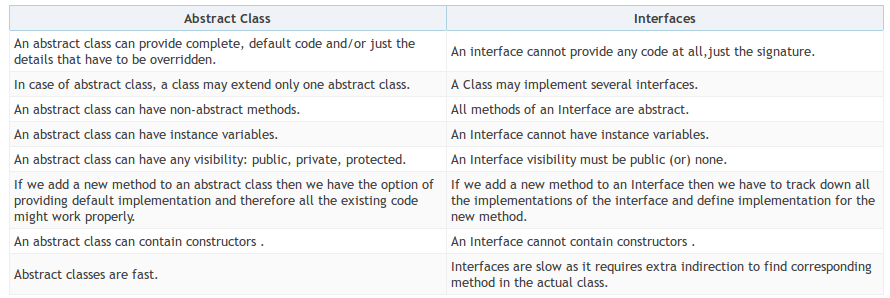
**26.Do interfaces have member variables?**

Interfaces may have member variables, but these are implicitly public, static, and final- in other words, interfaces can declare only constants, not instance variables that are available to all implementations and may be used as key references for method arguments for example.

**27.Can we instantiate an abstract class?**

**An abstract class can never be instantiated. Its sole purpose is to be extended (subclassed).**

**28.What are the differences between Interface and Abstract class?**



**29.When should I use abstract classes and when should I use interfaces?**

Use Interfaces when…

You see that something in your design will change frequently.

If various implementations only share method signatures then it is better to use Interfaces.

you need some classes to use some methods which you don't want to be included in the class, then you go for the interface, which makes it easy to just implement and make use of the methods defined in the interface.

Use Abstract Class when…

If various implementations are of the same kind and use common behavior or status then abstract class is better to use.

When you want to provide a generalized form of abstraction and leave the implementation task with the inheriting subclass.

Abstract classes are an excellent way to create planned inheritance hierarchies. They're also a good choice for nonleaf classes in class hierarchies.

**30.can there be an abstract class with no abstract methods in it?**

Yes, there can be an abstract class without abstract methods.

### 31) Which class is the superclass of all classes?

java.lang.Object is the root class for all the java classes and we don’t need to extend it.

### 32) What is Marker interface?

A marker interface is an empty interface without any method but used to force some functionality in implementing classes by Java. Some of the well known marker interfaces are Serializable and Cloneable.

### 33) Can you use this() and super() both in a constructor?

No. Because super() or this() must be the first statement.

### 34) Why we cannot override static method?

It is because the static method is the part of class and it is bound with class whereas instance method is bound with object and static gets memory in class area and instance gets memory in heap.

### 35) Can we override the overloaded method?

Yes.

### 36) Can we define private and protected modifiers for variables in interfaces?

No, they are implicitly public.

### 37) When can an object reference be cast to an interface reference?

An object reference can be cast to an interface reference when the object implements the referenced interface.

**Strings**

String is a class from java.lang package.

It is not a basic data type. It is user defined type ( non-premitive )

Java String provides a lot of concepts that can be performed on a string such as compare, concat, equals, split, length, replace, compareTo, intern, substring etc.

Eg:

Different ways :

String s1;

s1="hello";

=================

String s2="hello";

===================

String s3;

s3=**new** String("hello");

========================

String s4= **new** String ("hello");

========================

String s5=s4;

=====================

String s6 = **new** String( s4);

String s1=**null**;  string reference is null, it can not be used, it throws NullPointerException.

String s2= **new** String();  s2 is reference String object, which contains nothing, empty object ( zero no of chars )

In java, string is basically an object that represents sequence of char values.

An array of characters works same as java string. For example:

**char** [] ch ={'n','r','i','t'};

String s1 = **new** String( ch );

System.***out***.println(s1);

The java.lang.String class implements Serializable, Comparable and CharSequence interfaces

The java String is immutable i.e. it cannot be changed but a new instance is created.

For every time of assignment it will create new location.

For mutable class, you can use StringBuffer and StringBuilder class.

How to create String object?

There are two ways to create String object:

By string literal

By new keyword

1) String Literal

Java String literal is created by using double quotes. For Example:

String s="welcome";

Each time you create a string literal, the JVM checks the string constant pool first. If the string already exists in the pool, a reference to the pooled instance is returned. If string doesn't exist in the pool, a new string instance is created and placed in the pool. For example:

String s1="Welcome";

String s2="Welcome";//will not create new instance

In the above example only one object will be created. Firstly JVM will not find any string object with the value "Welcome" in string constant pool, so it will create a new object. After that it will find the string with the value "Welcome" in the pool, it will not create new object but will return the reference to the same instance.

Note: String objects are stored in a special memory area known as string constant pool.

**Why java uses concept of string literal?**

To make Java more memory efficient (because no new objects are created if it exists already in string constant pool).

2) By new keyword

String s=new String("Welcome");//creates two objects and one reference variable

In such case, JVM will create a new string object in normal(non pool) heap memory and the literal "Welcome" will be placed in the string constant pool. The variable s will refer to the object in heap(non pool).

Java String Example

**public** **class** Test

{

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

{

String s1="java";//creating string by java string literal

**char** ch[]={'s','t','r','i','n','g','s'};

String s2=**new** String(ch);//converting char array to string

String s3=**new** String("example");//creating java string by new keyword

String s4=**new** String(s2);

String s5=s1;

System.***out***.println (s1);

System.***out***.println (s2);

System.***out***.println (s3);

System.***out***.println (s4);

}

}

**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) | returns char value for the particular index |
| 2 | int length() | returns string length |
| 5 | String substring(int beginIndex) |  |
| 6 | String substring(int beginIndex,  int endIndex) | returns substring for given begin index and end index |
| 7 | boolean contains(CharSequence s) | returns true or false after matching the sequence of char value |
| 10 | boolean equals(Object another) | checks the equality of string with object |
| 11 | boolean isEmpty() | checks if string is empty |
| 13 | String replace(char old, char new) | replaces all occurrences of specified char value |
| 14 | String replace(CharSequence old, CharSequence new) | replaces all occurrences of specified CharSequence |
| 15 | String trim() | returns trimmed string omitting leading and trailing spaces |
| 16 | String [] split(String regex) | returns splitted string matching regex |
| 19 | int indexOf(int ch) | returns specified char value index |
| 20 | int indexOf(int ch, int fromIndex) | returns specified char value index starting with given index |
| 21 | int indexOf(String substring) | returns specified substring index |
| 22 | int indexOf(String substring, int fromIndex) | returns specified substring index starting with given index |
| 23 | String toLowerCase() | returns string in lowercase. |
| 25 | String toUpperCase() | returns string in uppercase |

* 1. charAt()

String s1="hello";

**char** ch = s1.charAt(0);

System.***out***.println(ch);

ch = s1.charAt(5);

// throws StringIndexOutOfBoundsException

* 1. length()

String s1="hello";

**int** len = s1.length();

System.***out***.println(len);

3. getBytes()

String s1="hello";

**byte**[] b = s1.getBytes();// to convert string to byte array.

**for** (**int** i = 0; i < b.length; i++) {

System.***out***.println(b[i]);

}

**4.** indexOf()

String s1="hello";

**int** index = s1.indexOf('l');

System.***out***.println(index);

5. isEmpty()  return true if string is empty.

String s1="";

**if**(s1.isEmpty())

{

System.***out***.println("yes");

}

**else**

{

System.***out***.println("No empty");

}

String s1=**null**;

**if**(s1.isEmpty()) // NullPointerException

{

System.***out***.println("yes");

}

**else**

{

System.***out***.println("No empty");

}

**6.replace()**

String s1="this is java";

String s2 = s1.replace("java", "kava");

System.***out***.println(s1);// no change, since string is immutable object.

O/P: this is java

System.***out***.println(s2);

O/P: this is kava

String is immarable object, it can not be modified .

Types of objects in java.

There are two types

1. mutable
2. immutable

7. toUpperCase()

String s1="hello";

String s2 = s1.toUpperCase();

System.***out***.println(s1);

System.***out***.println(s2);

For every attempt to modify, it will create new location and return reference to new location.

8.toLowerCase()

String s1="HeLlO12345";

String s2 = s1.toLowerCase();

System.***out***.println(s1);

System.***out***.println(s2);

**9.trim()**

String s1=" hello ";

System.***out***.println(s1.length()); // 7

String s2 = s1.trim();

System.***out***.println(s1.length()); // 7

System.***out***.println(s2.length()); // 5

**10.** contains()

String s1="this is java";

**if**(s1.contains("is"))

{

System.***out***.println("yes");

}

**else**

{

System.***out***.println("no");

}

11.indexOf()

String s1="this is java";

**int** index = s1.indexOf("java");

System.***out***.println(index);

String s1="this is java";

**int** index = s1.indexOf("java", 0);

System.***out***.println(index);

**Java String comparison**

We can compare string in java on the basis of content and reference.

**there are three ways to compare strings in java:**

By equals() method

By = = operator

By compareTo() method

It is used in authentication (by equals() method),

sorting (by compareTo() method),

reference matching (by == operator) etc

**1) String compare by equals() method**

The String equals() method compares the original content of the string. It compares values of string for equality. String class provides two methods:

public boolean equals(Object another) compares this string to the specified object.

public boolean equalsIgnoreCase(String another) compares this String to another string, ignoring case.

**public** **class** Test

{

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

{

String s1="hello";

String s2="hello";

**if**(s1.equals(s2))

{

System.***out***.println ("both are equal");

}

**else** {

System.***out***.println ("not equal");

}

}

}

o/p :

both are equal

**public** **class** Test

{

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

{

String s1="hello";

String s2="Hello";

**if**(s1.equals(s2))

{

System.***out***.println ("both are equal");

}

**else**

{

System.***out***.println ("not equal");

}

}

}

O/P ;

not equal

**public** **class** Test

{

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

{

String s1="hello";

String s2="Hello";

**if**(s1.equalsIgnoreCase(s2))

{

System.***out***.println ("both are equal");

}

**else**

{

System.***out***.println ("not equal");

}

}

}

O/p : both are equal

**Eg:**

**Program to validate userid and password.**

**import** java.util.Scanner;

**public** **class** Test {

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

Scanner sc = **new** Scanner(System.***in***);

System.***out***.println("Enter user id");

String userId = sc.next();

System.***out***.println("Enter Passwd :");

String pwd = sc.next();

**if** (userId.equalsIgnoreCase("nrit") && pwd.equals("java")) {

System.***out***.println("valid user ");

} **else** {

System.***out***.println("In valid user ");

}

}

}

**2) String compare by == operator**

The = = operator compares references ( locations ) not values.

**public** **class** Test {

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

String s1 = **new** String("hello");

String s2 = **new** String("hello");

**if**(s1==s2)

{

System.***out***.println("same location");

}

**else**

{

System.***out***.println("different location");

}

}

}

o/p : different location

**public** **class** Test {

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

String s1 = "hello";

String s2 = **new** String("hello");

**if** (s1 == s2) {

System.***out***.println("same location");

} **else** {

System.***out***.println("different location");

}

}

}

o/p : different location

String s2 = **new** String("hello");

How may objects are created

Ans : 1 or two

If “hello” already exist in the string pool, then only one creates inside the heap memory.

If “hello” does not exist in the string pool, then one object with “hello” palcing inside the string pool and another is created inside the heap memory.

**public** **class** Test

{

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

{

String s1="hello";

String s2="hello";

**if**(s1==s2)

{

System.***out***.println ("Same location");

}

**else**

{

System.***out***.println ("Different location");

}

}

}

o/p; Same location

**public** **class** Test {

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

String s1 = "hello";

**if** (s1 ==new String( "hello")) {

System.***out***.println("same location");

} **else** {

System.***out***.println("different location");

}

}

}

o/p; different location

**public** **class** Test {

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

**if** (**new** String("hello") == "hello") {

System.***out***.println("same location");

} **else** {

System.***out***.println("different location");

}

}

}

o/p :

different location

**public** **class** Test {

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

**if** ("hello" == "hello") {

System.***out***.println("same location");

} **else** {

System.***out***.println("different location");

}

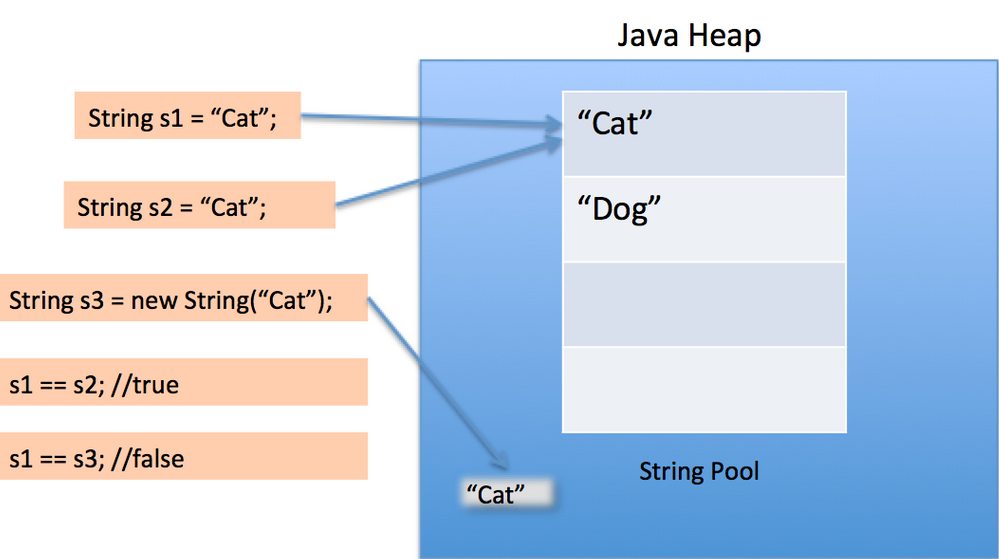
}

}

o/p: same location

# What is Java String Pool?

Here is a diagram which clearly explains how String Pool is maintained in java heap space and what happens when we use different ways to create Strings.



String Pool is possible only because [**String is immutable in Java**](https://www.journaldev.com/802/string-immutable-final-java) and it’s implementation of [**String interning**](https://en.wikipedia.org/wiki/String_interning) concept. String pool is also example of [**Flyweight design pattern**](https://www.journaldev.com/1562/flyweight-design-pattern-java)**.**

String pool helps in saving a lot of space for Java Runtime although it takes more time to create the String.

When we use double quotes to create a String, it first looks for String with same value in the String pool, if found it just returns the reference else it creates a new String in the pool and then returns the reference.

However using new operator, we force String class to create a new String object in heap space. We can use intern() method to put it into the pool or refer to other String object from string pool having same value.

public class Test {

/\*\*

\* [Java String](https://www.journaldev.com/16928/java-string) Pool example

\* @param args

\*/

public static void main(String[] args) {

String s1 = "Cat";

String s2 = "Cat";

String s3 = new String("Cat");

System.out.println("s1 == s2 :"+(s1==s2));

System.out.println("s1 == s3 :"+(s1==s3));

}

}

O/P:

s1 == s2 :true

s1 == s3 :false

how many stringw are getting created in below statement;

String str = new String("Cat");

In above statement, either 1 or 2 string will be created. If there is already a string literal “Cat” in the pool, then only one string “str” will be created in the pool. If there is no string literal “Cat” in the pool, then it will be first created in the pool and then in the heap space, so total 2 string objects will be created.

Advantage of String pool is to save the heap memory.

**public** **class** Test

{

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

{

String s1=**new** String("hello");

String s2=**new** String("hello");

**if**(s1==s2)

{

System.***out***.println ("Same location");

}

**else**

{

System.***out***.println ("Different location");

}

}

}

o/p: Different location

**public** **class** Test

{

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

{

String s1=**new** String("hello");

String s2=s1;

**if**(s1==s2)

{

System.***out***.println ("Same location");

}

**else**

{

System.***out***.println ("Different location");

}

}

}

O/P: Same location

**public** **class** Test

{

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

{

String s1=**new** String("hello");

String s2=**new** String(s1);

**if**(s1==s2)

{

System.***out***.println ("Same location");

}

**else**

{

System.***out***.println ("Different location");

}

}

}

O/P; Different location

**3) String compare by compareTo() method**

The String compareTo() method compares values lexicographically and returns an integer value that describes if first string is less than, equal to or greater than second string.

It compares ASCII value of the String.

Suppose s1 and s2 are two string variables.

String s1=**new** String("hello");

String s2=**new** String("hello");

**int** diff = s1.compareTo(s2);

1) returns 0 if both Strings contains same value

2) returns positive value if s1 > s2

3) returns negative value if s1<s2

**public** **class** Test

{

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

{

String s1=**new** String("hello");

String s2=**new** String("hello");

**if**(s1.compareTo(s2)==0)

{

System.***out***.println ("Same");

}

**else**

{

System.***out***.println ("Not Same");

}

}

}

O/P: Same

**public** **class** Test {

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

String s1=**new** String("hello");

String s2=**new** String("Hello");

**if**(s1.compareTo(s2)>0)

{

System.***out***.println ("S1 > S2");

}

**else**

{

System.***out***.println ("S2 > S1");

}

}

}

O/P: S1 > S2

**public** **class** Test

{

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

{

String s1=**new** String("Hello");

String s2=**new** String("hello");

**if**(s1.compareToIgnoreCase(s2)==0)

{

System.***out***.println ("Same");

}

**else**

{

System.***out***.println ("Not Same");

}

}

}

O/P: same

compareTo() is used sort the strings in ascending order or descending order.

**Sorting Strings:**

**public** **class** Test

{

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

{

String []names=**new** String[]{"java","hadoop","linux","unix","servlet","jsp","html"};

System.***out***.println ("Before Sorting ");

**for** (**int** i = 0; i < names.length; i++)

{

System.***out***.println (names[i]);

}

**for** (**int** i = 0; i < names.length; i++)

{

**for**(**int** j=0; j<names.length-1-i;j++)

{

**if**((names[j].compareTo(names[j+1]))>0)

{

String temp = names[j];

names[j]=names[j+1];

names[j+1]=temp;

}

}

}

System.***out***.println ("After Sorting ");

**for** (**int** i = 0; i < names.length; i++)

{

System.***out***.println (names[i]);

}

}

}

**String Concatenation in Java**

=========================

+ is an operator to concate the Strings.

**public** **class** Test

{

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

{

String s1="hello";

String s2= s1+"java";

String s3 = **new** String("world");

System.***out***.println (s2);

String s4 = s2+"\t"+s3;

System.***out***.println (s4);

}

}

O/P:

hellojava

hellojava world

**Java String replace() method**

The string replace() method replaces all occurrence of first sequence of character with second sequence of character.

**public** **class** Test

{

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

{

String s1="Java is a programming language. Java is a platform. Java is an Island.";

String replaceString=s1.replace("Java","Kava");//replaces all occurrences of "Java" to "Kava"

System.***out***.println (s1);

System.***out***.println (replaceString);

}

}

Output:

Java is a programming language. Java is a platform. Java is an Island.

Kava is a programming language. Kava is a platform. Kava is an Island.

replace(), will change value of the String as String is a immutable object.

It returns replaced value.

String value can not be changed for every attempt on the String it creates new location.

**public** **class** Test

{

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

{

String s1="Java is a programming language. Java is a platform. Java is an Island.";

String replaceString=s1.replaceAll("Java","Kava");//replaces all occurrences of "Java" to "Kava"

System.***out***.println (s1);

System.***out***.println (replaceString);

}

}

Output:

Java is a programming language. Java is a platform. Java is an Island.

Kava is a programming language. Kava is a platform. Kava is an Island.

Spilt() of String class:

================

It return array of Strings;

**public** **class** Test

{

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

{

String s1="java linux unix hadoop html";

String [] s2 =s1.split(" ");

**for** (String str : s2)

{

System.***out***.println (str);

}

}

}

O/P;

java

linux

unix

hadoop

html

**public** **class** Test {

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

String record = "1001:nrit:25:5000:male";

String [] fields = record.split(":");

System.***out***.println(fields[0]+"\t"+fields[1]+"\t"+fields[4]);

}

}

**O/p:**

1001 nrit male

**How to create Immutable class.**

To create immutable class in java, you have to do following steps.

1. Declare the class as final so it can’t be extended.
2. Make all fields private so that direct access is not allowed.
3. Don’t provide setter methods for variables
4. Make all **mutable fields final** so that it’s value can be assigned only once.
5. Initialize all the fields via a constructor performing deep copy.
6. Perform cloning of objects in the getter methods to return a copy rather than returning the actual object reference.

**Program to create immutable class**

**package** com.nrit.mnrao.test;

**final** **public** **class** Sample {

**final** **private** **int** id;

**final** **private** String name;

// initialization

**public** Sample()

{

id=0;

name=**null**;

}

// copying one object data into another object.

**public** Sample(Sample s)

{

id=s.id;

name=s.name;

}

// initialization

**public** Sample(**int** id, String name)

{

**this**.id =id;

**this**.name =name;

}

**public** **int** getId() {

**return** id;

}

**public** String getName() {

**return** name;

}

// cloning

**public** Sample newInstance()

{

Sample temp = **new** Sample(id, name) ;

**return** temp;

}

}

**public** **class** Test {

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

//creating and initializing object.

Sample s1 = **new** Sample(10,"nrit");

//Cloning s2 from s1

Sample s2 = s1.newInstance();

// creating s3 object and copying s1 data into s3.

Sample s3 = **new** Sample(s1);

**if**(s1!=s2)

{

System.***out***.println("cloned");

}

**else**

{

System.***out***.println("cloning failed");

}

**if**(s1!=s3)

{

System.***out***.println("Copy created");

}

**else**

{

System.***out***.println("copy failed");

}

System.***out***.println(s1.getId()+"\t"+s1.getName());

System.***out***.println(s2.getId()+"\t"+s2.getName());

System.***out***.println(s3.getId()+"\t"+s3.getName());

}

}

# Why String is immutable or final in Java

## Why String is immutable in Java?

# benefits of String immutability

[**String pool**](https://www.journaldev.com/797/what-is-java-string-pool)is possible only because String is immutable in java, this way Java Runtime saves a lot of java heap space because different String variables can refer to same String variable in the pool. If String would not have been immutable, then String interning would not have been possible because if any variable would have changed the value, it would have been reflected to other variables also.

If String is not immutable then it would cause severe security threat to the application. For example, database username, password are passed as String to get database connection and in [**socket programming**](https://www.journaldev.com/741/java-socket-programming-server-client) host and port details passed as String. Since String is immutable it’s value can’t be changed otherwise any hacker could change the referenced value to cause security issues in the application.

Since String is immutable, it is safe for multithreading and a single String instance can be shared across different threads. This avoid the usage of synchronization for thread safety, Strings are implicitly thread safe.

Strings are used in [**java classloader**](https://www.journaldev.com/349/java-classloader) and immutability provides security that correct class is getting loaded by Classloader. For example, think of an instance where you are trying to load java.sql.Connection class but the referenced value is changed to myhacked.Connection class that can do unwanted things to your database.

**StringBuffer**

It is a class from java.lang package

Java StringBuffer class is used to create mutable (modifiable) string. The StringBuffer class in java is same as String class except, it is mutable i.e. it can be changed.

**Note: Java StringBuffer class is thread-safe i.e. multiple threads cannot access it simultaneously. So it is safe and will result in an order.**

**Important Constructors of StringBuffer class**

StringBuffer() --> creates an empty string buffer with the initial capacity of 16 bytes.

StringBuffer sb = new StringBuffer() ;

StringBuffer(String str)--> creates a string buffer with the specified string.

StringBuffer sb = new StringBuffer(“hello”) ;

StringBuffer(int capacity)--> creates an empty string buffer with the specified capacity as length.

StringBuffer sb = new StringBuffer(10) ;

Important methods of StringBuffer class

**public synchronized StringBuffer append(String s):**

is used to append the specified string with this string.

The append() method is overloaded like append(char), append(boolean), append(int), append(float), append(double) etc.

**public synchronized StringBuffer insert(int offset, String s):**

is used to insert the specified string with this string at the specified position. The insert() method is overloaded like insert(int, char), insert(int, boolean), insert(int, int), insert(int, float), insert(int, double) etc.

**public synchronized StringBuffer replace(int startIndex, int endIndex, String str):**

is used to replace the string from specified startIndex and endIndex.

**public synchronized StringBuffer delete(int startIndex, int endIndex):**

is used to delete the string from specified startIndex and endIndex.

**public synchronized StringBuffer reverse()**

is used to reverse the string.

**public int capacity():**

is used to return the current capacity.

**public void ensureCapacity(int minimumCapacity)**

is used to ensure the capacity at least equal to the given minimum.

**public char charAt(int index):**

is used to return the character at the specified position.

**public int length()**

is used to return the length of the string i.e. total number of characters.

**public String substring(int beginIndex)**

is used to return the substring from the specified beginIndex.

**public String substring(int beginIndex, int endIndex)**

is used to return the substring from the specified beginIndex and endIndex.

Eg:

**public** **class** Test {

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

StringBuffer sb = **new** StringBuffer();

String record1 = "1001#mnrao11#5000#25#finance";

String record2 = "1002#mnrao2#6004#26#dev";

String record3 = "1003#mnrao32#7000#23#testng";

String record4 = "1004#mnrao4#6500#25#admin";

sb.append(record1);

sb.append("\n");

sb.append(record2);

sb.append("\n");

sb.append(record3);

sb.append("\n");

sb.append(record4);

String str = sb.toString();

String [] records = str.split("\n");

**for** (String record : records)

{

System.***out***.println (record);

}

}

}

**below program will display only names of the record:**

**public** **class** Test

{

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

{

StringBuffer sb = **new** StringBuffer();

sb.append("1001:Sri Ram:5000.0:dev\n");

sb.append("1002:Manoj:6000.0:admin\n");

sb.append("1003:Anusha:6500.0:testing\n");

sb.append("1004:prasad:5500.0:dev\n");

sb.append("1005:vinay:3500.0:finance\n");

sb.append("1006:mithun:5500.0:admin\n");

sb.append("1007:thirumala:8500.0:dev");

String empData = sb.toString();

String[] records = empData.split("\n");

**for** (String record : records)

{

String[] fields = record.split(":");

System.***out***.println (fields[1]);

}

}

}

|  |  |  |
| --- | --- | --- |
| **No.** | **String** | **StringBuffer** |
| 1. | String class is immutable. | StringBuffer class is mutable. |
| 2. | String is slow and consumes more memory when you concat too many strings because every time it creates new instance. | StringBuffer is fast and consumes less memory when you cancat strings. |
| 3. | String class overrides the equals() method of Object class. So you can compare the contents of two strings by equals() method. | StringBuffer class doesn't override the equals() method of Object class. |

**Difference between StringBuffer and StringBuilder**

|  |  |  |
| --- | --- | --- |
| **No.** | **StringBuffer** | **StringBuilder** |
| 1. | StringBuffer is synchronized i.e. thread safe. It means two threads can't call the methods of StringBuffer simultaneously. | StringBuilder is non-synchronized i.e. not thread safe. It means two threads can call the methods of StringBuilder simultaneously. |
| 2. | StringBuffer is less efficient than StringBuilder. | StringBuilder is more efficient than StringBuffer. |

1. Is String a data type in java?

Ans: String is not a primitive data type in java. When a string is created in java, it’s actually an object of Java.Lang.String class that gets created. After creation of this string object, all built-in methods of String class can be used on the string object.

2. Why Strings in Java are called as Immutable?

Ans: In java, string objects are called immutable as once value has been assigned to a string, it can’t be changed and if changed, a new object is created.

3. When a lot of changes are required in data, which one should be a preference to be used? String or StringBuffer?

Ans: Since StringBuffers are dynamic in nature and we can change the values of StringBuffer objects unlike String which is immutable, it’s always a good choice to use StringBuffer when data is being changed too much. If we use String in such a case, for every data change a new String object will be created which will be an extra overhead.

4. How can we use primitive data types as objects?

Ans: Primitive data types like int can be handled as objects by the use of their respective wrapper classes. For example, Integer is a wrapper class for primitive data type int. We can apply different methods to a wrapper class, just like any other object.

**5. Can we use a default constructor of a class even if an explicit constructor is defined?**

Ans: Java provides a default no argument constructor if no explicit constructor is defined in a Java class. But if an explicit constructor has been defined, default constructor can’t be invoked and developer can use only those constructors which are defined in the class.

**6.What are Wrapper classes?**

Java wrapper classes are the Object representation of eight primitive types in java. All the wrapper classes in java are immutable and final. Java 5 autoboxing and unboxing allows easy conversion between primitive types and their corresponding wrapper classes.

### 7) Why Java is not pure Object Oriented language?

Java is not said to be pure object oriented because it support primitive types such as int, byte, short, long etc. I believe it brings simplicity to the language while writing our code. Obviously java could have wrapper objects for the primitive types but just for the representation, they would not have provided any benefit.

As we know, for all the primitive types we have wrapper classes such as Integer, Long etc that provides some additional methods.

### 8) What is the use of System class?

Java System Class is one of the core classes. One of the easiest way to log information for debugging is System.out.print() method.

System class is final so that we can’t subclass and override it’s behavior through inheritance. System class doesn’t provide any public constructors, so we can’t instantiate this class and that’s why all of it’s methods are static.

Some of the utility methods of System class are for array copy, get current time, reading environment variables.

### 9) Does constructor return any value?

**Ans:**yes, that is current instance (You cannot use return type yet it returns a value).

### 10)What is object cloning?

The object cloning is used to create the exact copy of an objec

### 11) What is the basic difference between string and stringbuffer object?

String is an immutable object. StringBuffer is a mutable object.

### 12) What is the difference between StringBuffer and StringBuilder ?

StringBuffer is synchronized whereas StringBuilder is not synchronized.

### 13) How can we create immutable class in java ?

We can create immutable class as the String class by defining final class and

**StringTokenizer**

The **java.util.StringTokenizer** class allows an application to break a string into tokens.

* This class is a legacy class that is retained for compatibility reasons although its use is discouraged in new code.
* Its methods do not distinguish among identifiers, numbers, and quoted strings.
* This class methods do not even recognize and skip comments.

## Class declaration

Following is the declaration for **java.util.StringTokenizer** class:

public class StringTokenizer extends Object implements Enumeration<Object>

## Class constructors

**StringTokenizer(String str)**

This constructor a string tokenizer for the specified string.

**StringTokenizer(String str, String delim)**

This constructor constructs string tokenizer for the specified string.

**StringTokenizer(String str, String delim, boolean returnDelims)**

This constructor constructs a string tokenizer for the specified string.

[**int countTokens()**](https://www.tutorialspoint.com/java/util/stringtokenizer_counttokens.htm)

This method calculates the number of times that this tokenizer's nextToken method can be called before it generates an exception.

“java:oracle:linux:unix:sql”

[**boolean hasMoreElements()**](https://www.tutorialspoint.com/java/util/stringtokenizer_hasmoreelements.htm)

This method returns the same value as the hasMoreTokens method

[**boolean hasMoreTokens()**](https://www.tutorialspoint.com/java/util/stringtokenizer_hasmoretokens.htm)

This method tests if there are more tokens available from this tokenizer's string.

[**Object nextElement()**](https://www.tutorialspoint.com/java/util/stringtokenizer_nextelement.htm)

This method returns the same value as the nextToken method, except that its declared return value is Object rather than String.

[**String nextToken()**](https://www.tutorialspoint.com/java/util/stringtokenizer_nexttoken.htm)

This method returns the next token from this string tokenizer.

[**String nextToken(String delim)**](https://www.tutorialspoint.com/java/util/stringtokenizer_nexttoken_delim.htm)

This method returns the next token in this string tokenizer's string.

**import** java.util.StringTokenizer;

**public** **class** Test {

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

{

System.***out***.println ("Using Constructor 1 - ");

StringTokenizer st1 = **new** StringTokenizer("Hadoop Java Html Oracle Linux", " ");

**while** (st1.hasMoreTokens())

{

System.***out***.println (st1.nextToken());

}

System.***out***.println ("Using Constructor 2 - ");

StringTokenizer st2 = **new** StringTokenizer("Hadoop:Java:Html:Oracle:Linux", " :");

**while** (st2.hasMoreTokens())

{

System.***out***.println (st2.nextToken());

}

}

}

**Data Conversion in Java**

It is a conversion of data from one type to another type.

It is called as type casting.

There are two types in type casting

1. Primitive type casting
2. Non-primitive type casting

1)Basic to Basic **( primitive type casting )**

**Below all are Non-primitive type casting**

2)Basic to Object

3)Object to Basic

4) Object to Object

5) Sting to Basic

6) Basic to String

**1)Basic to Basic ( primitive types )**

all primitive types are basic type

eg: int, float ,char....

this type of conversion is type casting.

**Primitive data types casting**

These are

1) Implicit Casting and 2) Explicit casting

1) implicit casting:

it is a conversion of data from small type to big type. It is an implicit process ( automatically/internally )

Eg:

**byte** b=10;

**short** s=b;

here byte type of data converting into short ( type promotion )

**data type promotion as below.**

byte ===> short ===> int ===> long ==> double

byte ===> short ===> int ==> float ==> double

byte ===> short ==> char

char ==> int ==>long

eg1:

byte b=10;

short s = b ; --> valid

eg2:

int a=10;

long b=a; --> valid

eg3:

float a=10.5f;

double b=a; --> valid

integer type of data can be converted into real number type.

converting from real number to integer, implicit casting is not applicable.

To convert real to integer type explicit casting required.

2) Explicit casting:

It is conversion of data from big type to small type.

Java developer has to convert explicitly .

Eg:

short a=10;

byte b = a; --> invalid, since size of variable a is 2 bytes , which is more than size of variable b ( 1 byte )

such of kind of scenarios, we use explicit type casting.

Short a=10;

byte b = (byte ) a ; --> it is valid

same scenario with following

short a=130;

byte b = (byte ) a ; --> it compiles but at run time loss of data. It results in unexpected data ( i.e leads to bugs )

here value of b is -126 .

hence explicit type casting is recommended is only for constants not for variables.

float a= 10.5 ; --> invalid, since in java real numbers by default treats as double.

float a= 10.5f; --> valid

default,

integer data ( number ) is a int data type not a short and byte.

Real numbers are treated as double type.

**Result of mathematical expressions, with different data types.**

1) byte + byte = int

2) short + short = int

3) int + int = int ( compiles ) but at runtime there is chance of data flow.

Recommended one is ( int+int = long )

4) long + long = long

5) char + char = int.

**Object Wrapper classes**

**2)Basic to Object**

for every basic type java provides Object wrapper class to convert basic type to Object type.

|  |  |
| --- | --- |
| **Basic type key words** | **Object Wrapper class** |
| byte | Byte |
| short | Short |
| int | Integer |
| long | Long |
| float | Float |
| double | Double |
| char | Character |
| boolean | Boolean |

**Note:** All the above wrapper classes are from java.lang package.

Wrapper classes are immutable and final.

eg1:

int a=10;

to convert into Object:

=========================

Integer i1= new Integer(a);// i1 contains 10.

eg2:

double b=100.50;

Double d1 = new Double(b);

**3) Object to Basic Type:**

Object Wrapper classes provides xValue() to convert from Object to basic type.

x--> data type.

Eg:

for integer x is **int**.

For float x is **float**

eg1:

Integer i1= **new** Integer(10);

**int** a=i1.intValue();// value of a is 10.

eg2:

Double d1 = **new** Double(100.50);

**double** b = d1.doubleValue();

**Auto Boxing and Unboxing:**

it converts basic to object, object to basic automatically.

This concept was introduced from jdk1.5 ( tiger version ) onwards.

**Auto boxing:**

it is a conversion of data from basic to Object type:

eg:

Integer i1 = 10;// directly can be assigned.

Double d1 = 300.506;// directly can be assigned.

**Auto unboxing:**

Double d1= **new** Double(25.8);

**double** b=d1; // directly can be assigned. xValue() not required.

**4) Object to Object :**

These are of two types

1. Up casting
2. Down casting

**1) Up casting :**

It is a conversion of data from child to parent. It is an implicit process.

Eg:

Below is the parent.

**package** com.nrit.mnrao.test;

**public** **interface** Picture {

**abstract** **public** **void** draw();

}

**Child class:**

**package** com.nrit.mnrao.test;

**public** **class** Rectangle **implements** Picture {

@Override

**public** **void** draw() {

System.***out***.println("Rectangle");

}

}

Parent reference and child instance ( child to parent )

Picture p = new Rectangle(); // it is an implicit process.

**2) Down Casting :**

It is conversion of data from parent to child. It is an explicit casting.

Picture picture = **new** Rectangle(); // parent reference.

Rectangle rectangle = picture; //Not valud, since Parent reference assign

to child

to convert from parent child implicit in not valid. The way is explicit casting.

Picture picture = **new** Rectangle();

Rectangle rectangle = (Rectangle) picture;// it is an explicit casting.

**Object class:**

Object class is a top most parent of complete JDK hierarchy.

It is a default parent for every class, including user defined classes.

After compilation of every class, compiler makes Object calss as a parent of every class.

Eg:;

Source code.

**Sample.java as below.**

**public** **class** Sample {

}

Aftfter compilation

Sample.class contains following code.

**public** **class** Sample **extends** Object{

}

All the members of Objet gets inherited into Sample class. Hence Sample class object contains Object class members as well it’s own members.

Members of Object class:

equals();  to compare two Objects

getClass();  to get class name for the object.

Eg:

Sample s1 = **new** Sample();

Class<? **extends** Sample> name = s1.getClass();

System.***out***.println(name);

O/P :

Sample.

hashCode();  return address of object in form of unsigned iteger.

Eg:

Sample s1 = **new** Sample();

**int** hashCode = s1.hashCode();

System.***out***.println(hashCode);

notify() and notifyAll()  used with threads to send notification to threads

notify()  to send notification to first waiting thread in waiting queue.

notifyAll()  to send notification to all waiting threads in waiting queue.

toString()  to convert any type of data into string type.

Sample s1 = **new** Sample();

System.***out***.println(s1);

Here println()  expecting string, hence it makes to toString(), if toString() is available in the child class, then it makes call to child class method, if not avaialable then it makes a call to Obeject class toString() method.

Object class toString() returns address ( reference ) of the object.

**Overriding toString() method.**

**package** com.nrit.mnrao.test;

**public** **class** Sample **extends** Object {

**int** id;

String name;

**public** Sample() {

id = 0;

name = **null**;

}

**public** Sample(**int** id, String name) {

**this**.id = id;

**this**.name = name;

}

@Override

**public** String toString() {

**return** "Sample [id=" + id + ", name=" + name + "]";

}

}

**package** com.nrit.mnrao.test;

**public** **class** Test {

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

Sample s1 = **new** Sample(10, "nrit");

System.***out***.println(s1);

}

}

**Note:** toString() works only on the objects but not with basic data type.

Converting Object class type to String class type.

String str = "hello";

Object obj = str; // valid since child is assigining to parent

( up casting)

Object obj = **new** Sample();

String str =(String) obj; //compiles but raises ClassCastException

System.***out***.println(str);

//below is the valid coding for coversion.

**if** (obj **instanceof** String)

{

String str = (String) obj;

}

**else**

{

System.***out***.println("invalid runtime instance, expected for String type ");

}

wait()  to put the thread into waiting state for shared resources.

**5) String to basic type:**

**=================**

every wrapper class provides static parseX() to convert from String to basic type.

Eg1:

String str="101";

**int** a =Integer.*parseInt*(str);// here value of a is 101.

Eg2:

String str="100.50";

**float** f = Float.*parseFloat*(str);

parseX()  throws NumberFormatException, if string contains non-numeric value.

Eg1: to use parseX()

**package** com.nrit.mnrao.test;

**import** java.util.Scanner;

**public** **class** Test {

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

Scanner sc = **new** Scanner(System.***in***);

System.***out***.println("Enter EMPNO:");

String inputData = sc.next();

**int** eno = Integer.*parseInt*(inputData);

System.***out***.println("Enter name ");

String name = sc.next();

System.***out***.println("Enter Salary ");

inputData = sc.next();

**double** salary = Double.*parseDouble*(inputData);

System.***out***.println("Enter Dept ");

String dept = sc.next();

System.***out***.println(eno+"\t"+name+"\t"+salary+"\t"+dept);

}

}

**O/P;**

Enter EMPNO:

1001

Enter name

abc

Enter Salary

5000

Enter Dept

dev

1001 abc 5000.0 dev

Eg2: to use parseX()

**package** com.nrit.mnrao.test;

**public** **class** Test {

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

String record = "1001:nrit:5000:dev";

String[] fields = record.split(":");

**int** eno = Integer.*parseInt*(fields[0]);

String name = fields[1];

**double** salary = Double.*parseDouble*(fields[2]);

String dept = fields[3];

System.***out***.println(eno + "\t" + name + "\t" + salary + "\t" + dept);

}

}

**6)Basic ( any type ) to String type:**

**=========================**

String class provides static overloaded valueOf() method to convert any basic type of data into String type.

Eg1:

**int** a=125;

String str = String.*valueOf*(a);

Eg2:

**float** a=30.56f;

String str = String.*valueOf*(a);

To convert any object to String type:

Sample s1 = **new** Sample();

String str = String.*valueOf*(s1);

System.***out***.println(str);

Here valueOf() argument type is Object class type.

It method argument type is Object class type , then any type of object can be passed to that method ( parent reference and child object ).

As Object class is a default parent for every class it can refer to any object.

**Exception Handling**

before going to learn Exceptions, we should clear about, error, exception, bug and defect

**Error :** It is a compile time one. Such as syntactical errors.

**Exception :** It is a runtime one, it is an unkown instruction to processor at run time. when exception raises application terminates abnormally. It can be handled by writing exception handling code.

**Bug :** It is an unexpected value at runtime. Even bug raises application never terminates

abnormally. It can be fixed.

**Defect :** It can't be fixed. Some features may not be provided by the application software. It is manufacturing defect.

The exception handling in java is one of the powerful mechanism to handle the runtime errors so that normal flow of the application can be maintained.

**What is an exception**

Dictionary Meaning: Exception is an abnormal condition.

In java, 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 ClassNotFound, IO, SQL, Remote etc.

**Advantage of Exception Handling**

The core advantage of exception handling is to maintain the normal flow of the application. Exception normally disrupts the normal flow of the application that is why we use exception handling.

Let's take a scenario:

statement 1;

statement 2;

statement 3;

statement 4;

statement 5;//exception occurs

statement 6;

statement 7;

statement 8;

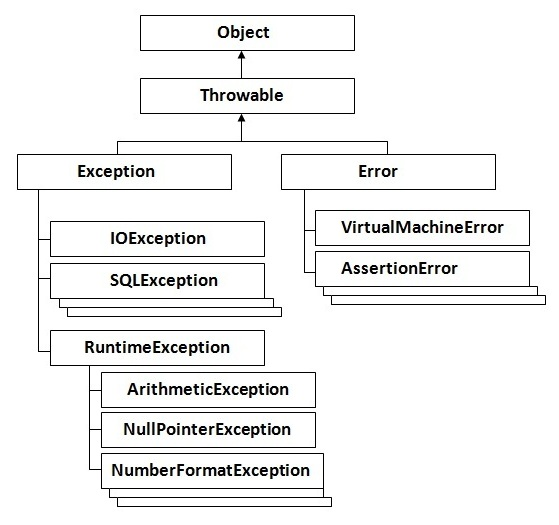
statement 9;

statement 10;

Suppose there are 10 statements in your program and there occurs an exception at statement

5, rest of the code will not be executed i.e. statement 6 to 10 will not run. If we perform exception handling, rest of the exception will be executed. That is why we use exception handling in java.

**Hierarchy of Java Exception classes**



**Common scenarios where exceptions may occur**

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

1) Scenario where ArithmeticException occurs

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

int a= 50/0;//ArithmeticException

2) Scenario where NullPointerException occurs

default catch

If we have null value in any variable, performing any operation by the variable occurs an NullPointerException.

String s=null;

System.out.println (s.length());//NullPointerException

3) Scenario where NumberFormatException occurs

The wrong formatting of any value, may occur NumberFormatException. Suppose I have a string variable that have characters, converting this variable into digit will occur NumberFormatException.

String s="10ab2”;

int i=Integer.parseInt(s);//NumberFormatException

4) Scenario where ArrayIndexOutOfBoundsException occurs

If you are inserting any value in the wrong index, it would result ArrayIndexOutOfBoundsException as shown below:

int a[] = new int[5];

a[5]=50; //ArrayIndexOutOfBoundsException

Java Exception Handling Keywords

**There are 5 keywords used in java exception handling.**

try , catch, finally, throw and throws

**Java try-catch**

Java try block is used to enclose the code that might throw an exception. It must be used within the method.

Java try block must be followed by either catch or finally block.

**Syntax of java try-catch**

try

{

------------------------;

-------------------------;

-------------------------; //code that may throw exception

-------------------------;

-------------------------;

}

catch(Exception\_Type ref)

{

---------------------;

---------------------;

}

------------

------------

**Example :**

**public** **class** Test

{

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

{

System.***out***.println ("Main Start");

**try**

{

System.***out***.println ("tray start");

**int** a=10;

**int** b;

**int** n=args.length;

b=a/n;

System.***out***.println ("result "+b);

System.***out***.println ("tray end");

}

**catch**(ArithmeticException e)

{

String msg = e.getMessage();// this is to get message from JVM.

System.out.println("divide by zero error "+msg);

e.printStackTrace(); // gives location ( line number ) of exception.

}

System.***out***.println ("main end");

}

}

**Try with multiple catch blocks:**

**try**

{

----------;

----------;

----------;

----------;

}

**catch** ( )

{

}

**catch** ( )

{

}

**catch** ( )

{

}

**catch** ( )

{

}

**Example for try with multiple catch blocks:**

**public** **class** Test

{

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

{

System.***out***.println ("Beg of main");

**try** {

**int** a = 10;

**int** n = args.length;

**int** b = a / n;

System.***out***.println ("Result ; " + b);

System.***out***.println ("First args:" + args[0]);

System.***out***.println ("Second args:" + args[1]);

System.***out***.println ("Third args:" + args[2]);

System.***out***.println ("End of try");

}

**catch**(ArithmeticException e)

{

String msg = e.getMessage();// this is to get message from JVM.

System.***out***.println("divide by zero error "+msg);

e.printStackTrace(); // gives location ( line number ) of exception.

}

**catch**(ArrayIndexOutOfBoundsException e)

{

String msg = e.getMessage();// this is to get message from JVM.

System.***out***.println("invalid index "+msg);

e.printStackTrace(); // gives location ( line number ) of exception.

}

**catch**(NumberFormatException e)

{

String msg = e.getMessage();// this is to get message from JVM.

System.***out***.println("Non bumeric value"+msg);

e.printStackTrace(); // gives location ( line number ) of exception.

}

System.***out***.println ("End of main");

}

}

**default catch :**

**catch** (Exception e )

{

**}**

**Example for default catch:**

**public** **class** Test

{

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

{

System.***out***.println ("Beg of main");

**try**

{

**int** a = 10;

**int** n = args.length;

**int** b = a / n;

System.***out***.println ("Result ; " + b);

System.***out***.println ("First args:" + args[0]);

System.***out***.println ("Second args:" + args[1]);

System.***out***.println ("Third args:" + args[2]);

System.***out***.println ("End of try");

}

**catch** (ArithmeticException e)

{

System.***out***.println ("devide by zero exception");

}

**catch** (NullPointerException e)

{

System.***out***.println ("Null Pointer Exception");

}

**catch** (Exception e )

{

System.***out***.println ("default exception");

}

System.***out***.println ("End of main");

}

}

How **Exception** class, can handle any type of excepton.

Ans:

Since it is a parent of all Exception classes, it can hadle all kinds of exceptions.

Program to handle **NumberFormatException**

**package** com.nrit.mnrao.test;

**import** java.util.Scanner;

**public** **class** Test {

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

System.***out***.println("Employee details");

Scanner sc = **new** Scanner(System.***in***);

**int** eno;

String empName;

**double** salary;

String deptName;

**while**(**true**)

{

**try**

{

System.***out***.println("Emp Num : ");

String inputData = sc.nextLine();

eno = Integer.*parseInt*(inputData);

**break**;

}

**catch**(NumberFormatException e)

{

System.***out***.println("Non numeric input data");

**continue**;

}

}

System.***out***.println("emp name ");

empName = sc.nextLine();

**while**(**true**)

{

**try**

{

System.***out***.println("Emp Salary : ");

String inputData = sc.nextLine();

salary = Double.*parseDouble*(inputData);

**break**;

}

**catch**(NumberFormatException e)

{

System.***out***.println("invalid salary ");

**continue**;

}

}

System.***out***.println("dept name ");

deptName = sc.nextLine();

System.***out***.println("Your input details are ");

System.***out***.println(eno+"\t"+empName+"\t"+salary+"\t"+deptName);

sc.close();

}

}

**Input :**

Employee details

Emp Num :

1001

emp name

abc

Emp Salary :

5000

dept name

dev

**output:**

Your input details are

1001 abc 5000.0 dev

Next time run, check the following:

**Input data**

Employee details

Emp Num :

10ab10

Non numeric input data

Emp Num :

10x20

Non numeric input data

Emp Num :

1001

emp name

dev

Emp Salary :

5000,50

invalid salary

Emp Salary :

5000#50

invalid salary

Emp Salary :

5000.50

dept name

admin

**Output:**

Your input details are

1001 dev 5000.5 admin

**Java finally block**

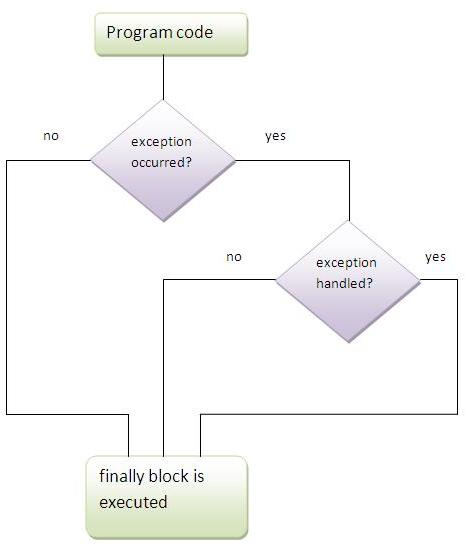
Java finally block is a block that is used to execute important code such as closing connection, stream etc.

Java finally block is always executed whether exception is handled or not.

Java finally block must be followed by try or catch block.

Finally block contain certain statement to be executed wether terminated normally or abnormally.

These are compulsory statements. Mostly cleaning operations such as file closing, database connection closing, tcp sockets closing and etc.



**Syntax of try-finally block**

Case 1:

**try**

{

}

**catch** (Exception e)

{

// **TODO**: handle exception

}

**finally**

{

}

Case 2:

**try**

{

}

**finally**

{

}

**Below is not a valid one**

**try**

{

}

**finally**

{

}

**catch** (Exception e)

{

// **TODO**: handle exception

}

Sequence must be try, catch and finally

Below is also not a valid one

**catch** (Exception e)

{

// **TODO**: handle exception

}

**finally**

{

}

To write catch / finally, try should be presented.

Multiple catch blocks can be placed but multiple finally blocks are not valid.

**Example :**

**public** **class** Test

{

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

{

System.***out***.println ("main start");

**try**

{

System.***out***.println ("Try start");

**int** a = 10;

**int** n = args.length;

**int** b = a / n;

System.***out***.println ("b= " + b);

System.***out***.println ("First param = " + args[0]);

System.***out***.println ("Second param = " + args[1]);

System.***out***.println ("Third param = " + args[2]);

System.***out***.println ("try end");

}

**catch** (ArithmeticException e)

{

System.***out***.println ("arithmetic ");

}

**catch** (NumberFormatException e)

{

System.***out***.println ("Array Index");

}

**finally**

{

System.***out***.println ("I am in finally");

}

System.***out***.println ("main end");

}

}

**Input :**

Command line params are as below

**hello java world**

**output ( no exception and normally completed )**

main start

Try start

b= 3

First param = hello

Second param = java

Third param = world

try end

I am in finally

main end

**Input :**

No command line params

**output** ( exception raised and handled )

main start

Try start

arithmetic

I am in finally

main end

**Input :**

Command line params are as below

**hello java**

**output** ( exception raised but not handled, terminated abnormally )

main start

Try start

b= 5

First param = hello

Second param = java

I am in finally

Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: 2

at com.nrit.mnrao.test.Test.main(Test.java:26)

there are two senarios

1. Normal termination
2. Abnormal termonation

**Normal termination:**

Any statements after finally block will also be executed.

**Abnormal termination:**

Any statements after finally block will not be executed.

**Java Nested try block**

The try block within a try block is known as nested try block in java.

Why use nested try block

Sometimes a situation may arise where a part of a block may cause one error and the entire block itself may cause another error. In such cases, exception handlers have to be nested.

Syntax:

**try**

{

**----------;**

**----------;**

**try**

{

----------;

----------;

----------;

----------;

}

catch ( )

{

}

**catch** ( )

{

}

----------;

----------;

}

**catch** ( )

{

}

**catch** ( )

{

}

----------;

---------;

Cases:

Case 1:

No exception in the out try as well as inner try, then no catch block executes and program completed till end, then terminates.

Case 2:

Exception in the outer try

Checks for the outer catch, if matched then, that catch blocks executes, if not matched, then termiates abnormally.

Case 3:

Exception in the inner try

Checks for the inner catch, if matched then, that catch blocks executes, then goes to outer try ending statements, then termiates normally.

If not matched with inner catch, then checks for outer catch blocks, if matched then, that catch blocks executes, then termiates normally. if not matched, then termiates abnormally.

**public** **class** Test {

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

{

System.***out***.println ("main start");

**try**

{

System.***out***.println ("outer try start");

**int** a=10;

**int** n=args.length;

**int** b = a/n;

System.***out***.println ("b="+b);

**try**

{

System.***out***.println ("Innner try start");

System.***out***.println ("First param "+args[0]);

System.***out***.println ("second param "+args[1]);

System.***out***.println ("third param "+args[2]);

System.***out***.println ("innner try end ");

}

**catch**(ArrayIndexOutOfBoundsException e)

{

System.***out***.println ("Inner try array index exception ");

}

**finally**

{

System.***out***.println ("Inner try finally");

}

System.***out***.println ("outer try end ");

}

**catch**(ArithmeticException e)

{

System.***out***.println ("out side try divide by zero error");

}

**finally**

{

System.***out***.println ("outer try finally");

}

System.***out***.println ("main end");

}

}

**try with default catch :**

**public** **class** Test

{

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

{

System.***out***.println ("Main Start");

**try**

{

System.***out***.println ("tray start");

**int** a=10;

**int** b;

**int** n=args.length;

b=a/n;

System.***out***.println ("dividion result "+b);

System.***out***.println ("Second arg");

System.***out***.println (args[1]);

System.***out***.println ("third arg");

System.***out***.println (args[2]);

System.***out***.println ("fourth arg");

System.***out***.println (args[3]);

System.***out***.println ("tray end");

}

**catch**(NullPointerException e)

{

//System.out.println ("Divide by zero error");

e.printStackTrace();

}

**catch**(ArrayIndexOutOfBoundsException e)

{

//System.out.println ("Divide by zero error");

e.printStackTrace();

}

**catch**(Exception e)

{

System.***out***.println ("default catch");

}

System.***out***.println ("main end");

}

}

**default catch must be last catch block.**

below is the compile time error.

**try**

{

----------;

----------;

----------;

----------;

}

**catch** (ArithmeticException e )

{

}

**catch** (Exception e ) // default catch

{

}

**catch** (NullPointerException e ) // compile time error

{

}

**catch** (ArrayIndexOutOfBoundsException e ) ) // compile time error

{

}

Note: If you don't handle exception, before terminating the program, JVM executes finally block(if any).

**Why use java finally**

Finally block in java can be used to put "cleanup" code such as closing a file, closing connection etc.

**Java throw keyword**

The Java throw keyword is used to throw an exception explicitly.

We can throw either checked or uncheked exception in java by throw keyword.

throw keyword is mainly used to throw custom exception.

The syntax of java throw keyword is given below.

throw new throwableInstance();

throwableInstance must be a child of Exception class.

Eg:

throw new IOException("sorry device error”);

java throw keyword example

eg:

**package** com.nrit.mnrao.test;

**public** **class** Test {

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

{

System.***out***.println ("Main Start");

**try**

{

System.***out***.println ("tray start");

**int** a=10;

**int** b;

**int** n=args.length;

**if**(n==0)

{

**throw** **new** ArithmeticException();

}

b=a/n;

System.***out***.println ("b="+b);

}

**catch**(ArithmeticException e)

{

System.***out***.println(e.getMessage());

}

System.***out***.println ("main end");

}

}

In the above example getMessage() **return value is null.**

If exception instance created by JVM implicitly, then JVM will initialize instance with text message. Then getMessage() returns text message initialized by the JVM.

In the above example**,** java developer**,** has created exception instance but not initialized with any text message. Hence it retruns null value.

Creating exception instance with text message.

**throw** **new** ArithmeticException("divide by zero ");

getMesage() returns value : divide by zero

**User defined exceptions :**

user defined exceptions class should extends of **“Exception”** class.

**public** **class** SampleException **extends** Exception

{

String message;

**public** SampleException()

{

message=**null**;;

}

**public** SampleException(String message)

{

**this**.message=message;

}

**public** String getMessage()

{

**return** message;

}

**public** String toString()

{

**return** message;

}

}

**public** **class** Test

{

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

{

System.***out***.println ("main start");

**try** {

System.***out***.println ("try start");

**int** a = 10;

**int** n = args.length;

**if** (n == 0) {

**throw** **new** SampleException("Sample user defined exception");

}

**int** b = a / n;

System.***out***.println (" b = " + b);

System.***out***.println ("First parameter " + args[0]);

System.***out***.println ("second parameter " + args[1]);

System.***out***.println ("Third parameter " + args[2]);

System.***out***.println ("try end");

}

**catch** (SampleException e)

{

System.***out***.println ("Arithmetic Exception");

System.***out***.println (e.getMessage());//makes call to method of SampleException class

System.***out***.println (e);//it makes a call to toString() method of SampleException calss;

}

System.***out***.println ("end of main");

}

}

1. Throwable instance must be child of Exception class.
2. Catch block takes the class type as the argument, which is extedns of Exception class.

**Types of Exception**

There are mainly two types of exceptions: checked and unchecked where error is considered as unchecked exception. The sun microsystem says there are three types of exceptions:

1. Exception

Checked Exception

Unchecked Exception

1. Error

**Difference between checked and unchecked exceptions**

1. **Checked Exception**

Checked exceptions are checked at compile-time.

The classes that extend Throwable / Exception class except RuntimeException and Error are known as checked exceptions e.g. IOException, SQLException etc.

User defind Exception classes.

All Exception classes, from other than java.lang package are checked exceptions.

**2) Unchecked Exception**

Unchecked exceptions are not checked at compile-time rather they are checked at runtime.

The classes that extends RuntimeException e.g. ArithmeticException, NullPointerException, ArrayIndexOutOfBoundsException etc.

All the Exception classes from java.lang package are Unchecked Exceptions

**3) Error**

Error is irrecoverable

e.g. OutOfMemoryError, VirtualMachineError, AssertionError etc.

Checked exceptions should handled at compile time. It can be handled by using try –catch or usng throws clause.

try –catch is used to get exception message, where as throws clause is to suppress Exception at compile time.

**Java throws keyword ( throws clause )**

The Java throws keyword is used to declare an exception. It gives an information to the programmer that there may occur an exception so it is better for the programmer to provide the exception handling code so that normal flow can be maintained.

Exception Handling is mainly used to handle the checked exceptions. If there occurs any unchecked exception such as NullPointerException, it is programmers fault that he is not performing check up before the code being used.

**Syntax of java throws**

return\_type method\_name() throws exception\_class\_name

{

//method code

}

**Java throws example**

**public** **class** Test {

**public** **static** **void** main(String[] args) **throws** SampleException {

System.***out***.println("Main Start");

System.***out***.println("tray start");

**int** a = 10;

**int** b;

**int** n = args.length;

**if** (n == 0) {

**throw** **new** SampleException("Sample error");

}

b = a / n;

System.***out***.println("b=" + b);

System.***out***.println("main end");

}

}

**Another example**

**public** **class** Test {

**public** **static** **void** main(String[] args) **throws** SampleException {

System.***out***.println("Main Start");

*display*(args);

System.***out***.println("main end");

}

**public** **static** **void** display( String[] args) **throws** SampleException

{

System.***out***.println("tray start");

**int** a = 10;

**int** b;

**int** n = args.length;

**if** (n == 0) {

**throw** **new** SampleException("Sample error");

}

b = a / n;

System.***out***.println("b=" + b);

}

}

If called method is having throws clause, then calling methods also must have throws clause or it should hadeld by using try-catch.

**Throws clause with multiple Exceptions**

**public** **static** **void** main(String[]args) **throws** IOException, SampleExeption, SQLException {

System.***out***.println("Main Start");

*display*(args);

System.***out***.println("main end");

}

Throws clause handling multipleExceptions

**public** **static** **void** main(String[]args) **throws** Exception {

System.***out***.println("Main Start");

*display*(args);

System.***out***.println("main end");

}

**If called method has throws clause then, calling method also must have throws clause.**

**public** **class** Test {

**public** **static** **void** main(String[] args) **throws** SampleException {

System.***out***.println("Main Start");

*display*(args);

System.***out***.println("main end");

}

**public** **static** **void** display( String[] args) **throws** SampleException

{

*show*(args);

}

**public** **static** **void** show(String[] args)**throws** SampleException

{

System.***out***.println("tray start");

**int** a = 10;

**int** b;

**int** n = args.length;

**if** (n == 0) {

**throw** **new** SampleException("Sample error");

}

b = a / n;

System.***out***.println("b=" + b);

}

}

**Rasing exception in the Called method and hadling local to method.**

**public** **class** Test {

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

System.***out***.println("Main Start");

*display*(args);

System.***out***.println("main end");

}

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

{

**try**

{

System.***out***.println("tray start");

**int** a = 10;

**int** b;

**int** n = args.length;

b = a / n;

System.***out***.println("b=" + b);

}

**catch**(ArithmeticException e)

{

e.printStackTrace();

}

}

}

**Rasing exception in the Called method and hadling inside the calling method.**

**public** **class** Test {

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

System.***out***.println("Main Start");

**try**

{

*display*(args);

}

**catch**(ArithmeticException e)

{

e.printStackTrace();

}

System.***out***.println("main end");

}

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

{

**try**

{

System.***out***.println("tray start");

**int** a = 10;

**int** b;

**int** n = args.length;

b = a / n;

System.***out***.println("b=" + b);

}

**catch**(NullPointerException e)

{

e.printStackTrace();

}

}

}

**Method re-throwing an exception :**

**public** **class** Test {

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

System.***out***.println("Main Start");

**try**

{

*display*(args);

}

**catch**(ArithmeticException e)

{

e.printStackTrace();

}

System.***out***.println("main end");

}

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

{

**try**

{

System.***out***.println("tray start");

**int** a = 10;

**int** b;

**int** n = args.length;

b = a / n;

System.***out***.println("b=" + b);

}

**catch**(ArithmeticException e)

{

System.***out***.println("divide by zero error ");

**throw** e;// re throwing exception

}

}

}

**Program to skip catch block .**

**public** **class** Test {

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

System.***out***.println("Main Start");

**try**

{

System.***out***.println("tray start");

**int** a = 10;

**int** b;

**int** n = args.length;

b = a / n;

System.***out***.println("b=" + b);

}

**catch**(ArithmeticException e)

{

System.*exit*(0);

System.***out***.println("divide by zero error ");

}

System.***out***.println("main end");

}

}

**Difference between throw and throws**

There are many differences between throw and throws keywords. A list of differences between throw and throws are given below:

|  |  |
| --- | --- |
| **throw** | **throws** |
| Java throw keyword is used to explicitly throw an exception. | Java throws keyword is used to declare an exception. |
| Throw key word is throw Checked exceptions. | Checked exception can be suppressed with throws. |
| Throw is followed by an instance. | Throws is followed by class. |
| Throw is used within the method. | Throws is used with the method signature. |
| We cannot throw multiple exceptions. | We can declare multiple exceptions e.g.  public void method() throws IOException,SQLException. |

**Difference between final, finally and finalize**

There are many differences between final, finally and finalize. A list of differences between final, finally and finalize are given below:

|  |  |  |
| --- | --- | --- |
| **final** | **finally** | **Finalize** |
| Final is used to apply restrictions on class, method and variable.  Final class can't be inherited,  final method can't be overridden and  final variable value can't be changed. | Finally is used to place important code,  it will be executed whether exception is handled or not. | Finalize is used to perform clean up processing just before object is garbage collected. |
| Final is a keyword. | Finally is a block. | Finalize is a method. |

**1.can you diferentiate between final, finally and finalize**

Ans:

**final** is an access modifier, it can be used with class, it's data members, methods and also with local variable.

Final data member is constant.

Final local varaibles also constant.

Final mathod can not be overridden in child class.

Final class prevents from inheritance.

**Finally**: it block for exception handling, it executes fot any conditions such, normally terminate or abnormally terminated.

**Finalize**: it is method from Object. It will be called automatically, when object is cleared by the Garbage collector.

**2.can we compile java program with out main method.**

Ans: Yes we can compile.

**3. Is it compulsory for a Try Block to be followed by a Catch Block in Java for Exception handling?**

Ans: Try block needs to be followed by either Catch block or Finally block or both. Any exception thrown from try block needs to be either caught in the catch block or else any specific tasks to be performed before code abortion are put in the Finally block.

**4. Is there any way to skip Finally block of exception even if some exception occurs in the exception block?**

Ans: If an exception is raised in Try block, control passes to catch block if it exists otherwise to finally block. Finally block is always executed when an exception occurs and the only way to avoid execution of any statements in Finally block is by aborting the code forcibly by writing following line of code at the end of try block:

System.exit(0);

**Collection Frame Work**

Collections in java is a framework that provides an architecture to store and manipulate the group of objects.

All the operations that you perform on a data such as searching, sorting, insertion, manipulation, deletion etc. can be performed by Java Collections.

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

**What is Collection in java**

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

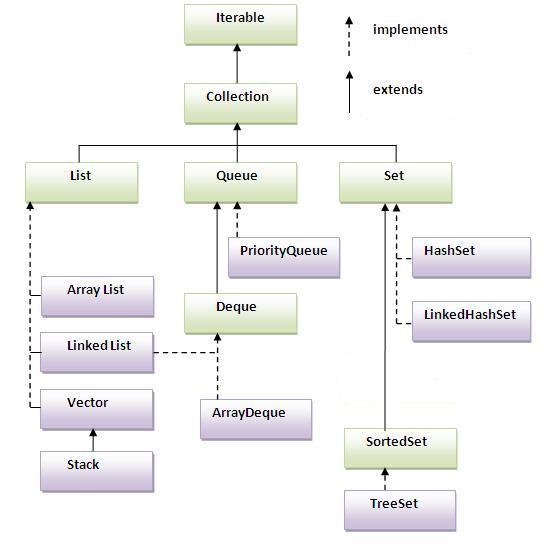
**What is framework in java**

provides readymade architecture.

represents set of classes and interface.

**Hierarchy of Collection Framework**

Let us see the hierarchy of collection framework.The java.util package contains all the classes and interfaces for Collection framework.



**Methods of Collection interface**

There are many methods declared in the Collection interface. They are as follows:

|  |  |  |
| --- | --- | --- |
| **No.** | **Method** | **Description** |
| 1. | public boolean add(Object element) | is used to insert an element in this collection. |
| 2. | public boolean addAll(Collection c) | is used to insert the specified collection elements in the invoking collection. |
| 3. | public boolean remove(Object element) | is used to delete an element from this collection. |
| 4. | public boolean removeAll(Collection c ) | is used to delete all the elements of specified collection from the invoking collection. |
| 5. | public boolean retainAll(Collection c) | is used to delete all the elements of invoking collection except the specified collection. |
| 6. | public int size() | return the total number of elements in the collection. |
| 7. | public void clear() | removes the total no of element from the collection. |
| 8. | public boolean contains(Object element) | is used to search an element. |
| 9. | public boolean containsAll(Collection c) | is used to search the specified collection in this collection. |
| 10. | public Iterator iterator() | returns an iterator. |
| 11. | public Object [] toArray() | converts collection into array. |
| 12. | public boolean isEmpty() | checks if collection is empty. |
| 13. | public boolean equals(Object element) | matches two collection. |
| 14. | public int hashCode() | returns the hashcode number for collection. |

**Iterator interface**

Iterator interface provides the facility of iterating the elements in forward direction only.

**Methods of Iterator interface**

There are only three methods in the Iterator interface. They are:

public boolean hasNext() it returns true if iterator has more elements.

public object next() it returns the element and moves the cursor pointer to the next element.

public void remove() it removes the last elements returned by the iterator. It is rarely used.

**Java ArrayList class**

Java ArrayList class uses a dynamic array for storing the elements. It extends AbstractList class and implements List interface.

Java ArrayList class can contain duplicate elements.

Java ArrayList class maintains insertion order.

Java ArrayList class is non synchronized.

Java ArrayList allows random access because array works at the index basis.

In Java ArrayList class, manipulation is slow because a lot of shifting needs to be occurred if any element is removed from the array list.

**Java Non-generic Vs Generic Collection**

Java collection framework was non-generic before JDK 1.5. Since 1.5, it is generic.

Java new generic collection allows you to have only one type of object in collection. Now it is type safe so typecasting is not required at run time.

Let's see the old non-generic example of creating java collection.

ArrayList al = new ArrayList();//creating old non-generic arraylist

non-generic will take any object :

we can add any object to array list:

al.add(employee);

al.add(student);

al.add(customer);

Let's see the new generic example of creating java collection.

ArrayList <String> al = new ArrayList <String> ();//creating new generic arraylist

In generic collection, we specify the type in angular braces. Now ArrayList is forced to have only specified type of objects in it. If you try to add another type of object, it gives compile time error.

**Example of Java ArrayList class**

**package** com.nrit.mnrao.test;

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** Test {

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

ArrayList < Integer > al = **new** ArrayList< Integer > ();

al.add(**new** Integer(10));

al.add(20);

al.add(30);

al.add(40);

al.add(50);

al.add(60);

al.add(70);

// reading arryalist elements

//1st way

System.***out***.println("array elements "+al);

System.***out***.println();

//2nd way

**for**(**int** i=0; i<al.size() ; i++)

{

System.***out***.print(al.get(i)+"\t");

}

System.***out***.println();

//3rd way

**for** (Integer i : al) {

System.***out***.print(i+"\t");

}

System.***out***.println();

//4th way

Iterator <Integer> iterator = al.iterator();

**while**(iterator.hasNext())

{

Integer nextInteger = iterator.next();

System.***out***.print(nextInteger+"\t");

}

}

}

**package** com.nrit.mnrao.test;

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** Test {

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

ArrayList <String> al = **new** ArrayList <String> ();

System.***out***.println(" no of elements : "+al.size());

**if**(al.isEmpty())

{

System.***out***.println("empty");

}

**else**

{

System.***out***.println("Not empty");

}

al.add("java");

al.add("hadoop");

System.***out***.println(" no of elements : "+al.size());

System.***out***.println("1st element "+al.get(0));

System.***out***.println("last element "+al.get(al.size()-1));

// to insert element at required index.

al.add(0, "oracle");

System.***out***.println(al);

al.add(2, "html");

System.***out***.println(al);

String str = al.remove(0);// physically removes

System.***out***.println(str);

System.***out***.println(al);

String str1 = al.get(0);// read only, will not remove physically

System.***out***.println(str1);

System.***out***.println(al);

System.***out***.println(al.size());

**if**(al.isEmpty())

{

System.***out***.println("empty ");

}

**else**

{

System.***out***.println(" not empty ");

}

al.clear();

**if**(al.isEmpty())

{

System.***out***.println("empty ");

}

**else**

{

System.***out***.println(" not empty ");

}

}

}

**Another example**

**package** com.nrit.mnrao.test;

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** Test {

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

ArrayList <String> al1 = **new** ArrayList <String> ();

al1.add("hive");

al1.add("sqoop");

al1.add("pig");

al1.add("hbase");

al1.add("mapper");

ArrayList <String> al2 = **new** ArrayList <String> ();

al2.add("java");

al2.add("jsp");

al2.add("servlet");

al2.add("html");

al2.add("spring");

al2.addAll(al1);

System.***out***.println(al2);

**if**(al2.containsAll(al1))

{

System.***out***.println("contains all");

}

**else**

{

System.***out***.println("no contains");

}

al2.remove("hive");

**if**(al2.containsAll(al1))

{

System.***out***.println("contains all");

}

**else**

{

System.***out***.println("not contain");

}

**if**( al2.contains("java") && al2.contains("hadoop"))

{

System.***out***.println("Yes");

}

**else**

{

System.***out***.println("no");

}

ArrayList <String> al3 = (ArrayList <String> )al2.clone();

System.***out***.println(al2);

System.***out***.println(al3);

}

}

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** TestCollection

{

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

{

ArrayList<String> al = **new** ArrayList<String>();// creating arraylist

al.add("Ravi");// adding object in arraylist

al.add("Vijay");

al.add("Ravi");

al.add("Ajay");

Iterator itr = al.iterator();// getting Iterator from arraylist to

// traverse elements

**while** (itr.hasNext()) {

System.***out***.println (itr.next());

}

}

}

O/p:

Ravi

Vijay

Ravi

Ajay

**Iterating the elements of Collection by for-each loop**

**import** java.util.ArrayList;

**public** **class** TestCollection

{

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

ArrayList<String> al = **new** ArrayList<String>();

al.add("Ravi");

al.add("Vijay");

al.add("Ravi");

al.add("Ajay");

**for** (String obj : al)

System.***out***.println (obj);

}

}

O/p:

Ravi

Vijay

Ravi

Ajay

**User-defined class objects in Java ArrayList**

**public** **class** Employee

{

**private** **int** empNum;

**private** String empName;

**private** **double** empSalary;

**private** **char** empGender;

**public** **int** getEmpNum() {

**return** empNum;

}

**public** **void** setEmpNum(**int** empNum) {

**this**.empNum = empNum;

}

**public** String getEmpName() {

**return** empName;

}

**public** **void** setEmpName(String empName) {

**this**.empName = empName;

}

**public** **double** getEmpSalary() {

**return** empSalary;

}

**public** **void** setEmpSalary(**double** empSalary) {

**this**.empSalary = empSalary;

}

**public** **char** getEmpGender() {

**return** empGender;

}

**public** **void** setEmpGender(**char** empGender) {

**this**.empGender = empGender;

}

}

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** Test {

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

ArrayList<Employee> al = **new** ArrayList<Employee>();

Employee employee = **new** Employee();

employee.setEmpNum(1001);

employee.setEmpName("nrit1");

employee.setEmpSalary(5000);

employee.setEmpGender('M');

al.add(employee);

employee = **new** Employee();

employee.setEmpNum(1002);

employee.setEmpName("nrit2");

employee.setEmpSalary(6000);

employee.setEmpGender('F');

al.add(employee);

employee = **new** Employee();

employee.setEmpNum(1003);

employee.setEmpName("nrit3");

employee.setEmpSalary(7000);

employee.setEmpGender('M');

al.add(employee);

employee = **new** Employee();

employee.setEmpNum(1004);

employee.setEmpName("nrit4");

employee.setEmpSalary(4000);

employee.setEmpGender('F');

al.add(employee);

Iterator<Employee> iterator = al.iterator();

**while** (iterator.hasNext()) {

Employee emp = iterator.next();

**int** empNum = emp.getEmpNum();

String empName = emp.getEmpName();

**double** empSalary = emp.getEmpSalary();

**char** empGender = emp.getEmpGender();

System.***out***.println(empNum + "\t" + empName + "\t" + empSalary + "\t" + empGender);

}

}

}

Another Way:

**package** com.nrit.mnrao.test;

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** Test {

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

String record1 = "1001:nrit1:5000:M";

String record2 = "1002:nrit2:6000:F";

String record3 = "1003:nrit3:4500:M";

String record4 = "1004:nrit4:7000:F";

ArrayList<Employee> al = **new** ArrayList<Employee>();

Employee employee = **new** Employee();

String[] fields = record1.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

employee = **new** Employee();

fields = record2.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

employee = **new** Employee();

fields = record3.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

employee = **new** Employee();

fields = record4.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

Iterator<Employee> iterator = al.iterator();

**while** (iterator.hasNext()) {

Employee emp = iterator.next();

**int** empNum = emp.getEmpNum();

String empName = emp.getEmpName();

**double** empSalary = emp.getEmpSalary();

**char** empGender = emp.getEmpGender();

System.***out***.println(empNum + "\t" + empName + "\t" + empSalary + "\t" + empGender);

}

}

}

=======================

**Using foreach:**

**package** com.nrit.mnrao.test;

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** Test {

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

String record1 = "1001:nrit1:5000:M";

String record2 = "1002:nrit2:6000:F";

String record3 = "1003:nrit3:4500:M";

String record4 = "1004:nrit4:7000:F";

ArrayList<Employee> al = **new** ArrayList<Employee>();

Employee employee = **new** Employee();

String[] fields = record1.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

employee = **new** Employee();

fields = record2.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

employee = **new** Employee();

fields = record3.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

employee = **new** Employee();

fields = record4.split(":");

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3].charAt(0));

al.add(employee);

**for** (Employee emp : al) {

**int** empNum = emp.getEmpNum();

String empName = emp.getEmpName();

**double** empSalary = emp.getEmpSalary();

**char** empGender = emp.getEmpGender();

System.***out***.println(empNum + "\t" + empName + "\t" + empSalary + "\t" + empGender);

}

}

}

**Java LinkedList class**

Java LinkedList class uses doubly linked list to store the elements. It extends the AbstractList class and implements List and Deque interfaces.

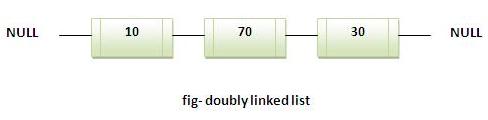
Java LinkedList class can contain duplicate elements.

Java LinkedList class maintains insertion order.

Java LinkedList class is non synchronized.

In Java LinkedList class, manipulation is fast because no shifting needs to be occurred.

Java LinkedList class can be used as list, stack or queue.



**Java LinkedList Example**

import java.util.\*;

public class Test

{

public static void main(String [] args)

{

LinkedList<String> al=new LinkedList<String>();

al.add("Ravi");

al.add("Vijay");

al.add("Ravi");

al.add("Ajay");

Iterator<String> itr=al.iterator();

while(itr.hasNext())

{

System.out.println (itr.next());

}

}

}

Output:

Ravi

Vijay

Ravi

Ajay

**Difference between ArrayList and LinkedList**

ArrayList and LinkedList both implements List interface and maintains insertion order. Both are non synchronized classes.

But there are many differences between ArrayList and LinkedList classes that are given below.

|  |  |
| --- | --- |
| ArrayList | LinkedList |
| 1) ArrayList internally uses dynamic array to store the elements | LinkedList internally uses doubly linked list to store the elements. |
| 2) Manipulation with ArrayList is slow because it internally uses array. If any element is removed from thekey array, all the bits are shifted in memory. | Manipulation with LinkedList is faster than ArrayList because it uses doubly linked list so no bit shifting is required in memory. |
| 3) ArrayList class can act as a list only because it implements List only. | LinkedList class can act as a list and queue both because it implements List and Deque interfaces. |
| 4) ArrayList is better for storing and accessing data. | LinkedList is better for manipulating data. |

**Example of ArrayList and LinkedList in Java**

Let's see a simple example where we are using ArrayList and LinkedList both.

**import** java.util.LinkedList;

**import** java.util.List;

**import** java.util.ArrayList;

**public** **class** Test

{

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

{

List<String> al = **new** ArrayList<String>();

al.add("Ravi");

al.add("Vijay");

al.add("Ravi");

al.add("Ajay");

List<String> al2 = **new** LinkedList<String>();

al2.add("James");

al2.add("Serena");

al2.add("Swati");

al2.add("Junaid");

System.***out***.println ("arraylist: " + al);

System.***out***.println ("linkedlist: " + al2);

}

}

Output:

arraylist: [Ravi,Vijay,Ravi,Ajay]

linkedlist: [James,Serena,Swati,Junaid]

**Vector:**

The **java.util.Vector** class implements a growable array of objects. Similar to an Array, it contains components that can be accessed using an integer index.

The size of a Vector can grow or shrink as needed to accommodate adding and removing items.

*Vector* is synchronized.

## . Class declaration

Following is the declaration for **java.util.Vector** class:

public class Vector<E>

extends AbstractList<E>

implements List<E>, RandomAccess, Cloneable, Serializable

Constructor & Description

**Vector()**

This constructor is used to create an empty vector so that its internal data array has size 10 and its standard capacity increment is zero.

**Vector(Collection<? extends E> c)**

This constructor is used to create a vector containing the elements of the specified collection, in the order they are returned by the collection's iterator.

**Vector(int initialCapacity)**

This constructor is used to create an empty vector with the specified initial capacity and with its capacity increment equal to zero.

**Vector(int initialCapacity, int capacityIncrement)**

This constructor is used to create an empty vector with the specified initial capacity and capacity increment.

Method & Description

|  |  |
| --- | --- |
|  | **Method & Description** |
|  | [**boolean add(E e)**](https://www.tutorialspoint.com/java/util/vector_add.htm)  This method appends the specified element to the end of this Vector. |
|  | [**void add(int index, E element)**](https://www.tutorialspoint.com/java/util/vector_add_index.htm)  This method inserts the specified element at the specified position in this Vector |
|  | [**boolean addAll(Collection<? extends E> c)**](https://www.tutorialspoint.com/java/util/vector_addall.htm)  This method appends all of the elements in the specified Collection to the end of this Vector. |
|  | [**boolean addAll(int index, Collection<? extends E> c)**](https://www.tutorialspoint.com/java/util/vector_addall_index.htm)  This method inserts all of the elements in the specified Collection into this Vector at the specified position. |
|  | [**void addElement(E obj)**](https://www.tutorialspoint.com/java/util/vector_addelement.htm)  This method adds the specified component to the end of this vector, increasing its size by one. |
|  | [**int capacity()**](https://www.tutorialspoint.com/java/util/vector_capacity.htm)  This method returns the current capacity of this vector. |
|  | [**void clear()**](https://www.tutorialspoint.com/java/util/vector_clear.htm)  This method removes all of the elements from this vector. |
|  | [**Clone clone()**](https://www.tutorialspoint.com/java/util/vector_clone.htm)  This method returns a clone of this vector. |
|  | [**boolean contains(Object o)**](https://www.tutorialspoint.com/java/util/vector_contains.htm)  This method returns true if this vector contains the specified element. |
|  | [**boolean containsAll(Collection<?> c)**](https://www.tutorialspoint.com/java/util/vector_containsall.htm)  This method returns true if this Vector contains all of the elements in the specified Collection. |
|  | [**void copyInto(Object[ ] anArray)**](https://www.tutorialspoint.com/java/util/vector_copyinto.htm)  This method copies the components of this vector into the specified array. |
|  | [**E elementAt(int index)**](https://www.tutorialspoint.com/java/util/vector_elementat.htm)  This method returns the component at the specified index. |
|  | [**Enumeration<E> elements()**](https://www.tutorialspoint.com/java/util/vector_elements.htm)  This method returns an enumeration of the components of this vector. |
|  | [**void ensureCapacity(int minCapacity)**](https://www.tutorialspoint.com/java/util/vector_ensurecapacity.htm)  This method increases the capacity of this vector, if necessary, to ensure that it can hold at least the number of components specified by the minimum capacity argument. |
|  | [**boolean equals(Object o)**](https://www.tutorialspoint.com/java/util/vector_equals.htm)  This method compares the specified Object with this Vector for equality. |
|  | [**E firstElement()**](https://www.tutorialspoint.com/java/util/vector_firstelement.htm)  This method returns the first component (the item at index 0) of this vector. |
|  | [**E get(int index)**](https://www.tutorialspoint.com/java/util/vector_get.htm)  This method returns the element at the specified position in this Vector. |
|  | [**int hashCode()**](https://www.tutorialspoint.com/java/util/vector_hashcode.htm)  This method returns the hash code value for this Vector. |
|  | [**int indexOf(Object o)**](https://www.tutorialspoint.com/java/util/vector_indexof.htm)  This method returns the index of the first occurrence of the specified element in this vector, or -1 if this vector does not contain the element. |
|  | [**int indexOf(Object o, int index)**](https://www.tutorialspoint.com/java/util/vector_indexof_index.htm)  This method returns the index of the first occurrence of the specified element in this vector, searching forwards from index, or returns -1 if the element is not found. |
|  | [**void insertElementAt(E obj, int index)**](https://www.tutorialspoint.com/java/util/vector_insertelementat.htm)  This method inserts the specified object as a component in this vector at the specified index. |
|  | [**boolean isEmpty()**](https://www.tutorialspoint.com/java/util/vector_isempty.htm)  This method tests if this vector has no components. |
|  | [**E lastElement()**](https://www.tutorialspoint.com/java/util/vector_lastelement.htm)  This method returns the last component of the vector. |
|  | [**int lastIndexOf(Object o)**](https://www.tutorialspoint.com/java/util/vector_lastindexof.htm)  This method returns the index of the last occurrence of the specified element in this vector, or -1 if this vector does not contain the element. |
|  | [**int lastIndexOf(Object o, int index)**](https://www.tutorialspoint.com/java/util/vector_lastindexof_index.htm)  This method returns the index of the last occurrence of the specified element in this vector, searching backwards from index, or returns -1 if the element is not found. |
|  | [**E remove(int index)**](https://www.tutorialspoint.com/java/util/vector_remove.htm)  This method removes the element at the specified position in this Vector. |
|  | [**boolean remove(Object o)**](https://www.tutorialspoint.com/java/util/vector_remove_object.htm)  This method removes the first occurrence of the specified element in this Vector If the Vector does not contain the element, it is unchanged. |
|  | [**boolean removeAll(Collection<?> c)**](https://www.tutorialspoint.com/java/util/vector_removeall.htm)  This method removes from this Vector all of its elements that are contained in the specified Collection. |
|  | [**void removeAllElements()**](https://www.tutorialspoint.com/java/util/vector_removeallelements.htm)  This method removes all components from this vector and sets its size to zero. |
|  | [**boolean removeElement(Object obj)**](https://www.tutorialspoint.com/java/util/vector_removeelement.htm)  This method removes the first occurrence of the argument from this vector. |
|  | [**void removeElementAt(int index)**](https://www.tutorialspoint.com/java/util/vector_removeelementat.htm)  This method deletes the component at the specified index. |
|  |  |
|  | [**boolean retainAll(Collection<?> c)**](https://www.tutorialspoint.com/java/util/vector_retainall.htm)  This method retains only the elements in this Vector that are contained in the specified Collection. |
|  | [**E set(int index, E element)**](https://www.tutorialspoint.com/java/util/vector_set.htm)  This method replaces the element at the specified position in this Vector with the specified element. |
|  | [**void setElementAt(E obj, int index)**](https://www.tutorialspoint.com/java/util/vector_setelementat.htm)  This method sets the component at the specified index of this vector to be the specified object. |
|  | [**void setSize(int newSize)**](https://www.tutorialspoint.com/java/util/vector_setsize.htm)  This method sets the size of this vector. |
|  | [i**nt size()**](https://www.tutorialspoint.com/java/util/vector_size.htm)  This method returns the number of components in this vector. |
|  | [**List <E> subList(int fromIndex, int toIndex)**](https://www.tutorialspoint.com/java/util/vector_sublist.htm)  This method returns a view of the portion of this List between fromIndex, inclusive, and toIndex, exclusive. |
|  | [**object[ ] toArray()**](https://www.tutorialspoint.com/java/util/vector_toarray.htm)  This method returns an array containing all of the elements in this Vector in the correct order. |
|  | [**<T> T[ ] toArray(T[ ] a)**](https://www.tutorialspoint.com/java/util/vector_toarray_t.htm)  This method returns an array containing all of the elements in this Vector in the correct order; the runtime type of the returned array is that of the specified array. |
|  | [**String toString()**](https://www.tutorialspoint.com/java/util/vector_tostring.htm)  This method returns a string representation of this Vector, containing the String representation of each element. |
|  | [**void trimToSize()**](https://www.tutorialspoint.com/java/util/vector_trimtosize.htm)  This method trims the capacity of this vector to be the vector's current size. |

# Program: Basic Vector Operations.

**package** com.nrit.mnrao.test;

**import** java.util.Vector;

**public** **class** BasicVectorOperations {

**public** **static** **void** main(String a[]) {

Vector<String> vct = **new** Vector<String>();

// adding elements to the end

vct.add("First");

vct.add("Second");

vct.add("Third");

System.***out***.println(vct);

// adding element at specified index

vct.add(2, "Random");

System.***out***.println(vct);

// getting elements by index

System.***out***.println("Element at index 3 is: " + vct.get(3));

// getting first element

System.***out***.println("The first element of this vector is: " + vct.firstElement());

// getting last element

System.***out***.println("The last element of this vector is: " + vct.lastElement());

// how to check vector is empty or not

System.***out***.println("Is this vector empty? " + vct.isEmpty());

}

}

|  |
| --- |
| Output: |
| [First, Second, Third]  [First, Second, Random, Third]  Element at index 3 is: Third  The first element of this vector is: First  The last element of this vector is: Third  Is this vector empty? false |

# Program: How to read all elements in vector by using iterator?

**package** com.nrit.mnrao.test;

**import** java.util.Iterator;

**import** java.util.Vector;

**public** **class** VectorIterator {

**public** **static** **void** main(String a[]) {

Vector<String> vct = **new** Vector<String>();

// adding elements to the end

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

Iterator<String> itr = vct.iterator();

**while** (itr.hasNext()) {

System.***out***.println(itr.next());

}

}

}

|  |
| --- |
| Output: |
| First  Second  Third  Random Program: How to read all elements in vector by using Enumeration? |

**package** com.nrit.mnrao.test;

**import** java.util.Enumeration;

**import** java.util.Vector;

**public** **class** VectorEnnumaratio {

**public** **static** **void** main(String a[]) {

Vector<String> vct = **new** Vector<String>();

// adding elements to the end

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

Enumeration<String> enm = vct.elements();

**while** (enm.hasMoreElements()) {

System.***out***.println(enm.nextElement());

}

}

}

# Program: How to copy or clone a vector?

**package** com.nrit.mnrao.test;

**import** java.util.Vector;

**public** **class** MyVectorClone {

**public** **static** **void** main(String a[]){

Vector<String> vct = **new** Vector<String>();

//adding elements to the end

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

System.***out***.println("Actual vector:"+vct);

Vector<String> copy = (Vector<String>) vct.clone();

System.***out***.println("Cloned vector:"+copy);

}

}

# Program: How to add all elements of a list to vector?

**package** com.nrit.mnrao.test;

**import** java.util.ArrayList;

**import** java.util.List;

**import** java.util.Vector;

**public** **class** MyVectorNewCollection {

**public** **static** **void** main(String a[]) {

Vector<String> vct = **new** Vector<String>();

// adding elements to the end

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

System.***out***.println("Actual vector:" + vct);

List<String> list = **new** ArrayList<String>();

list.add("one");

list.add("two");

vct.addAll(list);

System.***out***.println("After Copy: " + vct);

}

}

# Program: How to delete all elements from my vector?

**package** com.nrit.mnrao.test;

**import** java.util.Vector;

**public** **class** ClearMyVector {

**public** **static** **void** main(String a[]){

Vector<String> vct = **new** Vector<String>();

//adding elements to the end

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

System.***out***.println("Actual vector:"+vct);

vct.clear();

System.***out***.println("After clear vector:"+vct);

}

}

# Program: How to find does vector contains all list elements or not?

**package** com.nrit.mnrao.test;

**import** java.util.ArrayList;

**import** java.util.List;

**import** java.util.Vector;

**public** **class** MyElementCheck {

**public** **static** **void** main(String a[]) {

Vector<String> vct = **new** Vector<String>();

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

List<String> list = **new** ArrayList<String>();

list.add("Second");

list.add("Random");

System.***out***.println("Does vector contains all list elements?: " + vct.containsAll(list));

list.add("one");

System.***out***.println("Does vector contains all list elements?: " + vct.containsAll(list));

}

}

# Program: How to copy vector to array?

**package** com.nrit.mnrao.test;

**import** java.util.Vector;

**public** **class** MyVectorArrayCopy {

**public** **static** **void** main(String a[]) {

Vector<String> vct = **new** Vector<String>();

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

System.***out***.println("Actual vector:" + vct);

String []copyArr = **new** String[vct.size()];

vct.copyInto(copyArr);

System.***out***.println("Copied Array content:");

**for** (String str : copyArr) {

System.***out***.println(str);

}

}

}

# Program: How to get sub list from vector?

**package** com.nrit.mnrao.test;

**import** java.util.List;

**import** java.util.Vector;

**public** **class** MyVectorSubRange {

**public** **static** **void** main(String a[]) {

Vector<String> vct = **new** Vector<String>();

// adding elements to the end

vct.add("First");

vct.add("Second");

vct.add("Third");

vct.add("Random");

vct.add("Click");

System.***out***.println("Actual vector:" + vct);

List<String> list = vct.subList(2, 4);

System.***out***.println("Sub List: " + list);

}

}

**Difference between ArrayList and Vector:**

ArrayList and Vector both implements List interface and maintains insertion order.

|  |  |  |
| --- | --- | --- |
| **S.No.** | **ArrayList** | **Vector** |
| 1. | ArrayList is not synchronized. | Vector is synchronized. |
| 2. | ArrayList increments 50% of current array size if number of element exceeds from its capacity. | Vector increments 100% means doubles the array size if total number of element exceeds than its capacity. |
| 3. | ArrayList is not a legacy class, it is introduced in JDK 1.2. | Vector is a legacy class. |
| 4. | ArrayList is fast because it is non-synchronized. | Vector is slow because it is synchronized i.e. in multithreading environment, it will hold the other threads in runnable or non-runnable state until current thread releases the lock of object. |
| 5. | ArrayList uses Iterator interface to traverse the elements. | Vector uses Enumeration interface to traverse the elements. But it can use Iterator also. |

**Stack Class**

**Stack** is a subclass of **Vector** that implements a standard last-in, first-out stack. **Stack** only defines the default constructor, which creates an empty stack. **Stack** includes all the methods defined by **Vector**, and adds several of its own.

To put an object on the top of the stack, call **push()**. To remove and return the top element, call **pop()**. An **EmptyStackException** is thrown if you call **pop( )** when the invoking stack is empty. You can use **peek( )** to return, but not remove, the top object.

The **empty()** method returns **true** if nothing is on the stack. The **search()** method determines whether an object exists on the stack, and returns the number of pops that are required to bring it to the top of the stack. Here is an example that creates a stack, pushes several **Integer** objects onto it, and then pops them off again:

The **java.util.Stack** class represents a last-in-first-out (LIFO) stack of objects.

* When a stack is first created, it contains no items.
* In this class, the last element inserted is accessed first.

## Class declaration

Following is the declaration for **java.util.Stack** class:

public class Stack<E>

extends Vector<E>

Constructor & Description

**Stack()**

This constructor creates an empty stack.

|  |  |  |
| --- | --- | --- |
|  |  | |
|  | | **Method & description**  [**boolean empty()**](https://www.tutorialspoint.com/java/util/stack_empty.htm)  This method tests if this stack is empty. | |
|  | | [**E peek()**](https://www.tutorialspoint.com/java/util/stack_peek.htm)  This method looks at the object at the top of this stack without removing it from the stack. | |
|  | | [**E pop()**](https://www.tutorialspoint.com/java/util/stack_pop.htm)  This method removes the object at the top of this stack and returns that object as the value of this function. It stack is empty it thorws **“EmptyStackException”** | |
|  | | [**E push(E item)**](https://www.tutorialspoint.com/java/util/stack_push.htm)  This method pushes an item onto the top of this stack. | |
|  | | [**int search(Object o)**](https://www.tutorialspoint.com/java/util/stack_search.htm)  This method returns the 1-based position where an object is on this stack. | |

**package** com.nrit.mnrao.test;

**import** java.util.Stack;

**public** **class** Test {

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

Stack <String> bookRack = **new** Stack<String>();

bookRack.push("HADOOP");

bookRack.push("JAVA");

bookRack.push("ORACLE");

bookRack.push("C");

bookRack.push("LINUX");

System.***out***.println("books in the Rack "+bookRack);

System.***out***.println("Top book : "+bookRack.peek());

String book = bookRack.pop();

System.***out***.println("Removed Book "+book);

book = bookRack.pop();

System.***out***.println("Removed Book "+book);

System.***out***.println("Current books in the Rack "+bookRack);

}

}

**Program is to remove stack elements one by one.**

**package** com.nrit.mnrao.test;

**import** java.util.Stack;

**public** **class** Test {

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

Stack<String> bookRack = **new** Stack<String>();

bookRack.push("HADOOP");

bookRack.push("JAVA");

bookRack.push("ORACLE");

bookRack.push("C");

bookRack.push("LINUX");

**while**(! bookRack.empty())

{

String book = bookRack.pop();

System.***out***.println(book);

}

}

}

**Java HashSet class**

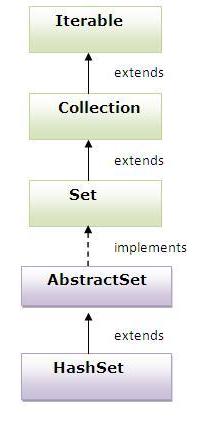
uses hashtable to store the elements.It extends AbstractSet class and implements Set interface.

contains unique elements only.

Difference between List and Set:

List can contain duplicate elements whereas Set contains unique elements only.

**Hierarchy of HashSet class:**



**Example of HashSet class:**

**import** java.util.Iterator;

**import** java.util.HashSet;

**public** **class** Test

{

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

{

HashSet<String> al = **new** HashSet<String>();

al.add("Ravi");

al.add("Vijay");

al.add("Ravi");

al.add("Ajay");

Iterator<String> itr = al.iterator();

**while** (itr.hasNext()) {

System.***out***.println (itr.next());

}

}

}

O/P:

Vijay

Ajay

Ravi

**TreeSet class:**

TreeSet class implements the Set interface that uses a tree for storage. It inherits AbstractSet class and implements NavigableSet interface. The objects of TreeSet class are stored in ascending order.

Contains unique elements only like HashSet.

Access and retrieval times are quiet fast.

Maintains ascending order.

**import** java.util.Iterator;

**import** java.util.TreeSet;

**public** **class** Test

{

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

{ // Creating and adding elements

TreeSet<String> al = **new** TreeSet<String>();

al.add("Ravi");

al.add("Vijay");

al.add("Ravi");

al.add("Ajay");

// Traversing elements

Iterator<String> itr = al.iterator();

**while** (itr.hasNext())

{

System.***out***.println (itr.next());

}

}

}

**Java Map Interface**

A map contains values based on the key i.e. key and value pair.

Each pair is known as an entry.

Map contains only unique elements.

Commonly used methods of Map interface:

**public Object put(object key,Object value):** is used to insert an entry in this map.

**public void putAll(Map map):** is used to insert the specified map in this map.

**public Object remove(object key):** is used to delete an entry for the specified key.

**public Object get(Object key):** is used to return the value for the specified key.

**public boolean containsKey(Object key):**  is used to search the specified key from this map.

**public boolean containsValue(Object value):** is used to search the specified value from this

map.

**public Set keySet():** returns the Set view containing all the keys.

**public Set entrySet():** returns the Set view containing all the keys and values.

**Java HashMap class**

A HashMap contains values based on the key. It implements the Map interface and extends **AbstractMap class.**

It contains only unique elements.

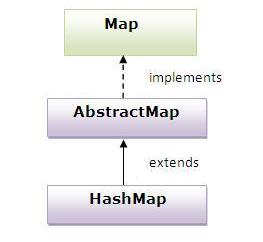
It may have one null key and multiple null values.

It maintains no order.

**Difference between HashSet and HashMap**

HashSet contains only values whereas HashMap contains entry(key and value).

**Hierarchy of HashMap class:**



Non generic Example for HashMap ( any key and any value )

**import** java.util.HashMap;

**import** java.util.Stack;

**public** **class** Test {

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

HashMap hmap = **new** HashMap();

hmap.put(1, "java");

hmap.put("hello", 1);

hmap.put(2, **new** Employee());

System.***out***.println(hmap);

}

}

**Generic HashMap Example:**

**import** java.util.HashMap;

**import** java.util.Stack;

**public** **class** Test {

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

HashMap<Integer, String> hmap = **new** HashMap<Integer, String> ();

hmap.put(1, "java");

hmap.put(2,"hadoop");

hmap.put(3, "oracle");

hmap.put(4, "unix");

System.***out***.println(hmap);

}

}

**Another Example**

**package** com.nrit.mnrao.test;

**import** java.util.HashMap;

**public** **class** Test {

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

HashMap<Integer, String> hmap = **new** HashMap<Integer, String>();

**for** (**int** i = 1; i <=10; i++) {

hmap.put(i, "java " + i);

}

//both key and value pair

System.***out***.println(hmap);

**for** (**int** i = 1; i <=10; i++) {

System.***out***.println(hmap.get(i));

}

}

}

**package** com.nrit.mnrao.test;

**import** java.util.HashMap;

**import** java.util.Iterator;

**import** java.util.Set;

**public** **class** Test {

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

HashMap<Integer, String> hmap = **new** HashMap<Integer, String>();

hmap.put(1, "java");

hmap.put(2, "hadoop");

hmap.put(3, "oracle");

hmap.put(4, "unix");

hmap.put(5, "linux");

Set<Integer> keys = hmap.keySet();

Iterator<Integer> iterator = keys.iterator();

**while**(iterator.hasNext())

{

Integer nextKey = iterator.next();

System.***out***.println(hmap.get(nextKey));

}

}

}

**package** com.nrit.mnrao.test;

**import** java.util.HashMap;

**import** java.util.Iterator;

**import** java.util.Map.Entry;

**import** java.util.Set;

**public** **class** Test {

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

HashMap<Integer, String> hmap = **new** HashMap<Integer, String>();

hmap.put(1, "java");

hmap.put(2, "hadoop");

hmap.put(3, "oracle");

hmap.put(4, "unix");

hmap.put(5, "linux");

Set <Entry<Integer, String>> entrySet = hmap.entrySet();

Iterator<Entry<Integer, String>> iterator = entrySet.iterator();

**while**(iterator.hasNext())

{

Entry<Integer, String> nextEntry = iterator.next();

Integer key = nextEntry.getKey();

String value = nextEntry.getValue();

System.***out***.println(key+"\t"+value);

}

}

}

**package** com.nrit.mnrao.test;

**import** java.util.HashMap;

**public** **class** Test {

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

HashMap<Integer, String> hmap = **new** HashMap<Integer, String>();

hmap.put(1, "java");

hmap.put(2, "hadoop");

hmap.put(3, "oracle");

hmap.put(4, "unix");

hmap.put(5, "linux");

System.***out***.println(hmap);

**if**(hmap.containsKey(4) )

{

String value = hmap.get(4);

**if**(value.equals("unix"))

{

hmap.replace(4, "unix", "linux");

}

}

System.***out***.println(hmap);

}

}

**Replacing element value**

**package** com.nrit.mnrao.test;

**import** java.util.HashMap;

**public** **class** Test {

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

HashMap<Integer, String> hmap = **new** HashMap<Integer, String>();

hmap.put(1, "java");

hmap.put(2, "hadoop");

hmap.put(3, "oracle");

hmap.put(4, "unix");

hmap.put(5, "linux");

System.***out***.println(hmap);

**if**(hmap.containsKey(4) )

{

**if**(hmap.replace(4, "unix", "linux"))

{

System.***out***.println("successfully replaced");

}

**else**

{

System.***out***.println("failed to replace");

}

}

System.***out***.println(hmap);

}

}

**Database properties**

**import** java.util.HashMap;

**public** **class** Test

{

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

{

HashMap<String,String> dataBaseproperties =**new** HashMap<String,String>();

dataBaseproperties.put("user", "demo");

dataBaseproperties.put("path", "/home/demo");

dataBaseproperties.put("host", "160.10.20.3");

dataBaseproperties.put("dbname", "student");

dataBaseproperties.put("uid", "root");

dataBaseproperties.put("pwd", "admin123");

String uidValue = dataBaseproperties.get("uid");

String pwdValue = dataBaseproperties.get("pwd");

String pathValue = dataBaseproperties.get("path");

String userValue = dataBaseproperties.get("user");

System.***out***.println (uidValue);

System.***out***.println (pwdValue);

System.***out***.println (pathValue);

System.***out***.println (userValue);

System.***out***.println (dataBaseproperties.toString());

}

}

**Hashtable class:**

Hashtable class implements a Map inetrface, which maps keys to values. It inherits Dictionary class and implements the Map interface.

A Hashtable is an array of list. Each list is known as a bucket. The position of bucket is identified by calling the hashcode() method. A Hashtable contains values based on the key.

It contains only unique elements.

It may have not have any null key or value.

It is synchronized

**import** java.util.Hashtable;

**import** java.util.Iterator;

**import** java.util.Map;

**import** java.util.TreeSet;

**public** **class** Test

{

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

{

Hashtable<Integer, String> hm = **new** Hashtable<Integer, String>();

hm.put(100, "Amit");

hm.put(102, "Ravi");

hm.put(101, "Vijay");

hm.put(103, "Rahul");

**for** (Map.Entry m : hm.entrySet())

{

System.***out***.println (m.getKey() + " " + m.getValue());

}

}

}

**Difference between HashMap and Hashtable:**

|  |  |  |
| --- | --- | --- |
| **S.No** | **HashMap** | **Hashtable** |
| 1. | HashMap is non synchronized. It is not-thread safe and can't be shared between many threads without proper synchronization code. | Hashtable is synchronized. It is thread-safe and can be shared with many threads. |
| 2. | HashMap allows one null key and multiple null values. | Hashtable doesn't allow any null key or value. |
| 3. | HashMap is a new class introduced in JDK 1.2. | Hashtable is a legacy class. |
| 4. | HashMap is fast. | Hashtable is slow. |
| 5. | We can make the HashMap as synchronized by calling this code  Map m = Collections.synchronizedMap(hashMap); | Hashtable is internally synchronized and can't be unsynchronized. |
| 6. | HashMap is traversed by Iterator. | Hashtable is traversed by Enumerator and Iterator. |
| 7. | Iterator in HashMap is fail-fast. | Enumerator in Hashtable is not fail-fast. |
| 8. | HashMap inherits AbstractMap class. | Hashtable inherits Dictionary class. |

**Collections class:**

collection class is used exclusively with static methods that operate on or return collections. It inherits Object class.

Java Collection class supports the polymorphic algorithms that operate on collections.

Java Collection class throws a NullPointerException if the collections or class objects provided to them are null.

**Collections class declaration**

public class Collections extends Object

**Methods of Java Collections class**

|  |  |
| --- | --- |
| Method | Description |
| static <T> boolean addAll(Collection<? super T> c, T... elements) | It is used to add all of the specified elements to the specified collection. |
| static <T> Queue<T> asLifoQueue(Deque<T> deque) | It is used to return a view of a Deque as a Last-In-First-Out (LIFO) Queue. |
| static <T> int binarySearch(List<? extends T> list, T key, Comparator<? super T< c) | It is used to search the specified list for the specified object using the binary search algorithm. |
| static <E> List<E> checkedList(List<E> list, Class<E> type) | It is used to return a dynamically typesafe view of the specified list. |
| static <E> Set<E> checkedSet(Set<E> s, Class<E> type) | It is used to return a dynamically typesafe view of the specified set. |
| static<E> SortedSet<E>checkedSortedSet(SortedSet<E> s, Class<E> type) | It is used to return a dynamically typesafe view of the specified sorted set |
| static void reverse(List<?> list) | It is used to reverse the order of the elements in the specified list. |
| static <T> T max(Collection<? extends T> coll, Comparator<? super T> comp) | It is used to return the maximum element of the given collection, according to the order induced by the specified comparator. |
| static <T extends Object & Comparable<? super T>>T min(Collection<? extends T> coll) | It is used to return the minimum element of the given collection, according to the natural ordering of its elements. |
| static boolean replaceAll(List list, T oldVal, T newVal) | It is used to replace all occurrences of one specified value in a list with another. |

**Collections Example:**

**import** java.util.ArrayList;

**import** java.util.Collections;

**import** java.util.List;

**public** **class** Test

{

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

{

List<String> list = **new** ArrayList<String>();

list.add("C");

list.add("Core Java");

list.add("Advance Java");

System.***out***.println ("Initial collection value:" + list);

Collections.*addAll*(list, "Servlet", "JSP");

System.***out***.println ("After adding elements collection value:" + list);

String[] strArr = { "C#", ".Net" };

Collections.*addAll*(list, strArr);

System.***out***.println ("After adding array collection value:" + list);

}

}

**import** java.util.ArrayList;

**import** java.util.Collections;

**import** java.util.List;

**public** **class** Test

{

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

{

List<Integer> list = **new** ArrayList<Integer>();

list.add(46);

list.add(67);

list.add(24);

list.add(16);

list.add(8);

list.add(12);

System.***out***.println ("Value of maximum element from the collection: " + Collections.*max*(list));

}

}

**import** java.util.ArrayList;

**import** java.util.Collections;

**import** java.util.List;

**public** **class** Test

{

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

{

List<Integer> list = **new** ArrayList<Integer>();

list.add(46);

list.add(67);

list.add(24);

list.add(16);

list.add(8);

list.add(12);

System.***out***.println ("Value of minimum element from the collection: "+Collections.*min*(list));

}

}

**Sorting in Collection:**

We can sort the elements of:

String objects

Wrapper class objects

User-defined class objects

Collections class provides static methods for sorting the elements of collection.

If collection elements are of Set type, we can use TreeSet.

But We cannot sort the elements of List.

Collections class provides methods for sorting the elements of List type elements.

**Method of Collections class for sorting List elements:**

public void sort(List list): is used to sort the elements of List.List elements must be of Comparable type.

**Example of Sorting the elements of List that contains string objects:**

**import** java.util.ArrayList;

**import** java.util.Collections;

**import** java.util.Iterator;

**public** **class** Test

{

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

{

ArrayList<String> al = **new** ArrayList<String>();

al.add("Viru");

al.add("Saurav");

al.add("Mukesh");

al.add("Tahir");

Collections.*sort*(al);

Iterator itr = al.iterator();

**while** (itr.hasNext()) {

System.***out***.println (itr.next());

}

}

}

**Example of Sorting the elements of List that contains Wrapper class objects:**

**import java.util.ArrayList;**

**import** java.util.Collections;

**import** java.util.Iterator;

**public** **class** Test

{

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

{

ArrayList al = **new** ArrayList();

al.add(Integer.*valueOf*(201));

al.add(Integer.*valueOf*(101));

al.add(230);// internally will be converted into objects as

// Integer.valueOf(230)

Collections.*sort*(al);

Iterator itr = al.iterator();

**while** (itr.hasNext())

{

System.***out***.println (itr.next());

}

}

}

**Properties class in Java**

The properties object contains key and value pair both as a string. It is the subclass of Hashtable.

It can be used to get property value based on the property key. The Properties class provides methods to get data from properties file and store data into properties file. Moreover, it can be used to get properties of system.

Advantage of properties file

Easy Maintenance: If any information is changed from the properties file, you don't need to recompile the java class. It is mainly used to contain variable information i.e. to be changed.

**Methods of Properties class**

The commonly used methods of Properties class are given below.

|  |  |
| --- | --- |
| **Method** | **Description** |
| public void load(Reader r) | loads data from the Reader object. |
| public void load(InputStream is) | loads data from the InputStream object |
| public String getProperty(String key) | returns value based on the key. |
| public void setProperty(String key,String value) | sets the property in the properties object. |
| public void store(Writer w, String comment) | writers the properties in the writer object. |
| public void store(OutputStream os, String comment) | writes the properties in the OutputStream object. |
| storeToXML(OutputStream os, String comment) | writers the properties in the writer object for generating xml document. |
| public void storeToXML(Writer w, String comment, String encoding) | writers the properties in the writer object for generating xml document with specified encoding. |

**Example of Properties class to get information from properties file**

To get information from the properties file, create the properties file first.

**db.properties file**

**===========**

**user=system**

**password=oracle**

**Test.java**

import java.util.\*;

import java.io.\*;

public class Test

{

public static void main(String[] args)throws Exception

{

FileReader reader=new FileReader("db.properties");

Properties p=new Properties();

p.load(reader);

System.out.println (p.getProperty("user"));

System.out.println (p.getProperty("password"));

}

}

Now if you change the value of the properties file, you don't need to compile the java class again. That means no maintenance problem.

**Interview Questions**

### 1) What is the difference between ArrayList and Vector?

|  |  |  |
| --- | --- | --- |
| **No.** | **ArrayList** | **Vector** |
| 1) | ArrayList is not synchronized. | Vector is synchronized. |
| 2) | ArrayList is not a legacy class. | Vector is a legacy class. |
| 3) | ArrayList increases its size by 50% of the array size. | Vector increases its size by doubling the array size. |

### 2) What is the difference between ArrayList and LinkedList?

|  |  |  |
| --- | --- | --- |
| **No.** | **ArrayList** | **LinkedList** |
| 1) | ArrayList uses a dynamic array. | LinkedList uses doubly linked list. |
| 2) | ArrayList is not efficient for manipulation because a lot of shifting is required. | LinkedList is efficient for manipulation. |
| 3) | ArrayList is better to store and fetch data. | LinkedList is better to manipulate data. |

### 3) What is the difference between Iterator and ListIterator?

Iterator traverses the elements in forward direction only whereas ListIterator traverses the elements in forward and backward direction.

|  |  |  |
| --- | --- | --- |
| **No.** | **Iterator** | **ListIterator** |
| 1) | Iterator traverses the elements in forward direction only. | ListIterator traverses the elements in backward and forward directions both. |
| 2) | Iterator can be used in List, Set and Queue. | ListIterator can be used in List only. |

### 4) What is the difference between Iterator and Enumeration?

|  |  |  |
| --- | --- | --- |
| **No.** | **Iterator** | **Enumeration** |
| 1) | Iterator can traverse legacy and non-legacy elements. | Enumeration can traverse only legacy elements. |
| 2) | Iterator is fail-fast. | Enumeration is not fail-fast. |
| 3) | Iterator is slower than Enumeration. | Enumeration is faster than Iterator. |

### 5) What is the difference between List and Set?

List can contain duplicate elements whereas Set contains only unique elements.

### 6) What is the difference between HashSet and TreeSet?

HashSet maintains **no order** whereas TreeSet maintains **ascending order**.

### 7) What is the difference between Set and Map?

Set contains values only whereas Map contains key and values both.

### 8) What is the difference between HashSet and HashMap?

HashSet contains only values whereas HashMap contains entry(key,value). HashSet can be iterated but HashMap need to convert into Set to be iterated.

### 9) What is the difference between HashMap and TreeMap?

HashMap maintains **no order** but TreeMap maintains **ascending order**.

### 10) What is the difference between HashMap and Hashtable?

|  |  |  |
| --- | --- | --- |
| **No.** | **HashMap** | **Hashtable** |
| 1) | HashMap is not synchronized. | Hashtable is synchronized. |
| 2) | HashMap can contain one null key and multiple null values. | Hashtable cannot contain any null key or null value |

### 11) What is the difference between Collection and Collections?

Collection is an interface whereas Collections is a class. Collection interface provides normal functionality of data structure to List, Set and Queue. But, Collections class is to sort and synchronize collection elements.

### 12) What is the difference between Comparable and Comparator?

|  |  |  |
| --- | --- | --- |
| **No.** | **Comparable** | **Comparator** |
| 1) | Comparable provides only one sort of sequence. | Comparator provides multiple sort of sequences. |
| 2) | It provides one method named compareTo(). | It provides one method named compare(). |
| 3) | It is found in java.lang package. | it is found in java.util package. |
| 4) | If we implement Comparable interface, actual class is modified. | Actual class is not modified. |

### 13) What is the advantage of Properties file?

If you change the value in properties file, you don't need to recompile the java class. So, it makes the application easy to manage.

### 14) What does the hashCode() method?

The hashCode() method returns a hash code value (an integer number).

The hashCode() method returns the same integer number, if two keys (by calling equals() method) are same.

But, it is possible that two hash code numbers can have different or same keys.

### 15) Why we override equals() method?

The equals method is used to check whether two objects are same or not. It needs to be overridden if we want to check the objects based on property.

For example, Employee is a class that has 3 data members: id, name and salary. But, we want to check the equality of employee object on the basis of salary. Then, we need to override the equals() method.

### 16) How to synchronize List, Set and Map elements?

Yes, Collections class provides methods to make List, Set or Map elements as synchronized:

|  |
| --- |
| public static List synchronizedList(List l){} |
| public static Set synchronizedSet(Set s){} |
| public static SortedSet synchronizedSortedSet(SortedSet s){} |
| public static Map synchronizedMap(Map m){} |
| public static SortedMap synchronizedSortedMap(SortedMap m){} |

### 17) What is the advantage of generic collection?

If we use generic class, we don't need typecasting. It is typesafe and checked at compile time.

### 18) What is hash-collision in Hashtable and how it is handled in Java?

Two different keys with the same hash value is known as hash-collision. Two different entries will be kept in a single hash bucket to avoid the collision.

### 19) What is the Dictionary class?

The Dictionary class provides the capability to store key-value pairs.

### 20) What is the default size of load factor in hashing based collection?

The default size of load factor is **0.75**. The default capacity is computed as initial capacity \* load factor. For example, 16 \* 0.75 = 12. So, 12 is the default capacity of Map.

**Input and Output streams**

Java I/O (Input and Output) is used to process the input and produce the output based on the input.

Java uses the concept of stream to make I/O operation fast. The java.io package contains all the classes required for input and output operations.

We can perform file handling in java by java IO API.

**Stream:**

A stream is a sequence of data. In Java a stream is composed of bytes. It's called a stream because it's like a stream of water that continues to flow.

In java, 3 streams are created for us automatically. All these streams are attached with console.

**1) System.out:** standard output stream

**2) System.in:** standard input stream

**3) System.err:** standard error stream ( System errors i.e JVM error message )

Let's see the code to print output and error message to the console.

System.out.println ("simple message");

System.err.println ("error message");

int i=System.in.read();//returns ASCII code of 1st character .

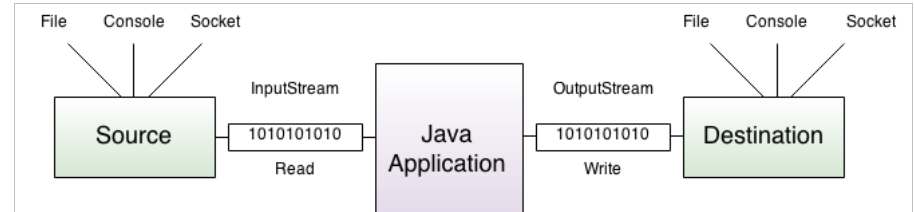
System.out.println ((char)i);//will print the character .

**InputStream ( Source of data )**

Java application uses an input stream to read data from a source, it may be a file,an array,peripheral device or socket.

**OutputStream ( Destination of Data )**

Java application uses an output stream to write data to a destination, it may be a file,an array,peripheral device or socket.



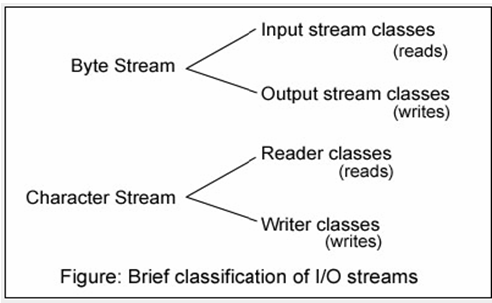
**Character Stream Vs Byte Stream in Java**

**Byte Streams**

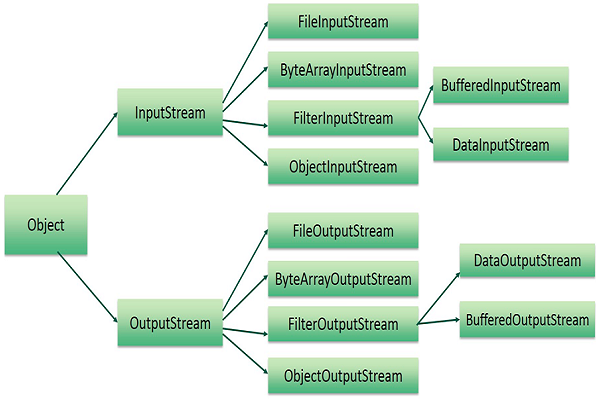
A byte stream access the file byte by byte. Java programs use byte streams to perform input and output of 8-bit bytes. It is suitable for any kind of file, however not quite appropriate for text files. For example, if the file is using a unicode encoding and a character is represented with two bytes, the byte stream will treat these separately and you will need to do the conversion yourself. Byte oriented streams do not use any encoding scheme while Character oriented streams use character encoding scheme(UNICODE). All byte stream classes are descended from InputStream and OutputStream .

**Character Streams**

A character stream will read a file character by character. Character Stream is a higher level concept than Byte Stream . A Character Stream is, effectively, a Byte Stream that has been wrapped with logic that allows it to output characters from a specific encoding . That means, a character stream needs to be given the file's encoding in order to work properly. Character stream can support all types of character sets ASCII, Unicode, UTF-8, UTF-16 etc. All character stream classes are descended from Reader and Writer .



**Hierachy of Byte Stream classes.**



**OutputStream class**

OutputStream class is an abstract class.It is the superclass of all classes representing an output stream of bytes. An output stream accepts output bytes and sends them to some sink.

**Commonly used methods of OutputStream class**

1) public void write( int ) throws IOException:

is used to write a byte to the required output stream.

2) public void write( byte [] ) throws IOException:

is used to write an array of byte to the required output stream.

3) public void flush() throws IOException:

flushes the required output stream.

4) public void close()throws IOException:

is used to close the required output stream.

**InputStream class**

InputStream class is an abstract class.It is the superclass of all classes representing an input stream of bytes.

1) public abstract int read() throws IOException:

reads the next byte of data from the input stream.It returns -1 at the end of file

2) public int available()throws IOException

returns an estimate of the number of bytes that can be read from the required input stream.

3) public void close()throws IOException:

is used to close the required input stream.

**File Class :**

It is class from java.io package to get information about file attributes.

File (String filePath ) : constructor to create file object

File file = new File(“C:\\project\\test\\file1”); 🡪 windows

File file = new File(“/home/nrit/file1”); 🡪 linux

Since java is an independent of plat form we should common code for both OS.

File file = new File(“c:/project/test/file1”);

Use / as path separator for any OS.

Eg:

File file = new File("C:/project/test/EMPLOYEE.dat");

file.exists() : checking for existence of the file.

file.isFile() : checking for file or not

file.isDirectory() : checking for direcoty or not

file.canRead() : checking for read permission

file.canWrite() : checking for write permission

file.canExecute() : checking for execute permission

file.length() : to get size of the file in bytes.

file.getParent : to get parent name

file.getName() : it return name of the file

file.renameTo(dest) : to rename a file

file.pathSeparator

file.pathSeparatorChar : OS file path separator.

file.lastModified() : last modified time.

**Program for the all abve methods.**

**package** com.nrit.mnrao.test;

**import** java.io.File;

**import** java.util.Date;

**public** **class** Test {

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

//using commanline parameter

File file1 = **new** File(args[0]);

File file2 = **new** File(args[1]);

**if**(file1.exists())

{

System.***out***.println("exist ");

}

**else**

{

System.***out***.println("does not exist ");

}

**if**(file1.isFile())

{

System.***out***.println("it is a file");

}

**else**

{

System.***out***.println("Not a file");

}

**if**(file1.isDirectory())

{

System.***out***.println("it is a directory");

}

**else**

{

System.***out***.println("Not a directory");

}

**if**(file1.canRead())

{

System.***out***.println("can read ");

}

**else**

{

System.***out***.println("can not read");

}

**if**(file1.canWrite())

{

System.***out***.println("can be modified ");

}

**else**

{

System.***out***.println("can not be modified");

}

**if**(file1.canExecute())

{

System.***out***.println("can be executed ");

}

**else**

{

System.***out***.println("can not be executed");

}

**long** len = file1.length();

System.***out***.println("size = "+len+" bytes");

System.***out***.println("size = "+(len/1024)+" kb");

System.***out***.println("size = "+(len/(1024\*1024))+" mb");

String parent = file1.getParent();

System.***out***.println("parent: "+parent);

String name = file1.getName();

System.***out***.println("name :"+name);

**if**( file1.renameTo(file2) )

{

System.***out***.println("renamed");

}

**else**

{

System.***out***.println("failed to rename");

}

System.***out***.println("path separator "+ file1.***pathSeparator***);

Date date = **new** Date(file1.lastModified());

System.***out***.println("Last modified time : "+ date);

}

}

Pass file path as command line params and run the abve program

runAs 🡪 RunConfiguration 🡪 argumets 🡪 "D:\MNRAO-Java-material\CoreJava\latest.pdf" "D:\MNRAO-Java-material\CoreJava\latest1.pdf"

to create new file

File filePath = **new** File(“D:\\NRIT\_Java-material\\CoreJava\\emp.dat”);

(or)

File filePath = **new** File(args[0]);

**if**(filePath.createNewFile())

{

System.***out***.println("created");

}

**else**

{

System.***out***.println("failed");

}

To delete file:

File filePath = **new** File(args[0]);

filePath.deleteOnExit();

**FileInputStream and FileOutputStream (File Handling)**

In Java, FileInputStream and FileOutputStream classes are used for file handling in java.

Java FileOutputStream class

Java FileOutputStream is an output stream for writing data to a file.

If you have to write primitive values then use FileOutputStream.Instead, for character-oriented data, prefer FileWriter.But you can write byte-oriented as well as character-oriented data.

**Program to create file using commandline params**

D:\test>java Create file1

It should take only one parameter.

It has to take data from keyboard

i/p:

at the end shoud be ctrl+z

step1:

$gedit Create.java

(or)

D:\test>notepad Create.java

**import** java.io.File;

**import** java.io.FileOutputStream;

**import** java.io.IOException;

**public** **class** Create {

**public** **static** **void** main(String[] args) **throws** IOException {

**if**(args.length!=1)

{

System.***out***.println("invalid syntax, usage: java Create <file\_name>");

System.*exit*(0);

}

File filePath = **new** File(args[0]);

**if**(filePath.exists())

{

System.***out***.println(args[0]+" already exist, can not create");

System.*exit*(0);

}

FileOutputStream fos=**null**;

**try**

{

fos = **new** FileOutputStream(filePath);

**char** ch = (**char** )System.***in***.read();

**while**(ch!=(**char**)-1)

{

fos.write(ch);

ch = (**char** )System.***in***.read();

}

fos.flush();

fos.close();

System.***out***.println("Successfully created");

}

**catch**(Exception e)

{

e.printStackTrace();

}

**finally**

{

**if**(fos!=**null**)

{

fos.close();

}

}

}

}

$javac Create.java

$java Create file1

Output:

Successfullly created

**$gedit Display.java**

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.IOException;

**public** **class** Display {

**public** **static** **void** main(String[] args) **throws** IOException {

**if**(args.length!=1)

{

System.***out***.println("invalid syntax, usage: java Display <file\_name>");

System.*exit*(0);

}

File inputFile = **new** File(args[0]);

**if**(!inputFile.exists())

{

System.***out***.println(args[0]+" file not found ");

System.*exit*(0);

}

**if**(!inputFile.isFile())

{

System.***out***.println(args[0]+"not a file ");

System.*exit*(0);

}

FileInputStream fis = **null**;

**try**

{

fis = **new** FileInputStream(inputFile);

**char** ch = (**char**)fis.read();

**while**(ch!=(**char**)-1)

{

System.***out***.print(ch);

ch = (**char**)fis.read();

}

fis.close();

}

**catch** (Exception e) {

e.printStackTrace();

}

**finally**

{

**if**(fis!=**null**)

{

fis.close();

}

}

}

}

$javac Display.java

$java Display file1

**Copying files.**

$gedit Copy.java

**import** java.io.IOException;

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.FileOutputStream;

**public** **class** Copy

{

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

{

**if**(args.length!=2)

{

System.***out***.println ("Invalid Syntax usage: java Copy <source\_filename> <dest\_filename> ");

System.*exit*(0);

}

File sourceFile = **new** File(args[0]);

**if**(!sourceFile.exists())

{

System.***out***.println (args[0]+" does not exist can not copy");

System.*exit*(0);

}

File destFile = **new** File(args[1]);

**if**(destFile.exists())

{

System.***out***.println (args[1]+" already exist can not copy");

System.*exit*(0);

}

FileInputStream fis=**null**;

FileOutputStream fos=**null**;

**try**

{

fis = **new** FileInputStream(args[0]);

fos=**new** FileOutputStream(args[1]);

**char** ch =(**char**) fis.read();

**while**(ch!=(**char**)-1)

{

fos.write(ch);

ch =(**char**) fis.read();

}

fis.close();

fos.close();

}

**catch**(Exception e)

{

e.printStackTrace();

}

**finally**

{

**if**(fis!=**null**)

{

fis.close();

}

**if**(fos!=**null**)

{

fos.close();

}

}

}

}

$javac Copy.java

$java Copy file1 file2

**Reading and writing lines:**

DataInputStream provides readLine() method to read a line

FileInputStream fis= **null**;

DataInputStream dis = **null**;

fis= **new** FileInputStream("employee.dat");

dis = **new** DataInputStream(fis);

String line = dis.~~readLine~~(); --> returns null when reach to EOF.

Program to read emplyeee records from the "employee.dat" file and has to display 1st filed, 2nd field and 5th field.

"employee.dat" **file contains following data.**

**1001:Sri Ram:5000.0:male:dev**

**1002:Manoj:6000.0:male:admin**

**1003:Anusha:6500.0:feamle:testing**

**1004:prasad:5500.0:male:dev**

**1005:vinay:3500.0:male:finance**

**1006:mithun:5500.0:male:admin**

**1007:thirumala:8500.0:female:dev**

**1050:nrit1:10000.0:male:admin**

**1051:nrit2:11000.0:female:dev**

**1011:Sri Ram:5000.0:male:dev**

**1012:Manoj:6000.0:male:admin**

**1013:Anusha:6500.0:female:testing**

**1014:prasad:5500.0:male:dev**

**import** java.io.DataInputStream;

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.IOException;

**public** **class** EmpDataFilter {

**public** **static** **void** main(String[] args) **throws** IOException {

**if**(args.length!=1)

{

System.***out***.println("Invalid Syntax, Uasge: EmpDataFilter <empdata\_file>");

System.*exit*(0);

}

File file = **new** File(args[0]);

String fileName = file.getName();

**if**(!fileName.equalsIgnoreCase("EMPLOYEE.dat"))

{

System.***out***.println("invalid file and missing data file");

System.*exit*(0);

}

FileInputStream fis = **null**;

DataInputStream dis = **null**;

**try**

{

fis = **new** FileInputStream(file);

dis = **new** DataInputStream(fis);

String record =dis.~~readLine~~();

**while**(record!=**null && !** record.isEmpty() )

{

String[] fields = record.split(":");

String result = fields[0]+":"+fields[1]+":"+fields[4];

System.***out***.println(result);

record =dis.~~readLine~~();

}

dis.close();

fis.close();

}

**catch** (Exception e)

{

e.printStackTrace();

}

**finally**

{

**if**(dis!=**null**)

{

dis.close();

}

**if**(fis!=**null**)

{

fis.close();

}

}

}

}

RunAs 🡪 RunConfiguration 🡪 Java Application ( double click ) 🡪 EmpDataFilter 🡪 arguments 🡪 “C:\project\test\EMPLOYEE.dat” 🡪 run

O/P:

1001:Sri Ram:dev

1002:Manoj:admin

1003:Anusha:testing

1004:prasad:dev

1005:vinay:finance

1006:mithun:admin

1007:thirumala:dev

1050:nrit1:admin

1051:nrit2:dev

1011:Sri Ram:dev

1012:Manoj:admin

1013:Anusha:testing

1014:prasad:dev

**program to convert above format into csv file ( employee.dat to employee.csv )**

**Note : employee.csv should also be generated at same location of “employee.dat”**

"employee.dat" **file contains following data.**

**1001:Sri Ram:5000.0:male:dev**

**1002:Manoj:6000.0:male:admin**

**1003:Anusha:6500.0:feamle:testing**

**1004:prasad:5500.0:male:dev**

**1005:vinay:3500.0:male:finance**

**1006:mithun:5500.0:male:admin**

**1007:thirumala:8500.0:female:dev**

**1050:nrit1:10000.0:male:admin**

**1051:nrit2:11000.0:female:dev**

**1011:Sri Ram:5000.0:male:dev**

**1012:Manoj:6000.0:male:admin**

**1013:Anusha:6500.0:female:testing**

**1014:prasad:5500.0:male:dev**

**program:**

**package** com.nrit.mnrao.test;

**import** java.io.DataInputStream;

**import** java.io.DataOutputStream;

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.FileOutputStream;

**import** java.io.IOException;

**public** **class** EmpDataCSVFIle {

**public** **static** **void** main(String[] args) **throws** IOException {

**if**(args.length!=2)

{

System.***out***.println("Invalid Syntax, Uasge: EmpDataCSVFIle <empdata\_file\_path> <empcsv\_file\_path> ");

System.*exit*(0);

}

File empDataFilePath = **new** File(args[0]);

File empDataCsvFilePath = **new** File(args[1]);

FileInputStream fis = **null**;

DataInputStream dis = **null**;

FileOutputStream fos =**null**;

DataOutputStream dos = **null**;

**try**

{

fis =**new** FileInputStream(empDataFilePath);

dis = **new** DataInputStream(fis);

fos = **new** FileOutputStream(empDataCsvFilePath);

dos = **new** DataOutputStream(fos);

String record = dis.~~readLine~~();

**while**(record!=**null** && !record.isEmpty())

{

String result = record.replaceAll(":", ",");

dos.writeBytes(result+"\n");

record = dis.~~readLine~~();

}

dis.close();

fis.close();

dos.close();

fos.close();

System.***out***.println("Successfully converted");

}

**catch**(Exception e )

{

e.printStackTrace();

}

**finally**

{

**if**(dis!=**null**)

{

dis.close();

}

**if**(fis!=**null**)

{

fis.close();

}

**if**(dos!=**null**)

{

dos.close();

}

**if**(fos!=**null**)

{

fos.close();

}

}

}

}

RunAs 🡪 RunConfiguration 🡪 Java Application ( double click ) 🡪 EmpDataCSVFIle 🡪 arguments 🡪 “C:\project\test\EMPLOYEE.dat” “C:\project\test\EMPLOYEE.csv” 🡪 run

**o/p employee.csv as follows:**

**1001,Sri Ram,5000.0,male,dev**

**1002,Manoj,6000.0,male,admin**

**1003,Anusha,6500.0,feamle,testing**

**1004,prasad,5500.0,male,dev**

**1005,vinay,3500.0,male,finance**

**1006,mithun,5500.0,male,admin**

**1007,thirumala,8500.0,female,dev**

**1050,nrit1,10000.0,male,admin**

**1051,nrit2,11000.0,female,dev**

**1011,Sri Ram,5000.0,male,dev**

**1012,Manoj,6000.0,male,admin**

**1013,Anusha,6500.0,female,testing**

**1014,prasad,5500.0,male,dev**

**Program to read records from text file, convert into Employee object and store into ArrayList and display from ArrayList**

**package** com.nrit.mnrao.test;

**public** **class** Employee {

**private** **int** empNum;

**private** String empName;

**private** **double** empSalary;

**private** String empGender;

**private** String empDept;

**public** **int** getEmpNum() {

**return** empNum;

}

**public** **void** setEmpNum(**int** empNum) {

**this**.empNum = empNum;

}

**public** String getEmpName() {

**return** empName;

}

**public** **void** setEmpName(String empName) {

**this**.empName = empName;

}

**public** **double** getEmpSalary() {

**return** empSalary;

}

**public** **void** setEmpSalary(**double** empSalary) {

**this**.empSalary = empSalary;

}

**public** String getEmpGender() {

**return** empGender;

}

**public** **void** setEmpGender(String empGender) {

**this**.empGender = empGender;

}

**public** String getEmpDept() {

**return** empDept;

}

**public** **void** setEmpDept(String empDept) {

**this**.empDept = empDept;

}

}

**package** com.nrit.mnrao.test;

**import** java.io.DataInputStream;

**import** java.io.DataOutputStream;

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.FileOutputStream;

**import** java.io.IOException;

**import** java.util.ArrayList;

**import** java.util.Iterator;

**public** **class** EmpDataRead {

**public** **static** **void** main(String[] args) **throws** IOException {

**if**(args.length!=1)

{

System.***out***.println("Invalid Syntax, Uasge: EmpDataRead <empdata\_file\_path> ");

System.*exit*(0);

}

File empDataFilePath = **new** File(args[0]);

FileInputStream fis = **null**;

DataInputStream dis = **null**;

**try**

{

fis =**new** FileInputStream(empDataFilePath);

dis = **new** DataInputStream(fis);

ArrayList<Employee> empDataList = **new** ArrayList<Employee>();

String record = dis.~~readLine~~();

**while**(record!=**null** && !record.isEmpty())

{

String[] fields = record.split(":");

Employee employee= **new** Employee();

employee.setEmpNum(Integer.*parseInt*(fields[0]));

employee.setEmpName(fields[1]);

employee.setEmpSalary(Double.*parseDouble*(fields[2]));

employee.setEmpGender(fields[3]);

employee.setEmpDept(fields[4]);

empDataList.add(employee);

record = dis.~~readLine~~();

}

dis.close();

fis.close();

System.***out***.println("Successfully loaded ");

Iterator<Employee> iterator = empDataList.iterator();

**while**(iterator.hasNext())

{

Employee nextRecord = iterator.next();

System.***out***.println(

nextRecord.getEmpNum()+"\t"+

nextRecord.getEmpName()+"\t"+

nextRecord.getEmpSalary()+"\t"+

nextRecord.getEmpGender()+"\t"+

nextRecord.getEmpDept()

);

}

}

**catch**(Exception e )

{

e.printStackTrace();

}

**finally**

{

**if**(dis!=**null**)

{

dis.close();

}

**if**(fis!=**null**)

{

fis.close();

}

}

}

}

**Program to find names of departments of Employees data.**

**Data as follows “EMPLOYEES.csv”**

**1001,Sri Ram,5000.0,male,dev**

**1002,Manoj,6000.0,male,admin**

**1003,Anusha,6500.0,feamle,testing**

**1004,prasad,5500.0,male,dev**

**1005,vinay,3500.0,male,finance**

**1006,mithun,5500.0,male,admin**

**1007,thirumala,8500.0,female,dev**

**1008,nrit1,10000.0,male,admin**

**1009,nrit2,11000.0,female,dev**

**1010,Sri Ram,5000.0,male,dev**

**1011,Manoj,6000.0,male,admin**

**1012,Anusha,6500.0,female,testing**

**1013,prasad,5500.0,male,dev**

**package** com.nrit.mnrao.test;

**import** java.io.DataInputStream;

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.IOException;

**import** java.util.Iterator;

**import** java.util.TreeSet;

**public** **class** EmpDeptNames {

**public** **static** **void** main(String[] args) **throws** IOException {

**if** (args.length != 1) {

System.***out***.println("Invalid syntax, Usage: UserValidate <Src\_data\_path>");

System.*exit*(0);

}

File file = **new** File(args[0]);

**if** (!file.exists()) {

System.***out***.println(args[0] + "does not exist");

System.*exit*(0);

}

FileInputStream fis = **null**;

DataInputStream dis = **null**;

**try** {

fis = **new** FileInputStream(file);

dis = **new** DataInputStream(fis);

TreeSet<String> deptNames = **new** TreeSet<String>();

String record = dis.~~readLine~~();

**while** (record != **null** && !record.isEmpty()) {

String [] fields = record.split(":");

deptNames.add(fields[4]);

record = dis.~~readLine~~();

}

dis.close();

fis.close();

Iterator<String> iterator = deptNames.iterator();

**while**(iterator.hasNext())

{

String deptName = iterator.next();

System.***out***.println(deptName);

}

}

**catch** (Exception e) {

e.printStackTrace();

}

**finally**

{

**if**(dis!=**null**)

{

dis.close();

}

**if**(fis!=**null**)

{

fis.close();

}

}

}

}

**Java SequenceInputStream Example**

**Example that reads the data from two files and writes screen**

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.IOException;

**import** java.io.SequenceInputStream;

**public** **class** Test

{

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

{

File file1 = **new** File("D:\\testin1.txt");

File file2 = **new** File("D:\\testin2.txt");

FileInputStream input1= **new** FileInputStream(file1);

FileInputStream input2=**new** FileInputStream(file2);

SequenceInputStream inst = **new** SequenceInputStream(input1, input2);

**char** ch=(**char**) inst.read();

**while**(ch!=(**char**)-1)

{

System.***out***.print(ch);

ch=(**char**)inst.read();

}

inst.close();

input1.close();

input2.close();

}

}

**Example that reads the data from two files and writes into another file**

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.FileOutputStream;

**import** java.io.IOException;

**import** java.io.SequenceInputStream;

**public** **class** Test

{

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

{

File file1 = **new** File("D:\\testin1.txt");

File file2 = **new** File("D:\\testin2.txt");

File file3 = **new** File("D:\\testout.txt");

FileInputStream input1= **new** FileInputStream(file1);

FileInputStream input2=**new** FileInputStream(file2);

FileOutputStream output=**new** FileOutputStream(file3);

SequenceInputStream inst=**new** SequenceInputStream(input1, input2);

**char** ch=(**char**)inst.read();

**while**(ch!=(**char**)-1)

{

output.write(ch);

ch=(**char**)inst.read();

}

inst.close();

input1.close();

input2.close();

output.close();

}

}

**Java Console Class:**

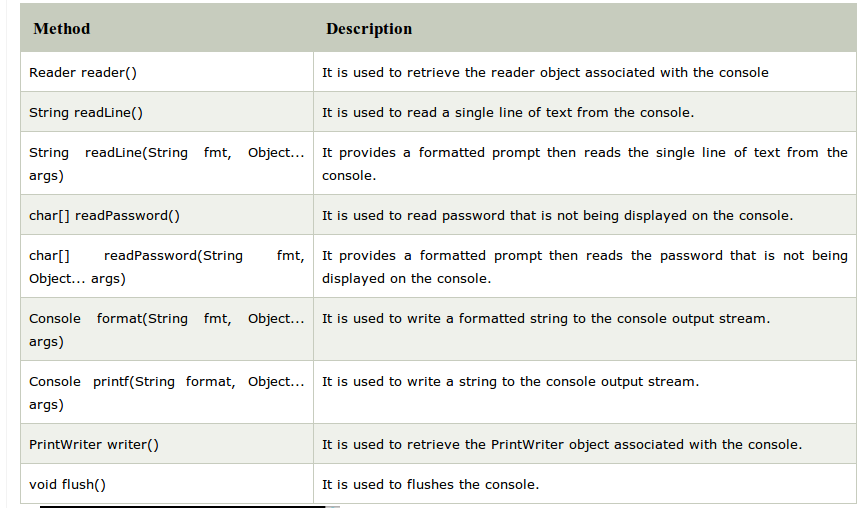
The Java Console class is be used to get input from console. It provides methods to read texts and passwords.

If you read password using Console class, it will not be displayed to the user.

The java.io.Console class is attached with system console internally. The Console class is introduced since 1.5.

**Let's see a simple example to read text from console.**

public final class Console extends Object implements Flushable



To read data from console:

**import** java.io.Console;

**public** **class** ConsoleTest

{

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

{

Console c = System.*console*();

System.***out***.println ("Enter your name: ");

String name= c.readLine();

System.***out***.println ("Welcome "+name);

}

}

**Password example:**

**import** java.io.Console;

**public** **class** ConsoleTest

{

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

{

Console c = System.*console*();

System.***out***.println ("Enter your name: ");

String name = c.readLine();

System.***out***.println ("Enter your passwd: ");

**char** [] ch = c.readPassword();

String pass = String.*valueOf*(ch);

**if**(name.equals("mnrao") && pass.equals("java"))

{

System.***out***.println ("Valid User");

}

**else**

{

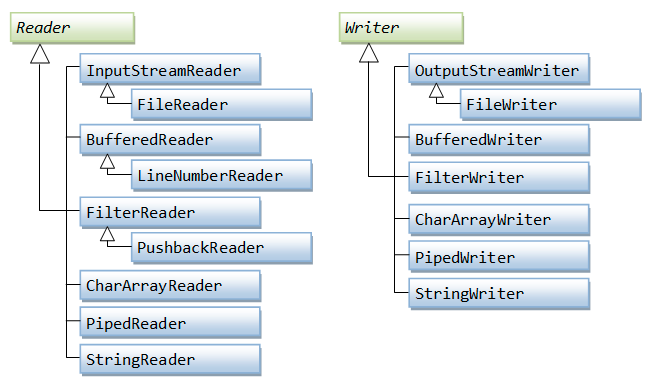
System.***out***.println ("Invalid user");

}

}

}

**Character Streams**



FileReader class:

==================

**import** java.io.FileReader;

**public** **class** Test

{

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

{

FileReader fr = **new** FileReader("/home/demo/files/file1");

**char** ch =(**char**) fr.read();

**while**(ch!=(**char**)-1)

{

System.***out***.print(ch);

ch =(**char**) fr.read();

}

fr.close();

}

}

**FileWriter Example:**

**import java.io.FileWriter;**

**public** **class** Test {

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

**try**

{

FileWriter fw = **new** FileWriter("D:/testout.txt");

fw.write("Welcome to NR IT Solutions");

fw.close();

}

**catch** (Exception e)

{

System.***out***.println (e);

}

System.***out***.println ("Success...");

}

}

**Java BufferedReader class:**

**import** java.io.BufferedReader;

**import** java.io.FileReader;

**import** java.io.IOException;

**public** **class** Test

{

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

{

FileReader fr = **new** FileReader("/home/demo/files/file1");

BufferedReader br = **new** BufferedReader( fr );

String line = br.readLine();

**while**(line != **null** && !line.equals("") )

{

System.***out***.println (line);

line = br.readLine();

}

br.close();

fr.close();

}

}

**BufferedWriter Example:**

**import** java.io.BufferedWriter;

**import** java.io.FileWriter;

**public** **class** Test

{

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

{

FileWriter writer = **new** FileWriter("D:\\testout.txt");

BufferedWriter buffer = **new** BufferedWriter(writer);

buffer.write("Welcome to NR IT Solutions\n");

buffer.close();

System.***out***.println ("Success");

}

}

**Reading data from console by InputStreamReader and BufferedReader**

**import** java.io.\*;

**public** **class** BufferedReaderExample

{

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

{

InputStreamReader r = **new** InputStreamReader(System.***in***);

BufferedReader br = **new** BufferedReader( r );

System.***out***.println ("Enter your name");

String name = br.readLine();

System.***out***.println ("Welcome " + name);

}

}

**PrintStream class Example:**

it provides print() and println () over loaded methods for different data types.

**import** java.io.FileOutputStream;

**import** java.io.PrintStream;

**public** **class** Test

{

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

{

FileOutputStream fout=**new** FileOutputStream("D:\\testout.txt ");

PrintStream pout = **new** PrintStream(fout);

pout.println (2016);

pout.println (2000.50);

pout.println ("Welcome to NR IT Solutions");

pout.close();

fout.close();

System.***out***.println ("Success?");

}

}

**PrintWriter class Example:**

**Example of writing the data on a console and in a text file testout.txt using Java PrintWriter class.**

**import** java.io.File;

**import** java.io.PrintWriter;

**public** **class** Test

{

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

{

// Data to write on Console using PrintWriter

PrintWriter writer = **new** PrintWriter(System.***out***);

writer.write("Welcome to NR IT Solutions");

writer.flush();

writer.close();

// Data to write in File using PrintWriter

PrintWriter writer1 = **null**;

writer1 = **new** PrintWriter(**new** File("D:\\testout.txt"));

writer1.write("Training on Java, Spring, Hibernate");

writer1.flush();

writer1.close();

}

}

System.***out***.printf():

===================

output formatting:

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

{

System.***out***.printf("%5d %10s",10, "hello");

}

**Loading Properties file data**

Properties class provide following methods

1. Object setProperty(String key, String value) it takes key and value pair

1. String getProperty(String key)

**package** com.nrit.test;

**import** java.io.FileReader;

**import** java.util.Properties;

**public** **class** PropTest {

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

**if** (args.length == 0) {

System.***out***.println("Missing properties file");

System.***out***.println("Usage: PropTest <prop\_file\_name>");

System.*exit*(0);

}

**try**

{

Properties dbProp = **new** Properties();

FileReader propPath = **new** FileReader(args[0]);

dbProp.load(propPath);

System.***out***.println("Database product : " + dbProp.getProperty("dbProduct"));

System.***out***.println("Database Host :" + dbProp.getProperty("dbhost"));

System.***out***.println("Database name :" + dbProp.getProperty("dbname"));

System.***out***.println("Database Driver : " + dbProp.getProperty("dbdriver"));

System.***out***.println("Database Port : " + dbProp.getProperty("dbport"));

System.***out***.println("Database UID : " + dbProp.getProperty("dbuid"));

System.***out***.println("Database PWD : " + dbProp.getProperty("dbpwd"));

propPath.close();

}

**catch** (Exception e) {

System.***out***.println(e);

}

}

}

**Excel Data Parsing**

**package** com.nrit.mnrao.excel;

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.util.Iterator;

**import** org.apache.poi.ss.usermodel.Row;

**import** org.apache.poi.xssf.usermodel.XSSFCell;

**import** org.apache.poi.xssf.usermodel.XSSFRow;

**import** org.apache.poi.xssf.usermodel.XSSFSheet;

**import** org.apache.poi.xssf.usermodel.XSSFWorkbook;

**public** **class** ExcelParser

{

**private** StringBuilder currentString = **null**;

**public** String parseExcelData(String filePath)

{

File file = **new** File(filePath);

FileInputStream fis =**null**;

**try** {

fis =**new** FileInputStream(file);

XSSFWorkbook workbook = **new** XSSFWorkbook(fis);

XSSFSheet sheet = workbook.getSheetAt(0);

Iterator<Row> rowIterator = sheet.rowIterator();

currentString = **new** StringBuilder();

System.***out***.println ("entered into parse Excel");

XSSFRow row;

XSSFCell cell;

**while** (rowIterator.hasNext())

{

row = (XSSFRow)rowIterator.next();

@SuppressWarnings("rawtypes")

Iterator cellIterator = row.cellIterator();

**while** (cellIterator.hasNext())

{

cell = (XSSFCell)cellIterator.next();

**switch** (cell.getCellType())

{

**case** XSSFCell.***CELL\_TYPE\_BOOLEAN***:

currentString.append(cell.getBooleanCellValue() + ",");

**break**;

**case** XSSFCell.***CELL\_TYPE\_NUMERIC***:

currentString.append(cell.getNumericCellValue() + ",");

**break**;

**case** XSSFCell.***CELL\_TYPE\_STRING***:

currentString.append(cell.getStringCellValue() + ",");

**break**;

}

}

currentString.setLength(currentString.length() - 1);

currentString.append("\n");

}

fis.close();

} **catch** (Exception e) {

}

System.***out***.println ("String builder : "+currentString.length()+"vaue "+currentString);

String finalData = currentString.toString();

**return** finalData;

}

}

===============================================

**package** com.nrit.mnrao.excel;

**import** java.io.IOException;

**public** **class** Test {

**public** **static** **void** main(String[] args) **throws** IOException, InterruptedException

{

String sourceFilePath = args[0];

String targetFilePath = args[1];

ExcelParser parser = **new** ExcelParser();

String excelData = parser.parseExcelData(sourceFilePath);

String [] records = excelData.split("\n");

CSVFile csvFile = **new** CSVFile();

csvFile.generateCSVFile(records, targetFilePath);

}

}

In eclipse :

Right click on main () 🡪 RunAs 🡪 RunConfiguration 🡪 JavaApplication 🡪

Arguments tab:

Windows:

D:\\hadoop\\employee.xlsx D:\\hadoop\\emp.csv

Linux:

/home/demo/hadoop employee.xlsx /home/demo/hadoop/ employee.csv

( source path of excel data DestinationPath of Data )

**XML Parser**

**Using DOM Parser:**

Eg:

Sample Data:

Employee.xml:

===================

<employees>

<employee>

<id>111</id>

<firstName>Lokesh</firstName>

<lastName>Gupta</lastName>

<location>India</location>

</employee>

<employee>

<id>222</id>

<firstName>Alex</firstName>

<lastName>Gussin</lastName>

<location>Russia</location>

</employee>

<employee>

<id>333</id>

<firstName>David</firstName>

<lastName>Feezor</lastName>

<location>USA</location>

</employee>

<employee>

<id>444</id>

<firstName>Russ</firstName>

<lastName>Dawson</lastName>

<location>USA</location>

</employee>

</employees>

**Result file emp.csv:**

111,Lokesh,Gupta,India

222,Alex,Gussin,Russia

333,David,Feezor,USA

444,Russ,Dawson,USA

**package** com.nrit.mnrao.xml;

**import** java.io.DataInputStream;

**import** java.io.File;

**import** java.io.FileInputStream;

**import** java.io.IOException;

**import** javax.xml.parsers.DocumentBuilder;

**import** javax.xml.parsers.DocumentBuilderFactory;

**import** javax.xml.parsers.ParserConfigurationException;

**import** org.w3c.dom.Document;

**import** org.w3c.dom.Element;

**import** org.w3c.dom.Node;

**import** org.w3c.dom.NodeList;

**import** org.xml.sax.SAXException;

**public** **class** XMLParser

{

**public** String parseXMLData(String xmlFilePath, String keyElement)

**throws** IOException, InterruptedException

{

File file = **new** File(xmlFilePath);

FileInputStream fis = **new** FileInputStream(file);

DataInputStream dis = **new** DataInputStream(fis);

// Get Document Builder

DocumentBuilderFactory factory = DocumentBuilderFactory.*newInstance*();

DocumentBuilder builder = **null**;

Document document = **null**;

**try**

{

builder = factory.newDocumentBuilder();

} **catch** (ParserConfigurationException e1)

{

// **TODO** Auto-generated catch block

e1.printStackTrace();

}

// Build Document

**try**

{

document = builder.parse(dis);

} **catch** (SAXException e)

{

// **TODO** Auto-generated catch block

e.printStackTrace();

}

// /Normalize the XML Structure; It's just too important !!

document.getDocumentElement().normalize();

// Here comes the root node

Element root = document.getDocumentElement();

System.***out***.println (root.getNodeName());

// Get all employees

NodeList nList = document.getElementsByTagName(keyElement);

StringBuffer buffer = **new** StringBuffer();

System.***out***.println (nList.getLength());

**for** (**int** temp = 0; temp < nList.getLength(); temp++)

{

Node node = nList.item(temp);

System.***out***.println (""); // Just a separator

**if** (node.getNodeType() == Node.***ELEMENT\_NODE***)

{

// Print each employee's detail

Element eElement = (Element) node;

// buffer.append(eElement.getAttribute("id")+",");

buffer.append(eElement.getElementsByTagName("id").item(0).getTextContent()

+ ",");

buffer.append(eElement.getElementsByTagName("firstName").item(0).getTextContent()

+ ",");

buffer.append(eElement.getElementsByTagName("lastName").item(0).getTextContent()

+ ",");

buffer.append(eElement.getElementsByTagName("location").item(0).getTextContent());

buffer.append("\n");

}

}

String data = buffer.toString();

System.***out***.println (data);

**return** data;

}

}

**package** com.nrit.mnrao.xml;

**import** java.io.DataOutputStream;

**import** java.io.File;

**import** java.io.FileOutputStream;

**import** java.io.IOException;

**public** **class** CSVFile {

**public** **void** generateCSVFile(String [] records, String targetParth) **throws** IOException

{

File file = **new** File(targetParth);

FileOutputStream fos = **null**;

DataOutputStream dos = **null**;

**try**

{

fos = **new** FileOutputStream(file);

dos = **new** DataOutputStream(fos);

**for** (String string : records) {

System.***out***.println (string);

dos.writeBytes(string+"\n");

}

dos.close();

fos.close();

}

**catch**(Exception e)

{

}

**finally**

{

**if**(dos!=**null**)

{

dos.close();

}

**if**(fos!=**null**)

{

fos.close();

}

}

}

}

**package** com.visix.mnrao.xml;

**import** java.io.IOException;

**public** **class** Test {

**public** **static** **void** main(String[] args) **throws** IOException, InterruptedException

{

String sourceFilePath = args[0];

String keyElement=args[1];

String targetFilePath = args[2];

System.***out***.println (sourceFilePath);

XMLParser parser = **new** XMLParser();

String xmlData = parser.parseXMLData(sourceFilePath, keyElement);

String [] records = xmlData.split("\n");

CSVFile csvFile = **new** CSVFile();

csvFile.generateCSVFile(records, targetFilePath);

System.out.println(“Successfully”);

}

}

In eclipse :

Right click on main () RunAs RunConfigurationJavaApplication

Arguments tab:

Windows:

D:\\hadoop\\employee.xml employee D:\\hadoop\\emp.csv

Linux:

/home/demo/hadoop/ employee.xml employee /home/demo/hadoop/ employee.csv

( source path of data searchKey DestinationPath of Data )

# Serialization

**Serialization in java** is a mechanism of writing the state of an object into a byte stream.

It is mainly used in Hibernate, RMI, JPA, EJB and JMS technologies.

The reverse operation of serialization is called deserialization ( Recollecting Object )

**Advantage of Java Serialization**

It is mainly used to travel object's state on the network (known as marshaling) or to store object into the file.

## java.io.Serializable interface

Serializable is a marker interface (has no data member and method).

It is used to "mark" java classes so that objects of these classes may get certain capability.

The Cloneable and Remote are also marker interfaces.

The String class and all the wrapper classes implements java.io.Serializable interface by default.

Persistance 🡪 permanent storage

Object Persistance : it is stroring an Object into the file perminanently

For object persistence serialization required.

By implementing Serializable interface we can make class object as Serializable object

**package** com.nrit.test;

**import** java.io.Serializable;

**public** **class** Employee **implements** Serializable{

**private** **int** empNum;

**private** String empName;

**private** **double** empSalary;

**private** String empDept;

**public** **int** getEmpNum() {

**return** empNum;

}

**public** **void** setEmpNum(**int** empNum) {

**this**.empNum = empNum;

}

**public** String getEmpName() {

**return** empName;

}

**public** **void** setEmpName(String empName) {

**this**.empName = empName;

}

**public** **double** getEmpSalary() {

**return** empSalary;

}

**public** **void** setEmpSalary(**double** empSalary) {

**this**.empSalary = empSalary;

}

**public** String getEmpDept() {

**return** empDept;

}

**public** **void** setEmpDept(String empDept) {

**this**.empDept = empDept;

}

@Override

**public** String toString() {

**return** "Employee [empNum=" + empNum + ", empName=" + empName + ", empSalary=" + empSalary + ", empDept="

+ empDept + "]";

}

}

**ObjectOutputStream class**

The ObjectOutputStream class is used to write primitive data types and Java objects to an OutputStream. Only objects that support the java.io.Serializable interface can be written to streams.

**Constructor**

public ObjectOutputStream(OutputStream out) throws IOException

creates an ObjectOutputStream that writes to the specified OutputStream.

**Methods**

1. public final void writeObject(Object obj) throws IOException writes the specified object to the ObjectOutputStream.
2. public void flush() throws IOException flushes the current output stream.
3. public void close() throws IOException closes the current output stream.

**package** com.nrit.test;

**import** java.io.FileOutputStream;

**import** java.io.ObjectOutputStream;

**public** **class** PersistTest {

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

FileOutputStream fos = **null**;

ObjectOutputStream oos = **null**;

**try**

{

fos = **new** FileOutputStream("C:/project/test/emp.dat");

oos = **new** ObjectOutputStream(fos);

Employee employee = **new** Employee();

employee.setEmpNum(1001);

employee.setEmpName("nrit1");

employee.setEmpSalary(5000);

employee.setEmpDept("dev");

oos.writeObject(employee);

employee = **new** Employee();

employee.setEmpNum(1002);

employee.setEmpName("nrit2");

employee.setEmpSalary(6000);

employee.setEmpDept("testing");

oos.writeObject(employee);

employee = **new** Employee();

employee.setEmpNum(1003);

employee.setEmpName("nrit3");

employee.setEmpSalary(3000);

employee.setEmpDept("admin");

oos.writeObject(employee);

System.***out***.println("Successfully Written");

oos.flush();

oos.close();

fos.close();

}

**catch** (Exception e) {

e.printStackTrace();

}

}

}

## Deserialization

Deserialization is the process of reconstructing the object from the serialized state.It is the reverse operation of serialization.

## ObjectInputStream class

An ObjectInputStream deserializes objects and primitive data written using an ObjectOutputStream.

## Constructor

**public ObjectInputStream(InputStream in) throws IOException**

creates an ObjectInputStream that reads from the specified InputStream.

1. public final Object readObject() throws IOException, ClassNotFoundException

* reads an object from the input stream.

|  |
| --- |
|  |
| 2) public void close() throws IOException closes **ObjectInputStream** |
|  |
|  |

**package** com.nrit.test;

**import** java.io.FileInputStream;

**import** java.io.ObjectInputStream;

**public** **class** DePersistTest {

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

FileInputStream fis = **null**;

ObjectInputStream ois = **null**;

**try**

{

fis = **new** FileInputStream("C:/project/test/emp.dat");

ois = **new** ObjectInputStream(fis);

Object obj = ois.readObject();

System.***out***.println("Fist EMP");

**if**( obj **instanceof** Employee)

{

Employee employee = (Employee)obj;

System.***out***.println(employee.getEmpNum()+"\t"+

employee.getEmpName()+"\t"+

employee.getEmpSalary()+"\t"+

employee.getEmpDept()+"\t"

);

}

System.***out***.println("Second EMP");

obj = ois.readObject();

**if**( obj **instanceof** Employee)

{

Employee employee = (Employee)obj;

System.***out***.println(employee.getEmpNum()+"\t"+

employee.getEmpName()+"\t"+

employee.getEmpSalary()+"\t"+

employee.getEmpDept()+"\t"

);

}

System.***out***.println("Third EMP");

obj = ois.readObject();

**if**( obj **instanceof** Employee)

{

Employee employee = (Employee)obj;

System.***out***.println(employee.getEmpNum()+"\t"+

employee.getEmpName()+"\t"+

employee.getEmpSalary()+"\t"+

employee.getEmpDept()+"\t"

);

}

ois.close();

fis.close();

}

**catch** (Exception e) {

e.printStackTrace();

}

}

}

## Java Serialization with static data member

If there is any static data member in a class, it will not be serialized because static is the part of class but not part of an object.

**import** java.io.Serializable;

**public** **class** Employee **implements** Serializable

{

**private** **int** id;

**private** String name;

**private** **static** String *company*="Visix Technologies ";//it won't be serialized

**public** Employee(**int** id, String name)

{

**this**.id = id;

**this**.name = name;

}

}

## Java Serialization with array or collection

Rule:

In case of array or collection, all the objects of array or collection must be serializable. If any object is not serialiizable, serialization will be failed.

## Java Transient Keyword

If you don't want to serialize any data member of a class, you can mark it as transient.

**import** java.io.Serializable;

**public** **class** Student **implements** Serializable

{

**int** id;

String name;

**transient** **int** age;//Now it will not be serialized

**public** Student(**int** id, String name,**int** age)

{

**this**.id = id;

**this**.name = name;

**this**.age=age;

}

}

**Program to store object into file**

**import** java.io.\*;

**public class** PersistExample

{

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

{

Student s1 =**new** Student(111,"ravi",22);//creating object

//writing object into file

FileOutputStream f=**new** FileOutputStream("emp.txt");

ObjectOutputStream out=**new** ObjectOutputStream(f);

out.writeObject(s1);

out.flush();

out.close();

f.close();

System.***out***.println ("success written to file");

}

}

**Program to read object from the file**

**import** java.io.\*;

**public** **class** DePersistTest

{

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

{

ObjectInputStream in=**new** ObjectInputStream(**new** FileInputStream("f.txt"));

Student s=(Student)in.readObject();

System.***out***.println (s.id+" "+s.name+" "+s.age);

in.close();

}

}

O/p

111 ravi 0

**Reflection API**

Java Reflection is a process of examining or modifying the run time behavior of a class at run time.

The java.lang.Class class provides many methods that can be used to get metadata, examine and change the run time behavior of a class.

Metadata: Data about data ( information about other information )

The java.lang and java.lang.reflect packages provide classes for java reflection.

**Where it is used**

The Reflection API is mainly used in:

IDE (Integrated Development Environment) e.g. Eclipse, MyEclipse, NetBeans etc.

Debugger, Test Tools etc.

Commonly used methods of Class class:

Method Description

**1) public String getName()**

returns the class name

**2) public static Class forName(String className)throws ClassNotFoundException**

loads the class and returns the reference of Class class.

**3) public Object newInstance()throws InstantiationException,IllegalAccessException**

creates new instance.

**4) public boolean isInterface()**

checks if it is interface.

**5) public boolean isArray()**

checks if it is array.

**6) public boolean isPrimitive()**

checks if it is primitive.

**7) public Class getSuperclass()**

returns the superclass class reference.

**8) public Field[] getDeclaredFields()throws SecurityException**

returns the total number of fields of this class.

**9) public Method[] getDeclaredMethods()throws SecurityException**

returns the total number of methods of this class.

**10) public Constructor[] getDeclaredConstructors()throws SecurityException**

returns the total number of constructors of this class.

**11) public Method getDeclaredMethod(String name,Class[] parameterTypes)throws NoSuchMethodException,SecurityException**

returns the method class instance.

**How to get the object of Class class?**

There are 3 ways to get the instance of Class class. They are as follows:

forName() method of Class class

getClass() method of Object class

1) forName() method of Class class

is used to load the class dynamically.

returns the instance of Class class.

It should be used if you know the fully qualified name of class.

This cannot be used for primitive types only for the classes.

Let's see the simple example of forName() method.

**package** com.nrit.mnrao.test;

**public** **class** Employee {

**private** **int** empNum;

**private** String empName;

**private** **double** empSalary;

**private** String empDept;

**public** Employee()

{

}

**public** Employee(**int** empNum,String empName,**double** empSalary,String empDept )

{

}

**public** **int** getEmpNum() {

**return** empNum;

}

**public** **void** setEmpNum(**int** empNum) {

**this**.empNum = empNum;

}

**public** String getEmpName() {

**return** empName;

}

**public** **void** setEmpName(String empName) {

**this**.empName = empName;

}

**public** **double** getEmpSalary() {

**return** empSalary;

}

**public** **void** setEmpSalary(**double** empSalary) {

**this**.empSalary = empSalary;

}

**public** String getEmpDept() {

**return** empDept;

}

**public** **void** setEmpDept(String empDept) {

**this**.empDept = empDept;

}

@Override

**public** String toString() {

**return** "Employee [empNum=" + empNum + ", empName=" + empName + ", empSalary=" + empSalary + ", empDept="

+ empDept + "]";

}

}

**package** com.nrit.mnrao.sample;

**import** java.lang.reflect.Constructor;

**import** java.lang.reflect.Field;

**import** java.lang.reflect.Method;

**public** **class** Test {

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

**try**

{

Class c = Class.*forName*("com.nrit.mnrao.test.Employee");

System.***out***.println("Successfully loaded");

System.***out***.println("class name : "+c.getName());

Constructor [] conNames = c.getConstructors();

System.***out***.println("It provides following constructors");

**for** (Constructor conName : conNames) {

System.***out***.println(conName);

}

Field [] fieldNames = c.getDeclaredFields();

System.***out***.println("It provides following Data members");

**for** (Field fieldName : fieldNames) {

System.***out***.println(fieldName);

}

Method [] methodNames = c.getDeclaredMethods();

System.***out***.println("It provides following Methods");

**for** (Method methodName : methodNames) {

System.***out***.println(methodName);

}

Class superclass = c.getSuperclass();

System.***out***.println("superclass : "+superclass);

}

**catch**(ClassNotFoundException e)

{

e.printStackTrace();

}

}

}

**Creating object by the user inplace of Class.forName()**

**package** com.nrit.mnrao.sample;

**import** java.lang.reflect.Constructor;

**import** java.lang.reflect.Field;

**import** java.lang.reflect.Method;

**import** com.nrit.mnrao.test.Employee;

**public** **class** Test {

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

**try**

{

Employee emp = **new** Employee();

Class<? **extends** Employee> c = emp.getClass();

System.***out***.println("class name : "+c.getName());

Constructor [] conNames = c.getConstructors();

System.***out***.println("It provides following constructors");

**for** (Constructor conName : conNames) {

System.***out***.println(conName);

}

Field [] fieldNames = c.getDeclaredFields();

System.***out***.println("It provides following Data members");

**for** (Field fieldName : fieldNames) {

System.***out***.println(fieldName);

}

Method [] methodNames = c.getDeclaredMethods();

System.***out***.println("It provides following Methods");

**for** (Method methodName : methodNames) {

System.***out***.println(methodName);

}

Class superclass = c.getSuperclass();

System.***out***.println("superclass : "+superclass);

}

**catch**(Exception e)

{

e.printStackTrace();

}

}

}

**Multi Threading**

**Mutli Tasking:**

It is a running multiple jobs simultaneously.

Multi tasking can be in two ways.

1. Process based Multi Tasking
2. Thread based Muti Tasking

**Process based Multi Tasking:**

In this for every job separate process creates and loads the job into the process.

These processes are created bt Operating System.

OS has to manage all the processes.

If jobs are java program, then JVM loads into every process to execute those programs.

Two JVMs can not share the data. Every one runs in its processes.

Two JVM can not communicate each other.

RMI is the way to communicate between Two JVMs.

For example there are four jobs. Then OS creates four childs and loads four JVMs into that processes.

Processs based job scheduling can be

1. Roud robin scheduling ( Cirucluar )
2. Priority based scheduling ( four ground job will be given more priority and next is its back ground

Advantage:

1.Process based is a safe one as no chance of crashing.

2.No chance of corrupting data as every process has it’s own memory space.

Dis-Advantage :

1.OS has to manage many processes. Hence heavy load on the OS. It is an heavy weight process.

2.Performance is less.

Eg:

UNIX OS

**Thread based Muti Tasking:**

In this concept, only one child process creates for any no of threads and all threads will share same memory space.

Advantage:

It is light weight tachinology and more performance.

Dis-Advantage

Chance of crashing threads.

Developer should expert in writing Multi thread coding.

Thread based Muti Tasking can be a round robin or priority based.

For process based recommoned one is round robin based

For thread based recommended one priority based.

**Threading:**

Thread is a part of an application.

Thread is an independent path of execution.

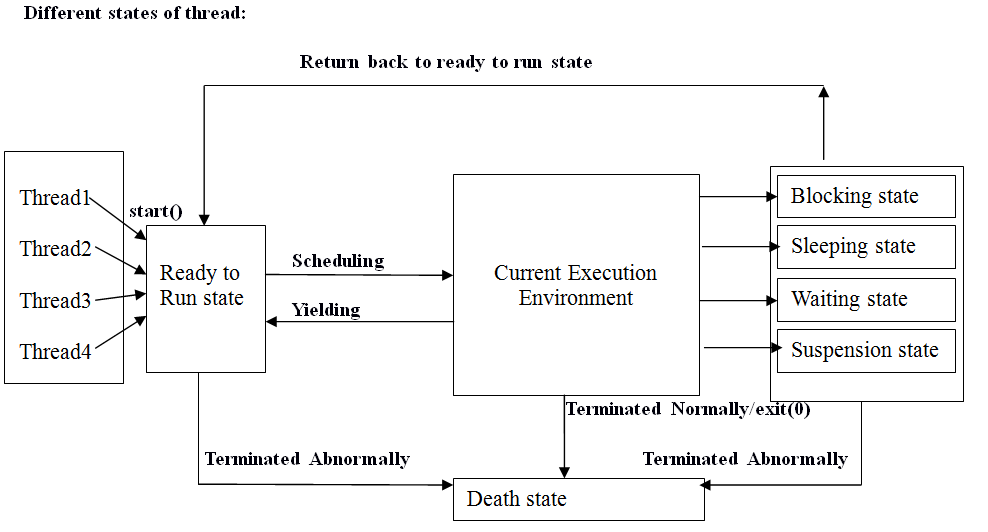
Def:

Execution of different parts of same application at the same time is called as multi-threading.

For any no of threads only one child process will be created and that can be shared by all threads of application.

Adv:

maximum utilization of CPU Time, so that we can get more performance.



JVM provides Thread scheduler, which manages different states of the thread.

**1) Ready to run state:**

It is a state of waiting for CPU time. A Thread comes to ready to run state, When start() method is called on thread.

**2) Current execution state :**

It is a state of assigning CPU time to thread

**3) Blocking state:**

Thread goes to blocking state when performing I/O operations with external resources, such as keyboard, database server and other servers.

**4) Sleeping state:**

It is a state of waiting for shared resources for specific amount of time. A thread goes to sleeping state when sleep() is called on thread.

**5) waiting state**

It is state of waiting for the shared resources until getting the resources. Thread goes to waiting state when wait() method called on thread.

**6) suspend state:**

If any child thread is going to perform any illegal transactions on the system resources, then main thread will suspend the child thread. If any thread is in suspend state it should be revoked by some other thread.

**7) Death state:**

A thread goes to death state, when terminated normally or abnormally (or) called exit(0) method on thread.

Once thread goes to death state it can not be invoked.

**8) Scheduling :** thread scheduler schedules the threads for execution. Thread scheduling can be done any one of the two ways.

1) priority scheduling (or) primitive scheduling

2) Round robin process.

**9) yielding :**

If any thread enters into ready to run state (new or old thread ) thread scheduler checks priority of current execution thread with threads which are waiting for CPU time. If waiting thread is having more priority than the current execution thread, then thread scheduler forcibly brings the current execution thread into ready to run state.

**Creation of a thread :**

A thread can be created in two ways:

1. by extending from Thread class
2. by implementing Runnable interface

Recommended one is implements Runnable.

Thread class and Runnable interfaces are from java.lang package.

**Runnable interface;**

public interface Runnable {

public void run();

}

run should be implemented in the child class, which is acting as thread. run() contains thread coding.

**Thread class:**

This class implements the Runnable interface.

Constructors of Thread class:

1) Thread()

Thread t = new Thread ();

2) Thread(String name)

Thread t = new Thread (“child”);

3) Thread(Runnable r, String name)

Thread t = new Thread(this, “child”);

**Methods:**

1. String name = t.getName() returns name of the thread
2. String parent = t.getParent(); return parent name of the thread.
3. t.start() to take thread into ready to run state.
4. public static void sleep(int milliSeconds) to take thread into sleeping state.

**Creation of a thread by extending from Thread class.**

**public** **class** MyThread **extends** Thread

{

**public** MyThread()

{

**super**("child");

}

**public** **void** run()

{

System.***out***.println ("Child thread started");

**try**

{

**for**(**int** i=0;i<5;i++)

{

System.***out***.println ("child : "+i);

Thread.*sleep*(200);

}

}

**catch**(InterruptedException e)

{

System.***out***.println ("Child Interrupted");

}

System.***out***.println ("end of child thread");

}

}

**public** **class** ThreadTest

{

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

{

System.***out***.println ("parent started");

Thread t = **new** MyThread();

System.***out***.println ("child created");

t.start();

**try**

{

**for** (**int** i = 0; i < 5; i++)

{

System.***out***.println ("Parent : " + i);

Thread.*sleep*(200);

}

}

**catch** (InterruptedException e)

{

System.***out***.println ("Parent Interrupted");

}

System.***out***.println ("end of Parent thread");

}

}

o/p:

parent started

child created

Parent : 0

Child thread started

child : 0

Parent : 1

child : 1

Parent : 2

child : 2

Parent : 3

child : 3

Parent : 4

child : 4

end of Parent thread

end of child thread

**Creation of thread by implementing Runnable interface.**

**public** **class** MyThread **implements** Runnable

{

Thread t;

**public** MyThread()

{

t=**new** Thread(**this**,"child");

t.start();

}

**public** **void** run()

{

System.***out***.println ("Child thread started");

**try**

{

**for**(**int** i=0;i<5;i++)

{

System.***out***.println ("child : "+i);

Thread.*sleep*(200);

}

}

**catch**(InterruptedException e)

{

System.***out***.println ("Child Interrupted");

}

System.***out***.println ("end of child thread");

}

}

**public** **class** ThreadTest

{

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

{

System.***out***.println ("parent started");

**new** MyThread();

**try**

{

**for** (**int** i = 0; i < 5; i++)

{

System.***out***.println ("Parent : " + i);

Thread.*sleep*(200);

}

}

**catch** (InterruptedException e)

{

System.***out***.println ("Parent Interrupted");

}

System.***out***.println ("end of Parent thread");

}

}

o/p:

parent started

child created

Parent : 0

Child thread started

child : 0

Parent : 1

child : 1

Parent : 2

child : 2

Parent : 3

child : 3

Parent : 4

child : 4

end of child thread

end of Parent thread

**Creating Multiple threads:**

**public** **class** MyThread **implements** Runnable

{

Thread t;

**public** MyThread(String name)

{

t=**new** Thread(**this**,name);

t.start();

}

**public** **void** run()

{

String name = t.getName();

System.***out***.println ("Child Name : "+name);

**try**

{

**for**(**int** i=0;i<5;i++)

{

System.***out***.println (name+" : "+i);

Thread.*sleep*(200);

}

}

**catch**(InterruptedException e)

{

System.***out***.println ("Child Interrupted name : "+name);

}

System.***out***.println ("end of child thread name : "+name);

}

}

**public** **class** ThreadTest

{

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

{

System.***out***.println ("parent started");

String [] threadNames = {"one","two","three","four","five"};

**try**

{

**for** (**int** i = 0; i < threadNames.length; i++)

{

**new** MyThread(threadNames[i]);

}

Thread.*sleep*(8000);

}

**catch** (InterruptedException e)

{

System.***out***.println ("Parent Interrupted");

}

System.***out***.println ("end of Parent thread");

}

}

**Thread priority:**

Priority is Ranging from 1 to 10

Thread.***MAX\_PRIORITY*** =10;

Thread.***MIN\_PRIORITY*** = 1;

Thread.***NORM\_PRIORITY*** = 5; it is a default priority.

Methods

public void setPriority(int priority ) : to set priority of the thread.

public int getPriority( ) : to get priority of the thread.

**public** **class** MyThread **implements** Runnable

{

Thread t;

**public** MyThread(String name, **int** priority)

{

t=**new** Thread(**this**, name);

t.setPriority(priority);

t.start();

}

**public** **void** run()

{

System.***out***.println ("Child Name : "+t.getName());

System.***out***.println ("Priority : "+t.getPriority());

System.***out***.println ("End ");

}

}

**public** **class** ThreadTest

{

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

{

String [] threadNames={"One","Two","Three","Four","Five","Six","Seven","eight","nine"};

Thread currentThread = Thread.*currentThread*();

currentThread.setPriority(10);

**for** (**int** i = 0; i < threadNames.length; i++)

{

**new** MyThread(threadNames[i], i+1);

}

System.***out***.println ("Childs are created");

System.***out***.println ("End of parent");

}

}

In the above example parent thread dies first and then child . Hence child threads becomes orphaned threads.

In this scenario we can use join() to wait for the child threads to complete.

**Methods:**

1. public boolean isAlive(); return true if thread is alive otherwise false.
2. public void join(); to wait for the child thread.

**public** **class** MyThread **implements** Runnable

{

Thread t;

**public** MyThread(String name)

{

t = **new** Thread(**this**, name);

t.start();

}

**public** **void** run()

{

System.***out***.println ("Child Name : "+t.getName());

System.***out***.println ("End ");

}

}

**public** **class** ThreadTest

{

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

{

MyThread t1 = **new** MyThread("One");

MyThread t2 = **new** MyThread("Two");

MyThread t3 = **new** MyThread("Three");

System.***out***.println ("One is in Alive "+t1.t.isAlive());

System.***out***.println ("Two is in Alive "+t2.t.isAlive());

System.***out***.println ("Three is in Alive "+t3.t.isAlive());

**try**

{

t1.t.join();

t2.t.join();

t3.t.join();

}

**catch** (InterruptedException e)

{

System.***out***.println (e.getMessage());

}

System.***out***.println ("One is in Alive "+t1.t.isAlive());

System.***out***.println ("Two is in Alive "+t2.t.isAlive());

System.***out***.println ("Three is in Alive "+t3.t.isAlive());

System.***out***.println ("End of parent");

}

}

**Thread synchronization:**

When Multiple threads are trying to access shared resources, there is a chance of crashing threads. To avoid thread crashing, developer has to write synchronization coding.

Methods to synchronize a thread.

1. public void wait()

this method takes the thread into waiting state. It throws InterruptedException.

1. public void notify()

this method is to invoke the first waiting thread.

1. public void notifyAll()

this method is to invoke all waiting threads

the above three methods are from Object class, not from thread class. Hence these can be called direcly.

**public** **class** Queue

{

**int** data=0;

**boolean** state = **false**;

**public** **synchronized** **void** pop()

{

**if**( ! state )

{

**try**

{

wait();

}

**catch**(InterruptedException e)

{

System.***out***.println ("Consumer Interrupted");

}

}

System.***out***.println ("consumed Data "+data);

state=**false**;

notify();

}

**public** **synchronized** **void** push(**int** num)

{

**if**(state)

{

**try**

{

wait();

}

**catch**(InterruptedException e)

{

System.***out***.println ("Consumer Interrupted");

}

}

data=num;

System.***out***.println ("Produced Data "+data);

state=**true**;

notify();

}

}

**public** **class** Producer **implements** Runnable

{

Thread t;

Queue q1;

**public** Producer(Queue q)

{

q1=q;

t=**new** Thread(**this**,"producer");

t.start();

}

**public** **void** run()

{

System.***out***.println ("Producer started");

**int** i=0;

**while**(**true**)

{

i++;

q1.push(i);

}

}

}

**public** **class** Consumer **implements** Runnable

{

Thread t;

Queue q1;

**public** Consumer(Queue q)

{

q1=q;

t=**new** Thread(**this**,"consumer");

t.start();

}

**public** **void** run()

{

System.***out***.println ("consumer started");

**while**(**true**)

{

q1.pop();

}

}

}

**public** **class** ProdConsumer

{

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

{

Queue q = **new** Queue();

Consumer c1 = **new** Consumer(q);

Producer p1 = **new** Producer(q);

System.***out***.println ("Press Ctrl + C for End ");

}

}

**Interview Questions**

### 1) What is multithreading?

Multithreading is a process of executing multiple threads simultaneously. Its main advantage is:

* Threads share the same address space.
* Thread is lightweight.
* Cost of communication between process is low.

### 2) What is thread?

A thread is a lightweight subprocess.It is a separate path of execution.It is called separate path of execution because each thread runs in a separate stack frame.

### 3)What is the difference between preemptive scheduling and time slicing?

Under preemptive scheduling, the highest priority task executes until it enters the waiting or dead states or a higher priority task comes into existence. Under time slicing, a task executes for a predefined slice of time and then reenters the pool of ready tasks. The scheduler then determines which task should execute next, based on priority and other factors.

### 4) What does join() method?

The join() method waits for a thread to die. In other words, it causes the currently running threads to stop executing until the thread it joins with completes its task.

### 5) What is difference between wait() and sleep() method?

|  |  |
| --- | --- |
| **wait()** | **sleep()** |
| 1) The wait() method is defined in Object class. | The sleep() method is defined in Thread class. |
| 2) wait() method releases the lock. | The sleep() method doesn't releases the lock. |

### 6) Is it possible to start a thread twice?

No, there is no possibility to start a thread twice. If we does, it throws an exception.

### 7) Can we call the run() method instead of start()?

yes, but it will not work as a thread rather it will work as a normal object so there will not be context-switching between the threads.

### 8) What about the daemon threads?

The daemon threads are basically the low priority threads that provides the background support to the user threads. It provides services to the user threads.

### 9)Can we make the user thread as daemon thread if thread is started?

No, if you do so, it will throw IllegalThreadStateException

### 10)What is shutdown hook?

The shutdown hook is basically a thread i.e. invoked implicitely before JVM shuts down. So we can use it perform clean up resource

### 11)When should we interrupt a thread?

We should interrupt a thread if we want to break out the sleep or wait state of a thread.

### 12) What is synchronization?

Synchronization is the capabilility of control the access of multiple threads to any shared resource.It is used:

1. To prevent thread interference.
2. To prevent consistency problem.

### 13) What is the purpose of Synchronized block?

* Synchronized block is used to lock an object for any shared resource.
* Scope of synchronized block is smaller than the method.

### 14)Can Java object be locked down for exclusive use by a given thread?

Yes. You can lock an object by putting it in a "synchronized" block. The locked object is inaccessible to any thread other than the one that explicitly claimed it.

### 15) What is static synchronization?

If you make any static method as synchronized, the lock will be on the class not on object.

### 16)What is the difference between notify() and notifyAll()?

The notify() is used to unblock one waiting thread whereas notifyAll() method is used to unblock all the threads in waiting state.

### 17)What is deadlock?

Deadlock is a situation when two threads are waiting on each other to release a resource. Each thread waiting for a resource which is held by the other waiting thread.

**Networking**

## Java Networking Terminology

The widely used java networking terminologies are given below:

**Network :**

It is a physical connections between the computer. It can be established by using hub / switch and Cables.

**Networking :**

It is communication system between two computers in the Network.

**LAN ( Local Area Network )**

It is a short distance ( in the same Data Centre ) , it can achieved by using HUB or SWITCH.

**WAN ( Wide Area Network )**

For long distance ( between two Data Centres located at different location of same building ) . it can be through the switches or routers.

**MAN ( Metroplitan Area Network )**

For very larger distance between different location of citiy. It can be through router.

Eg:

WIFI connection.

**Intranet :**

Network of similar networks. It can be through bridge .

**Internet :**

Network of dissimilar type of Networks. It can be through Gateway.

To achieve networking Hardware and Software components are required.

**Hardware components:**

1. NIC ( Network Interface Card )
2. Media of communication.

NIC will maintain the IP address of the system.

The choice of media of communication depends on the following factors.

1. Amount of distance
2. Amount of data transferring
3. How frequently data is transferring.

**Topology:**

It defines how physical connections have been made between computers.

1. Ring Topology 2)Bus Topology 3)Star

Mostly used one is physical Bus and logical star Topology

**Architecture:**

If defines how communication would be done between computers.

1. Point – to – point communication
2. Broad casting

**Point – to – point communication:**

In this communication first routing established between source and destination, then communication starts.

It is a connection oriented (or) TCP based communication

Eg: telephone

**Broad casting:**

In this communication data will be delivered to all systems in the network and the system will respond to which data intended.

Eg: radio

1. IP Address
2. Protocol
3. Port Number
4. MAC Address
5. Connection-oriented and connection-less protocol
6. Socket

### 1) IP Address

IP address is a unique number assigned to a node of a network e.g. 192.168.0.1 . It is composed of four octets that ranging from 0 to 255.

It is a logical address that can be changed.

### 2) Protocol

A protocol is a set of rules basically that is followed for communication. For example:

* TCP
* FTP
* Telnet
* SMTP
* POP etc.

### 3) Port Number

The port number is used to uniquely identify different applications. It acts as a communication endpoint between applications.

The port number is associated with the IP address for communication between two applications.

### 4) MAC Address

MAC (Media Access Control) Address is a unique identifier of NIC (Network Interface Controller). A network node can have multiple NIC but each with unique MAC.

### 5) Connection-oriented and connection-less protocol

In connection-oriented protocol, acknowledgement is sent by the receiver. So it is reliable but slow. The example of connection-oriented protocol is TCP.

But, in connection-less protocol, acknowledgement is not sent by the receiver. So it is not reliable but fast. The example of connection-less protocol is UDP.

### 6) Socket

A socket is an endpoint between two way communication.

**Difference between TCP & UDP:**

|  |  |  |
| --- | --- | --- |
| **S.No** | **TCP** | **UDP** |
| 1. | Transmission Control Protocol | User Datagram Protocol |
| 2. | Connection Oriented | Connectionless |
| 3. | Byte stream protocol | Packet stream protocol |
| 4. | TCP expects for the acknowledgement | Never expects for acknowledgement |
| 5. | There is a guarantee for destination data | No guarantee for destination of data |
| 6. | Point – to – point communication | Broad casting |

## Socket class

A socket is simply an endpoint for communications between the machines. The Socket class can be used to create a socket.

### Methods used Network Programming:

**public InputStream getInputStream() :** returns the InputStream attached with this socket.

**public OutputStream getOutputStream():** returns the OutputStream attached with this socket.

**public synchronized void close()**: closes this socket

## ServerSocket class

The ServerSocket class can be used to create a server socket. This object is used to establish communication with the clients

1) **public Socket accept()**:

returns the socket and establish a connection between server and client.

**2) public synchronized void close()**:

closes the server socket.

**TCP Echo Server:**

**package** com.nrit.mnrao.test;

**import** java.io.DataInputStream;

**import** java.io.DataOutputStream;

**import** java.io.InputStream;

**import** java.net.ServerSocket;

**import** java.net.Socket;

**public** **class** TCPEchoServer {

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

{

ServerSocket ss=**null**;

Socket s =**null**;

DataInputStream dis=**null**;

DataOutputStream dos=**null**;

**try**

{

ss = **new** ServerSocket(2341);

System.***out***.println ("Waiting for the client request");

s = ss.accept();

System.***out***.println ("received request from the clien");

dis = **new** DataInputStream(s.getInputStream());

dos = **new** DataOutputStream(s.getOutputStream());

**while**(**true**)

{

String message = dis.~~readLine~~();

System.***out***.println (message);

dos.writeBytes(message+"\n");

}

}

**catch**(Exception e)

{

e.printStackTrace();

}

}

}

**TCP ECHO Client:**

**package** com.nrit.mnrao.test;

**import** java.io.DataInputStream;

**import** java.io.DataOutputStream;

**import** java.net.Socket;

**public** **class** TCPEchoClient {

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

Socket s=**null**;

DataInputStream dis=**null**;

DataOutputStream dos =**null**;

DataInputStream kb=**null**;

**try**

{

s = **new** Socket("localhost",2341);

dis = **new** DataInputStream(s.getInputStream());

dos = **new** DataOutputStream(s.getOutputStream());

kb = **new** DataInputStream(System.***in***);

**while**(**true**)

{

System.***out***.print("Enter Input : ");

String input = kb.~~readLine~~();

dos.writeBytes(input+"\n");

String reply = dis.~~readLine~~();

System.***out***.println (reply);

}

}

**catch**(Exception e)

{

}

}

}

**UDP communication:**

# Java DatagramSocket and DatagramPacket

**Java DatagramSocket** class represents a connection-less socket for sending and receiving datagram packets.

A datagram is basically an information but there is no guarantee of its content, arrival or arrival time.

**Constructors of DatagramSocket class**

* **DatagramSocket() throws SocketEeption:** it creates a datagram socket and binds it with the available Port Number on the localhost machine.
* **DatagramSocket(int port) throws SocketEeption:** it creates a datagram socket and binds it with the given Port Number.
* **DatagramSocket(int port, InetAddress address) throws SocketEeption:** it creates a datagram socket and binds it with the specified port number and host address.

## Java DatagramPacket class

**Java DatagramPacket** is a message that can be sent or received. If you send multiple packet, it may arrive in any order. Additionally, packet delivery is not guaranteed.

## Constructors of DatagramPacket class

* **DatagramPacket(byte[] barr, int length):** it creates a datagram packet. This constructor is used to receive the packets.
* **DatagramPacket(byte[] barr, int length, InetAddress address, int port):** it creates a datagram packet. This constructor is used to send the packets.

**Server:**

**import** java.net.DatagramPacket;

**import** java.net.DatagramSocket;

**import** java.net.InetAddress;

**import** java.util.Date;

**public** **class** UDPServer {

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

**try**

{

DatagramSocket ds = **new** DatagramSocket();

InetAddress localHost = InetAddress.*getLocalHost*();

**while**(**true**)

{

Date currentDate = **new** Date();

String str = currentDate.toString();

**byte** [] b = str.getBytes();

DatagramPacket dp = **new** DatagramPacket(b

,b.length,localHost,2341);

ds.send(dp);

Thread.*sleep*(5000);

}

}

**catch**(Exception e)

{

e.printStackTrace();

}

}

}

**Client:**

**import** java.net.DatagramPacket;

**import** java.net.DatagramSocket;

**public** **class** UDPClient {

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

**try**

{

DatagramSocket ds = **new** DatagramSocket(2341);

**while**(**true**)

{

**byte** [] b = **new** **byte**[1024];

DatagramPacket dp = **new** DatagramPacket(b,b.length);

ds.receive(dp);

b = dp.getData();

String str = **new** String(b);

System.***out***.println ("Server Date = "+ str);

Thread.*sleep*(4000);

}

}

**catch**(Exception e)

{

e.printStackTrace();

}

}

}

**Server Sending data to Multiple clients:**

**import** java.net.DatagramPacket;

**import** java.net.DatagramSocket;

**import** java.net.InetAddress;

**import** java.util.Date;

**public** **class** UDPMultiServer {

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

**int** count=0;

**try**

{

DatagramSocket ds = **new** DatagramSocket();

InetAddress localHost = InetAddress.*getLocalHost*();

**while**(**true**)

{

Date currentDate = **new** Date();

String str = currentDate.toString();

count++;

**if**(count%2==0)

{

str="Even "+str;

**byte** [] b = str.getBytes();

DatagramPacket dp = **new** DatagramPacket(b,b.length,localHost,2342);

ds.send(dp);

Thread.*sleep*(5000);

}

**else**

{

str=" Odd "+str;

**byte** [] b = str.getBytes();

DatagramPacket dp = **new** DatagramPacket(b,b.length,localHost,2341);

ds.send(dp);

Thread.*sleep*(5000);

}

}

}

**catch**(Exception e)

{

e.printStackTrace();

}

}

}

**Client1:**

**import** java.net.DatagramPacket;

**import** java.net.DatagramSocket;

**public** **class** UDPClient1 {

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

**try**

{

DatagramSocket ds = **new** DatagramSocket(2341);

**while**(**true**)

{

**byte** [] b = **new** **byte**[1000];

DatagramPacket dp = **new** DatagramPacket(b,b.length);

ds.receive(dp);

b = dp.getData();

String str = **new** String(b);

System.***out***.println ("Server Date = "+ str);

Thread.*sleep*(4000);

}

}

**catch**(Exception e)

{

e.printStackTrace();

}

}

}

**Client2:**

**import** java.net.DatagramPacket;

**import** java.net.DatagramSocket;

**public** **class** UDPClient2 {

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

**try**

{

DatagramSocket ds = **new** DatagramSocket(2342);

**while**(**true**)

{

**byte** [] b = **new** **byte**[1000];

DatagramPacket dp = **new** DatagramPacket(b,b.length);

ds.receive(dp);

b = dp.getData();

String str = **new** String(b);

System.***out***.println ("Server Date = "+ str);

Thread.*sleep*(4000);

}

}

**catch**(Exception e)

{

e.printStackTrace();

}

}

}

# Java URL

The **Java URL** class represents an URL. URL is an acronym for Uniform Resource Locator. It points to a resource on the World Wide Web.

For example:

**https://www.google.com:8020/ index.jsp**

A URL contains many information:

1. **Protocol:** In this case, https is the protocol.
2. **Server name or IP Address:** In this case, www.google.com is the server name.
3. **Port Number:** It is an optional attribute. If we write http// www.google.com:8020/ index.jsp / , 8020 is the port number. If port number is not mentioned in the URL, it returns -1.
4. **File Name or directory name:** In this case, index.jsp is the file name.

java.net.URL class provides following methods

1. public String getProtocol() : it returns the protocol of the URL.
2. public String getHost() : it returns the host name of the URL.
3. public String getPort() : it returns the Port Number of the URL.
4. public String getFile() : it returns the file name of the URL.
5. public URLConnection openConnection() : it returns the instance of URLConnection i.e. associated with this URL.

**import** java.net.URL;

**public** **class** URLTest

{

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

{

**try**

{

URL url = **new** URL("https://www.google.com:8020/index.jsp");

System.***out***.println ("Protocol: "+url.getProtocol());

System.***out***.println ("Host Name: "+url.getHost());

System.***out***.println ("Port Number: "+url.getPort());

System.***out***.println ("File Name: "+url.getFile());

}

**catch**(Exception e)

{

System.***out***.println (e);

}

}

}

# Java InetAddress class

**Java InetAddress** class represents an IP address. The java.net.InetAddress class provides methods to get the IP of any host name for example www.gmail.com, www.google.com, www.facebook.com etc.

## Methods of InetAddress class

* 1. public static InetAddress getByName(String host) throws UnknownHostException

It returns the instance of InetAddress containing LocalHost IP and name.

* 1. public static InetAddress getLocalHost() throws UnknownHostException

it returns the instance of InetAdddress containing local host name and address.

* 1. public String getHostName()

it returns the host name of the IP address.

* 1. public String getHostAddress()

it returns the IP address in string format.

**import** java.net.InetAddress;

**public** **class** InetTest {

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

**try** {

InetAddress ip = InetAddress.*getByName*("www.facebook.com");

System.***out***.println ("Host Name: " + ip.getHostName());

System.***out***.println ("IP Address: " + ip.getHostAddress());

} **catch** (Exception e) {

System.***out***.println (e);

}

}

}

**Java Jar files**

## What is JAR?

The **jar (Java Archive)** tool of JDK provides the facility to create the executable jar file. An executable jar file calls the main method of the class if you double click it.

**Step1:** Create a folder

#### Eg:

#### D:\sample

#### Write First.java with following code:

#### public class First

#### {

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

#### {

#### System.out.println ("Hello World");

#### }

#### }

Compile it and generate .class file.

D:\sample >javac First.java

Step2:

create **.mf file**, also known as manifest file.

#### Creating manifest file

To create manifest file, you need to write Main-Class, then colon, then space, then classname then enter.

#### In mf file, new line is must after the class name.

For example:

Manifest file Name : myfile.mf , contains following.

myfile.mf

Main-Class: First

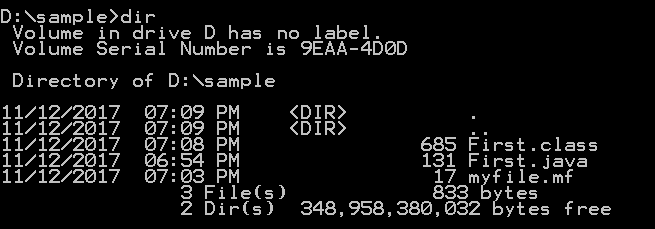
## Creating executable jar file using jar tool

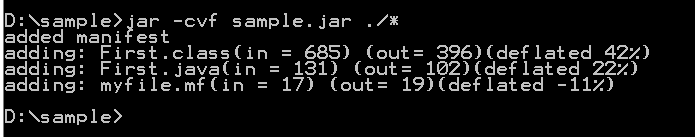
The jar tool provides many switches, some of them are as follows:

1. **-c** creates new archive file
2. **-v** generates verbose output. It displays the included or extracted resource on the standard output.
3. **-m** includes manifest information from the given mf file.
4. **-f** specifies the archive file name
5. **-x** extracts files from the archive file

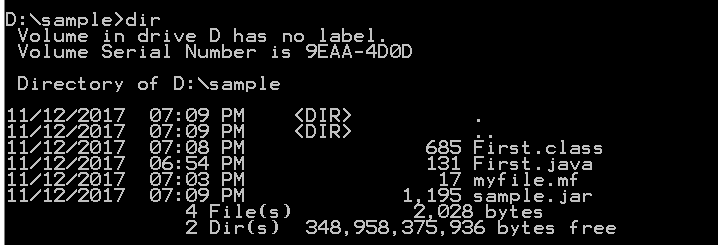
Now, let's write the code to generated the executable jar using mf file.

You need to write **jar** then **switches** then **mf\_file** then **jar\_file** then **.classfile** as given below:





**Here result file is sample.jar file**

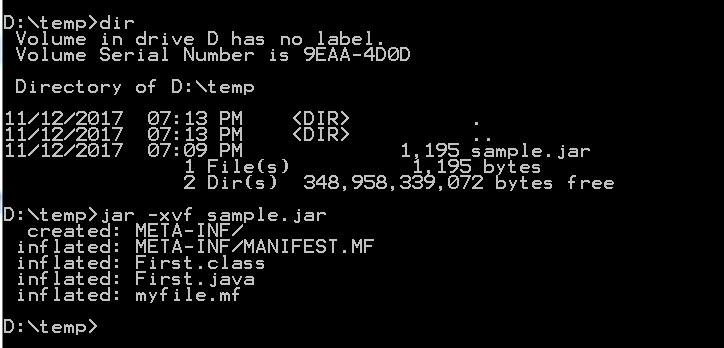


Extracting jar file:

Copy the above jar file into temp folder.

Goto d:\ temp

D:>cd temp



## JVM Architecture

## What is the JVM?

A **Virtual Machine** is a software implementation of a physical machine. Java was developed with the concept of **WORA (Write Once Run Anywhere)**,which runs on a **VM**. The **compiler** compiles the Java file into a Java **.class** file, then that **.class** file is input into the JVM, which Loads and executes the class file. Below is a diagram of the Architecture of the JVM.

### JVM Architecture Diagram



## How Does the JVM Work?

As shown in the above architecture diagram, the JVM is divided into three main subsystems:

1. **Class Loader Subsystem**
2. **Runtime Data Area**
3. **Execution Engine**

### 1. Class Loader Subsystem

Java's [**dynamic class loading**](http://www.javainterviewpoint.com/use-of-class-forname-in-java/) functionality is handled by the class loader subsystem. It loads, links. and initializes the class file when it refers to a class for the first time at **runtime**, not **compile time.**

#### 1.1 Loading

Classes will be loaded by this component. Boot Strap class Loader, Extension class Loader, and Application class Loader are the three class loader which will help in achieving it.

1. **Boot Strap** [**ClassLoader**](http://www.javainterviewpoint.com/) – Responsible for loading classes from the bootstrap classpath, nothing but **rt.jar.** Highest priority will be given to this loader.
2. **Extension ClassLoader** – Responsible for loading classes which are inside **ext** folder **(jre\lib).**
3. **Application ClassLoader** –Responsible for loading **Application Level Classpath**, path mentioned Environment Variable etc.

The above **Class Loaders** will follow **Delegation Hierarchy Algorithm** while loading the class files.

#### 1.2 Linking

1. **Verify** – Bytecode verifier will verify whether the generated bytecode is proper or not if verification fails we will get the **verification error.**
2. **Prepare** – For all static variables memory will be allocated and assigned with **default values.**
3. **Resolve** – All **symbolic memory references** are replaced with the **original references** from **Method Area**.

#### 1.3 Initialization

This is the final phase of Class Loading, here all [**static variables**](http://www.javainterviewpoint.com/use-of-static-keyword-in-java/)will be assigned with the original values, and the [**static block**](http://www.javainterviewpoint.com/java-static-import/) will be executed.

### 2. Runtime Data Area

The Runtime Data Area is divided into 5 major components:

1. **Method Area** – All the **class level data** will be stored here, including **static variables**. There is only one method area per JVM, and it is a shared resource.
2. **Heap Area** – All the **Objects** and their corresponding **instance variables** and **arrays** will be stored here. There is also one Heap Area per JVM. Since the **Method** and **Heap areas** share memory for multiple threads, the data stored is not thread **safe.**
3. **Stack Area** – For every thread, a separate **runtime stack** will be created. For every **method call**, one entry will be made in the stack memory which is called as **Stack Frame**. All **local variables** will be created in the stack memory. The stack area is thread safe since it is not a shared resource. The Stack Frame is divided into three subentities:
   1. **Local Variable Array** – Related to the method how many **local variables** are involved and the corresponding values will be stored here.
   2. **Operand stack** – If any intermediate operation is required to perform, **operand stack** acts as runtime workspace to perform the operation.
   3. **Frame data** – All symbols corresponding to the method is stored here. In the case of any **exception**, the catch block information will be maintained in the frame data.
4. **PC Registers** – Each thread will have separate **PC Registers,** to hold the address of **current executing instruction** once the instruction is executed the PC register will be **updated** with the next instruction.
5. **Native Method stacks** – Native Method Stack holds native method information. For every thread, a separate native method stack will be created.

### 3. Execution Engine

The bytecode which is assigned to the **Runtime Data Area** will be executed by the Execution Engine. The Execution Engine reads the bytecode and executes it piece by piece.

1. **Interpreter** – The interpreter interprets the bytecode faster, but executes slowly. The disadvantage of the interpreter is that when one method is called multiple times, every time a new interpretation is required.
2. **JIT Compiler** – The JIT Compiler neutralizes the disadvantage of the interpreter. The Execution Engine will be using the help of the interpreter in converting byte code, but when it finds repeated code it uses the JIT compiler, which compiles the entire bytecode and changes it to native code. This native code will be used directly for repeated method calls, which improve the performance of the system.
3. **Intermediate Code generator** – Produces intermediate code
4. **Code Optimizer** – Responsible for optimizing the intermediate code generated above
5. **Target Code Generator** – Responsible for Generating Machine Code or Native Code
6. **Profiler** – A special component, responsible for finding hotspots, i.e. whether the method is called multiple times or not.
7. **Garbage Collector**: Collects and removes unreferenced objects. Garbage Collection can be triggered by calling ***"System.gc()"***, but the execution is not guaranteed. Garbage collection of the JVM collects the objects that are created.

**Java Native Interface (JNI)**: **JNI** will be interacting with the **Native Method Libraries** and provides the Native Libraries required for the Execution Engine.

**Native Method Libraries**:It is a collection of the Native Libraries which is required for the Execution Engine.

**Interview Questions**

**1. What’s the difference between an array and Vector?**

Ans: An array groups data of same primitive type and is static in nature while vectors are dynamic in nature and can hold data of different data types.

**2. What is multi-threading?**

Ans: Multi threading is a programming concept to run multiple tasks in a concurrent manner within a single program. Threads share same process stack and running in parallel. It helps in performance improvement of any program.

**3. How garbage collection is done in Java?**

Ans: In java, when an object is not referenced any more, garbage collection takes place and the object is destroyed automatically. For automatic garbage collection java calls either System.gc() method or Runtime.gc() method.

**4. How can we make copy of a java object?**

Ans: We can use the concept of cloning to create copy of an object. Using clone, we create copies with the actual state of an object.

Clone() is a method of Cloneable interface and hence, Cloneable interface needs to be implemented for making object copies.

**5 In java, how we can disallow serialization of variables?**

Ans: If we want certain variables of a class not to be serialized, we can use the keyword transient while declaring them. For example, the variable trans\_var below is a transient variable and can’t be serialized:

**6. Which types of exceptions are caught at compile time?**

Ans: Checked exceptions can be caught at the time of program compilation. Checked exceptions must be handled by using try catch block in the code in order to successfully compile the code.

**7.What is multi-catch block in java?**

Java 7 one of the improvement was multi-catch block where we can catch multiple exceptions in a single catch block. This makes are code shorter and cleaner when every catch block has similar code.

If a catch block handles multiple exception, you can separate them using a pipe (|) and in this case exception parameter (ex) is final, so you can’t change it.

catch(IOException | SQLException | Exception ex){

logger.error(ex);

throw new MyException(ex.getMessage());

}

**8.What is Classloader in Java?**

Java Classloader is the program that loads byte code program into memory when we want to access any class. We can create our own classloader by extending ClassLoader class and overriding loadClass(String name) method.

**9.Can we have try without catch block?**

Yes, we can have try-finally statement and hence avoiding catch block.

**10.What is Garbage Collection?**

Garbage Collection is the process of looking at heap memory, identifying which objects are in use and which are not, and deleting the unused objects. In Java, process of deallocating memory is handled automatically by the garbage collector.

We can run the garbage collector with code Runtime.getRuntime().gc() or use utility method System.gc().

**11.What is Serialization and Deserialization?**

We can convert a Java object to an Stream that is called Serialization. Once an object is converted to Stream, it can be saved to file or send over the network or used in socket connections.

The object should implement Serializable interface and we can use java.io.ObjectOutputStream to write object to file or to any OutputStream object.

**12.How to run a JAR file through command prompt?**

We can run a jar file using java command but it requires Main-Class entry in jar manifest file. Main-Class is the entry point of the jar and used by java command to execute the class.

**13.What is a transient variable?**

A transient variable is a variable that may not be serialized during Serialization and which is initialized by its default value during de-serialization,

**14.What is the difference between error, exception, bug and defect ?**

Eorror :- It is a compile time one.

Exception :- It is a runtime one, when exception raises application terminates abnormally. It can be

handled by writing exception handling code.

Bug :- It is an unexpected value at runtime. Even bug raises application never terminates

abnormally. It can can be fixed.

Defect :- It can't be fixed. Some features may not be provided by the application software.

**15.What are the advantages of ArrayList over arrays?**

ArrayList can grow dynamically and provides more powerful insertion and search mechanisms than arrays.

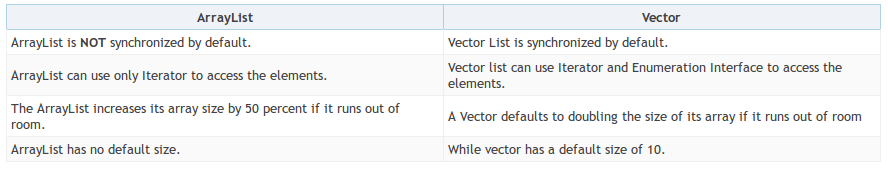
**16.What is daemon thread?**

Daemon thread is a low priority thread, which runs intermittently in the back ground doing the garbage collection operation for the java runtime system.

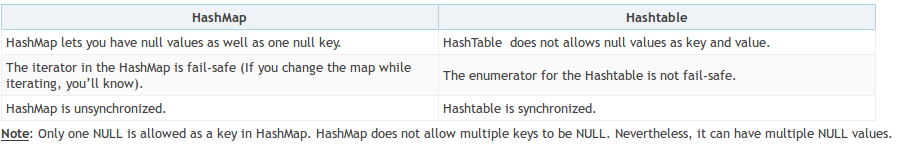
**17.How do you prevent a method from being overridden?**

To prevent a specific method from being overridden in a subclass, use the final modifier on the method declaration, which means "this is the final implementation of this method", the end of its inheritance hierarchy.

**17.Difference between ArrayList and Vector ?**



**19.Difference between HashMap and Hashtable ?**



Some more Questions and Answers.

### 20) Why Java doesn’t support multiple inheritance?

Java doesn’t support multiple inheritance in classes because of “Diamond Problem”. However multiple inheritance is supported in interfaces. An interface can extend multiple interfaces because they just declare the methods and implementation will be present in the implementing class. So there is no issue of diamond problem with interfaces.

### 21) What is overloading and overriding in java?

When we have more than one method with same name in a single class but the arguments are different, then it is called as method overloading.

Overriding concept comes in picture with inheritance when we have two methods with same signature, one in parent class and another in child class. We can use @Override annotation in the child class overridden method to make sure if parent class method is changed, so as child class.

### 22) Can we overload main method?

Yes, we can have multiple methods with name “main” in a single class. However if we run the class, java runtime environment will look for main method with syntax as public static void main(String [] args).

### 23) Can we have multiple public classes in a java source file?

We can’t have more than one public class in a single java source file. A single source file can have multiple classes that are not public.

### 24) What is Java Package and which package is imported by default?

Java package is the mechanism to organize the java classes by grouping them. The grouping logic can be based on functionality or modules based. A java class fully classified name contains package and class name. For example, java.lang.Object is the fully classified name of Object class that is part of java.lang package.

java.lang package is imported by default and we don’t need to import any class from this package explicitly.

### 25) What is final keyword?

final keyword is used with Class to make sure no other class can extend it, for example String class is final and we can’t extend it.

We can use final keyword with methods to make sure child classes can’t override it.

final keyword can be used with variables to make sure that it can be assigned only once. However the state of the variable can be changed, for example we can assign a final variable to an object only once but the object variables can change later on.

Java interface variables are by default final and static.

### 26) What is static keyword?

static keyword can be used with class level variables to make it global i.e all the objects will share the same variable.

static keyword can be used with methods also. A static method can access only static variables of class and invoke only static methods of the class.

### 27) What is finally and finalize in java?

finally block is used with try-catch to put the code that you want to get executed always, even if any exception is thrown by the try-catch block. finally block is mostly used to release resources created in the try block.

finalize() is a special method in Object class that we can override in our classes. This method get’s called by garbage collector when the object is getting garbage collected. This method is usually overridden to release system resources when object is garbage collected.

### 28) What is try-with-resources in java?

One of the Java 7 features is try-with-resources statement for automatic resource management. Before Java 7, there was no auto resource management and we should explicitly close the resource. Usually, it was done in the finally block of a try-catch statement. This approach used to cause memory leaks when we forgot to close the resource.

From Java 7, we can create resources inside try block and use it. Java takes care of closing it as soon as try-catch block gets finished.

### 29) What is multi-catch block in java?

Java 7 one of the improvement was multi-catch block where we can catch multiple exceptions in a single catch block. This makes are code shorter and cleaner when every catch block has similar code.

If a catch block handles multiple exception, you can separate them using a pipe (|) and in this case exception parameter (ex) is final, so you can’t change it.

### 30) What is static block?

Java static block is the group of statements that gets executed when the class is loaded into memory by [Java ClassLoader](https://www.journaldev.com/349/java-classloader). It is used to initialize static variables of the class. Mostly it’s used to create static resources when class is loaded.

### 31) What is an interface?

Interfaces are core part of java programming language and used a lot not only in JDK but also java design patterns, most of the frameworks and tools. Interfaces provide a way to achieve abstraction in java and used to define the contract for the subclasses to implement.

### 32) What is an abstract class?

Abstract classes are used in java to create a class with some default method implementation for subclasses. An abstract class can have abstract method without body and it can have methods with implementation also.

abstract keyword is used to create a abstract class. Abstract classes can’t be instantiated and mostly used to provide base for sub-classes to extend and implement the abstract methods and override or use the implemented methods in abstract class.

### 33) What is the difference between abstract class and interface?

abstract keyword is used to create abstract class whereas interface is the keyword for interfaces.

Abstract classes can have method implementations whereas interfaces can’t.

A class can extend only one abstract class but it can implement multiple interfaces.

We can run abstract class if it has main() method whereas we can’t run an interface.

### 34) Can an interface implement or extend another interface?

Interfaces don’t implement another interface, they extend it. Since interfaces can’t have method implementations, there is no issue of diamond problem. That’s why we have multiple inheritance in interfaces i.e an interface can extend multiple interfaces.

### 35) What are Wrapper classes?

Java wrapper classes are the Object representation of eight primitive types in java. All the wrapper classes in java are immutable and final. Java 5 autoboxing and unboxing allows easy conversion between primitive types and their corresponding wrapper classes.

### 36) What is Enum in Java?

Enum was introduced in Java 1.5 as a new type whose fields consists of fixed set of constants. For example, in Java we can create Direction as enum with fixed fields as EAST, WEST, NORTH, SOUTH.

enum is the keyword to create an enum type and similar to class. Enum constants are implicitly static and final.

### 37) What is Java Annotations?

Java Annotations provide information about the code and they have no direct effect on the code they annotate. Annotations are introduced in Java 5. Annotation is metadata about the program embedded in the program itself. It can be parsed by the annotation parsing tool or by compiler. We can also specify annotation availability to either compile time only or till runtime also. Java Built-in annotations are @Override, @Deprecated and @SuppressWarnings.

### 38) What is Java Reflection API? Why it’s so important to have?

Java Reflection API provides ability to inspect and modify the runtime behavior of java application. We can inspect a java class, interface, enum and get their methods and field details. Reflection API is an advanced topic and we should avoid it in normal programming. Reflection API usage can break the design pattern such as Singleton pattern by invoking the private constructor i.e violating the rules of access modifiers.

Even though we don’t use Reflection API in normal programming, it’s very important to have. We can’t have any frameworks such as Spring, Hibernate or servers such as Tomcat, JBoss without Reflection API. They invoke the appropriate methods and instantiate classes through reflection API and use it a lot for other processing.

### 39) What is composition in java?

Composition is the design technique to implement has-a relationship in classes. We can use Object composition for code reuse.

Java composition is achieved by using instance variables that refers to other objects. Benefit of using composition is that we can control the visibility of other object to client classes and reuse only what we need.

### 40) What is the benefit of Composition over Inheritance?

One of the best practices of java programming is to “favor composition over inheritance”. Some of the possible reasons are:

* Any change in the superclass might affect subclass even though we might not be using the superclass methods. For example, if we have a method test() in subclass and suddenly somebody introduces a method test() in superclass, we will get compilation errors in subclass. Composition will never face this issue because we are using only what methods we need.
* Inheritance exposes all the super class methods and variables to client and if we have no control in designing superclass, it can lead to security holes. Composition allows us to provide restricted access to the methods and hence more secure.
* We can get runtime binding in composition where inheritance binds the classes at compile time. So composition provides flexibility in invocation of methods.

### 41) How to sort a collection of custom Objects in Java?

We need to implement Comparable interface to support sorting of custom objects in a collection. Comparable interface has compareTo(T obj) method which is used by sorting methods and by providing this method implementation, we can provide default way to sort custom objects collection.

However, if you want to sort based on different criteria, such as sorting an Employees collection based on salary or age, then we can create Comparator instances and pass it as sorting methodology.

### 42) What is inner class in java?

We can define a class inside a class and they are called nested classes. Any non-static nested class is known as inner class. Inner classes are associated with the object of the class and they can access all the variables and methods of the outer class. Since inner classes are associated with instance, we can’t have any static variables in them.

We can have local inner class or anonymous inner class inside a class

### 43) What is anonymous inner class?

A local inner class without name is known as anonymous inner class. An anonymous class is defined and instantiated in a single statement. Anonymous inner class always extend a class or implement an interface.

Since an anonymous class has no name, it is not possible to define a constructor for an anonymous class. Anonymous inner classes are accessible only at the point where it is defined.

### 44) What is Classloader in Java?

Java Classloader is the program that loads byte code program into memory when we want to access any class. We can create our own classloader by extending ClassLoader class and overriding loadClass(String name) method.

### 45) What are different types of classloaders?

There are three types of built-in Class Loaders in Java:

1. Bootstrap Class Loader – It loads JDK internal classes, typically loads rt.jar and other core classes.
2. Extensions Class Loader – It loads classes from the JDK extensions directory, usually $JAVA\_HOME/lib/ext directory.
3. System Class Loader – It loads classes from the current classpath that can be set while invoking a program using -cp or -classpath command line options.

### 46) What does super keyword do?

super keyword can be used to access super class method when you have overridden the method in the child class.

We can use super keyword to invoke super class constructor in child class constructor but in this case it should be the first statement in the constructor method.

public class SuperClass {

public SuperClass(){

}

public SuperClass(int i){}

public void test(){

System.out.println ("super class test method");

}

}

Use of super keyword can be seen in below child class implementation.

public class ChildClass extends SuperClass {

public ChildClass(String str){

//access super class constructor with super keyword

super();

//access child class method

test();

//use super to access super class method

super.test();

}

@Override

public void test(){

System.out.println ("child class test method");

}

}

### 47) What is break and continue statement?

We can use break statement to terminate for, while, or do-while loop. We can use break statement in switch statement to exit the switch case.

The continue statement skips the current iteration of a for, while or do-while loop. We can use continue statement with label to skip the current iteration of outermost loop.

### 48) What is this keyword?

this keyword provides reference to the current object and it’s mostly used to make sure that object variables are used, not the local variables having same name.

//constructor

public Point(int x, int y) {

this.x = x;

this.y = y;

}

We can also use this keyword to invoke other constructors from a constructor.

public Rectangle() {

this(0, 0, 0, 0);

}

public Rectangle(int width, int height) {

this(0, 0, width, height);

}

public Rectangle(int x, int y, int width, int height) {

this.x = x;

this.y = y;

this.width = width;

this.height = height;

}

### 49) What is default constructor?

No argument constructor of a class is known as default constructor. When we don’t define any constructor for the class, java compiler automatically creates the default no-args constructor for the class. If there are other constructors defined, then compiler won’t create default constructor for us.

### 50) Can we have try without catch block?

Yes, we can have try-finally statement and hence avoiding catch block.

### 51) What is Garbage Collection?

Garbage Collection is the process of looking at heap memory, identifying which objects are in use and which are not, and deleting the unused objects. In Java, process of deallocating memory is handled automatically by the garbage collector.

We can run the garbage collector with code Runtime.getRuntime().gc() or use utility method System.gc().

### 52) What is Serialization and Deserialization?

We can convert a Java object to an Stream that is called Serialization. Once an object is converted to Stream, it can be saved to file or send over the network or used in socket connections.

The object should implement Serializable interface and we can use java.io.ObjectOutputStream to write object to file or to any OutputStream object.

The process of converting stream data created through serialization to Object is called deserialization.

### 53) How to run a JAR file through command prompt?

We can run a jar file using java command but it requires Main-Class entry in jar manifest file. Main-Class is the entry point of the jar and used by java command to execute the class.

### 54) What will be the output of following programs?

1. **static method in class**

public class Test {

public static String toString(){

System.out.println ("Test toString called");

return "";

}

public static void main(String [] args){

System.out.println (toString());

}

}

**Answer**: The code won’t compile because we can’t have an Object class method with static keyword. Note that Object class has toString() method. You will get compile time error as “This static method cannot hide the instance method from Object”. The reason is that static method belongs to class and since every class base is Object, we can’t have same method in instance as well as in class. You won’t get this error if you change the method name from toString() to something else that is not present in super class Object.

**static method invocation**

public class Test {

public static String display(){

System.out.println ("Test display called");

return "";

}

public static void main(String [] args){

Test obj = null;

System.out.println (obj. display ());

}

}

**Answer**: Well this is a strange situation. We all have seen NullPointerException when we invoke a method on object that is NULL. But here this program will work and prints “Test foo called”.

The reason for this is the java compiler code optimization. When the java code is compiled to produced byte code, it figures out that foo() is a static method and should be called using class. So it changes the method call obj. display () to Test. display () and hence no NullPointerException.

### 55) What is marker interface?

An interface that have no data member and method is known as a marker interface.For example Serializable, Cloneable etc.

56) What is difference between abstract class and interface?

|  |  |
| --- | --- |
|  | **Interface** |
| 1)An abstract class can have method body (non-abstract methods). | Interface have only abstract methods. |
| 2)An abstract class can have instance variables. | An interface cannot have instance variables. |
| 3)An abstract class can have constructor. | Interface cannot have constructor. |
| 4)An abstract class can have static methods. | Interface cannot have static methods. |
| 5)You can extends one abstract class. | You can implement multiple interfaces. |

### 57) What is package?

A package is a group of similar type of classes interfaces and sub-packages. It provides access protection and removes naming collision.

58) Do I need to import java.lang package any time? Why ?

No. It is by default loaded internally by the JVM.

59) Can I import same package/class twice? Will the JVM load the package twice at runtime?

One can import the same package or same class multiple times. Neither compiler nor JVM complains about it.But the JVM will internally load the class only once no matter how many times you import the same class.

60) What is static import ?

By static import, we can access the static members of a class directly, there is no to qualify it with the class name.

### 61) What is Exception Handling?

Exception Handling is a mechanism to handle runtime errors.It is mainly used to handle checked exceptions.

62) What is difference between Checked Exception and Unchecked Exception?

### 1)Checked Exception

The classes that extend Throwable class except RuntimeException and Error are known as checked exceptions e.g.IOException,SQLException etc. Checked exceptions are checked at compile-time.

### 2)Unchecked Exception

The classes that extend RuntimeException are known as unchecked exceptions e.g. ArithmeticException,NullPointerException etc. Unchecked exceptions are not checked at compile-time.

63) What is the base class for Error and Exception?

Throwable.

64.How an object is serialized in java?

Ans: In java, to convert an object into byte stream by serialization, an interface with the name Serializable is implemented by the class. All objects of a class implementing serializable interface get serialized and their state is saved in byte stream.

65. When we should use serialization?

Ans: Serialization is used when data needs to be transmitted over the network. Using serialization, object’s state is saved and converted into byte stream .The byte stream is transferred over the network and the object is re-created at destination.

### 66) Is it necessary that each try block must be followed by a catch block?

It is not necessary that each try block must be followed by a catch block. It should be followed by either a catch block OR a finally block. And whatever exceptions are likely to be thrown should be declared in the throws clause of the method.

67) What is finally block?

* finally block is a block that is always executed.

### 68) Can finally block be used without catch?

* Yes, by try block. finally must be followed by either try or catch.

### 69) Is there any case when finally will not be executed?

finally block will not be executed if program exits(either by calling System.exit() or by causing a fatal error that causes the process to abort).

### 70) What is difference between throw and throws?

|  |  |
| --- | --- |
| **throw keyword** | **throws keyword** |
| 1)throw is used to explicitly throw an exception. | throws is used to declare an exception. |
| 2)checked exceptions can not be propagated with throw only. | checked exception can be propagated with throws. |
| 3)throw is followed by an instance. | throws is followed by class. |
| 4)throw is used within the method. | throws is used with the method signature. |
| 5)You cannot throw multiple exception | You can declare multiple exception e.g. public void method()throws IOException,SQLException. |

### 71) Can an exception be rethrown?

Yes.

### 72) Can subclass overriding method declare an exception if parent class method doesn't throw an exception ?

Yes but only unchecked exception not checked.

### 73) What is exception propagation ?

Forwarding the exception object to the invoking method is known as exception propagation.

### 74) What is the meaning of immutable in terms of String?

The simple meaning of immutable is unmodifiable or unchangeable. Once string object has been created, its value can't be changed.

### 75) Why string objects are immutable in java?

Because java uses the concept of string literal. Suppose there are 5 reference variables,all referes to one object "sachin".If one reference variable changes the value of the object, it will be affected to all the reference variables. That is why string objects are immutable in java.

### 76) How many ways we can create the string object?

There are two ways to create the string object, by string literal and by new keyword.

### 77) How many objects will be created in the following code?

1. String s1="Welcome";
2. String s2="Welcome";
3. String s3="Welcome";

Only one object.

### 78) Why java uses the concept of string literal?

To make Java more memory efficient (because no new objects are created if it exists already in string constant pool).

### 79)How many objects will be created in the following code?

1. String s = new String("Welcome");

Two objects, one in string constant pool and other in non-pool(heap)

### 80) What is the purpose of toString() method in java ?

The toString() method returns the string representation of any object. If you print any object, java compiler internally invokes the toString() method on the object. So overriding the toString() method, returns the desired output, it can be the state of an object etc. depends on your implementation.

### 81)What is nested class?

A class which is declared inside another class is known as nested class. There are 4 types of nested class member inner class, local inner class, annonymous inner class and static nested class.

### 82) Is there any difference between nested classes and inner classes?

Yes, inner classes are non-static nested classes i.e. inner classes are the part of nested classes.

### 83) Can we access the non-final local variable, inside the local inner class?

No, local variable must be constant if you want to access it in local inner class.

### 84) What is nested interface ?

Any interface i.e. declared inside the interface or class, is known as nested interface. It is static by default.

### 85) Can a class have an interface?

Yes, it is known as nested interface.

### 86) Can an Interface have a class?

Yes, they are static implicitely.

### 87) What is Garbage Collection?

Garbage collection is a process of reclaiming the runtime unused objects.It is performed for memory management.

### 88) What is gc()?

gc() is a daemon thread.gc() method is defined in System class that is used to send request to JVM to perform garbage collection.

### 89) What is the purpose of finalize() method?

finalize() method is invoked just before the object is garbage collected.It is used to perform cleanup processing.

### 90) Can an unrefrenced objects be refrenced again?

Yes.

### 91)What kind of thread is the Garbage collector thread?

Daemon thread.

### 92)What is difference between final, finally and finalize?

|  |
| --- |
| **final:** final is a keyword, final can be variable, method or class.You, can't change the value of final variable, can't override final method, can't inherit final class. |
| **finally:** finally block is used in exception handling. finally block is always executed. |
| **finalize():**finalize() method is used in garbage collection.finalize() method is invoked just before the object is garbage collected.The finalize() method can be used to perform any cleanup processing. |

### 93)What is the purpose of the Runtime class?

The purpose of the Runtime class is to provide access to the Java runtime system.

### 94)How will you invoke any external process in Java?

By Runtime.getRuntime().exec(?) method.

### 95)What is the difference between the Reader/Writer class hierarchy and the IputStream/OutputStream class hierarchy?

The Reader/Writer class hierarchy is character-oriented, and the InputStream/OutputStream class hierarchy is byte-oriented.

### 96)What an I/O filter?

An I/O filter is an object that reads from one stream and writes to another, usually altering the data in some way as it is passed from one stream to another.

### 97) What is serialization?

Serialization is a process of writing the state of an object into a byte stream.It is mainly used to travel object's state on the network.

### 98) What is Deserialization?

Deserialization is the process of reconstructing the object from the serialized state.It is the reverse operation of serialization.

### 99) What is transient keyword?

If you define any data member as transient,it will not be serialized.

### 100)What is Externalizable?

Externalizable interface is used to write the state of an object into a byte stream in compressed format.It is not a marker interface.

### 101)What is the difference between Serializalble and Externalizable interface?

Serializable is a marker interface but Externalizable is not a marker interface.When you use Serializable interface, your class is serialized automatically by default. But you can override writeObject() and readObject() two methods to control more complex object serailization process. When you use Externalizable interface, you have a complete control over your class's serialization process.

### 102)How do I convert a numeric IP address like 192.18.97.39 into a hostname like java.sun.com?

By InetAddress.getByName("192.18.97.39").getHostName() where 192.18.97.39 is the IP address.

### 103) What is reflection?

Reflection is the process of examining or modifying the runtime behaviour of a class at runtime.It is used in:

* IDE (Integreted Development Environment) e.g. Eclipse, MyEclipse, NetBeans.
* Debugger
* Test Tools etc.

### 104) Can you access the private method from outside the class?

Yes, by changing the runtime behaviour of a class if the class is not secured.

### 105)What are wrapper classes?

Wrapper classes are classes that allow primitive types to be accessed as objects.

### 106)What is a native method?

A native method is a method that is implemented in a language other than Java.

### 107)What is the purpose of the System class?

The purpose of the System class is to provide access to system resources.

### 108)What comes to mind when someone mentions a shallow copy in Java?

Object cloning.

### 109)What is singleton class?

Singleton class means that any given time only one instance of the class is present, in one JVM.

### 110)What is a lightweight component?

Lightweight components are the one which doesn?t go with the native call to obtain the graphical units. They share their parent component graphical units to render them. For example, Swing components.

### 111)What is a heavyweight component?

For every paint call, there will be a native call to get the graphical units.For Example, AWT.

### 161)What is Locale?

A Locale object represents a specific geographical, political, or cultural region.

### 162)How will you load a specific locale?

By ResourceBundle.getBundle(?) method.

**Java Versions, Features and History**

* **Released on 23 January 1996, JDK 1.0 version**
* **Released on 19 February 1997 JDK 1.1 version.**  
  **New features in JDK 1.1** 
  1. JDBC (Java Database Connectivity)
  2. [Inner Classes](http://www.instanceofjava.com/2014/12/inner-classes-in-java.html)
  3. Java Beans
  4. RMI (Remote Method Invocation)
  5. Reflection (introspection only)
* **Released on 8 December 1998 J2SE 1.2 version.**

**New features in J2SE 1.2**

* 1. [Collections framework.](http://www.instanceofjava.com/p/collections.html)
  2. Java String memory map for constants.
  3. Just In Time (JIT) compiler.
  4. Jar Signer for signing Java ARchive (JAR) files.
  5. Policy Tool for granting access to system resources.
  6. Java Foundation Classes (JFC) which consists of Swing 1.0, Drag and Drop, and Java 2D class libraries.
  7. Java Plug-in
  8. Scrollable result sets, BLOB, CLOB, batch update, user-defined types in JDBC.
  9. Audio support in Applets.
* **Released on 8 May 2000 J2SE 1.3 version.**  
  **New features in J2SE 1.3** 
  1. Java Sound
  2. Jar Indexing
  3. A huge list of enhancements in almost all the java area.
* **Released on 6 February 2002 J2SE 1.4 version.**  
  **New features in J2SE 1.4** 
  1. XML Processing
  2. Java Print Service
  3. Logging API
  4. Java Web Start
  5. JDBC 3.0 API
  6. Assertions
  7. Preferences API
  8. Chained Exception
  9. IPv6 Support
  10. Regular Expressions
  11. Image I/O API
* **Released on 30 September 2004 J2SE 1.5 version.**  
  **New features in J2SE 1.5** 
  1. Generics
  2. [Enhanced for Loop](http://www.instanceofjava.com/2014/12/enhanced-for-loop.html)
  3. [Autoboxing/Unboxing](http://www.instanceofjava.com/2014/12/boxing-and-unboxing-in-java.html)
  4. [Enum](http://www.instanceofjava.com/2016/04/enum-in-java-example.html)
  5. [Varargs](http://www.instanceofjava.com/2014/12/varargs-in-java.html)
  6. [Static Import](http://www.instanceofjava.com/2015/03/what-is-static-import-java-5-example.html)
  7. Metadata (Annotations)
  8. Instrumentation
* **Released on 11 December 2006 J2SE 1.6 version.**  
  **New features in J2SE 1.6** 
  1. Scripting Language Support
  2. JDBC 4.0 API
  3. Java Compiler API
  4. Pluggable Annotations
  5. Native PKI, Java GSS, Kerberos and LDAP support.
  6. Integrated Web Services.
  7. Lot more enhancements.
* **Released on 28 July 2011 J2SE 1.7 version.**  
  **New features in J2SE 1.7** 
  1. Strings in switch Statement
  2. Type Inference for Generic Instance Creation
  3. Multiple Exception Handling
  4. Support for Dynamic Languages
  5. Try with Resources
  6. Java nio Package
  7. Binary Literals, underscore in literals
  8. Diamond Syntax
  9. Automatic null Handling
* **Released on 18th march 2014 JDK 1.8 version.**  
  **New features in JDK 1.8**

1. [Default and Static methods in Interface](http://www.instanceofjava.com/2015/02/java-8-interface-static-default-methods.html)
2. Lambda Expressions
3. Optional
4. Streams
5. Method References
6. Data Time API
7. Nashorn Javascript Engine
8. Parallel Arrays

**Some of the important java 9 features are;**

1. [Java 9 REPL (JShell)](https://www.journaldev.com/13121/java-9-features-with-examples#repl)
2. [Factory Methods for Immutable List, Set, Map and Map.Entry](https://www.journaldev.com/13121/java-9-features-with-examples#factory-methods-immutable)
3. [Private methods in Interfaces](https://www.journaldev.com/13121/java-9-features-with-examples#private-methods)
4. [Java 9 Module System](https://www.journaldev.com/13121/java-9-features-with-examples#module-system)
5. [Process API Improvements](https://www.journaldev.com/13121/java-9-features-with-examples#process-api)
6. [Try With Resources Improvement](https://www.journaldev.com/13121/java-9-features-with-examples#try-with-resources)
7. [CompletableFuture API Improvements](https://www.journaldev.com/13121/java-9-features-with-examples#completablefuture)
8. [Reactive Streams](https://www.journaldev.com/13121/java-9-features-with-examples#reactive-streams)
9. [Diamond Operator for Anonymous Inner Class](https://www.journaldev.com/13121/java-9-features-with-examples#diamond-operator)
10. [Optional Class Improvements](https://www.journaldev.com/13121/java-9-features-with-examples#optional)
11. [Stream API Improvements](https://www.journaldev.com/13121/java-9-features-with-examples#stream-api)
12. [Enhanced @Deprecated annotation](https://www.journaldev.com/13121/java-9-features-with-examples#deprecated)
13. [HTTP 2 Client](https://www.journaldev.com/13121/java-9-features-with-examples#http2-client)
14. [Мulti-Resolution Image API](https://www.journaldev.com/13121/java-9-features-with-examples#image-api)
15. [Miscellaneous Java 9 Features](https://www.journaldev.com/13121/java-9-features-with-examples#java-9-core)

### 1.Java 9 REPL (JShell)

Oracle Corp has introduced a new tool called “jshell”. It stands for Java Shell and also known as REPL (Read Evaluate Print Loop). It is used to execute and test any Java Constructs like class, interface, enum, object, statements etc. very easily.

G:\>jshell

| Welcome to JShell -- Version 9-ea

| For an introduction type: /help intro

jshell> int a = 10

a ==> 10

jshell> System.out.println ("a value = " + a )

a value = 10

### 2.Factory Methods for Immutable List, Set, Map and Map.Entry

Oracle Corp has introduced some convenient factory methods to create Immutable List, Set, Map and Map.Entry objects. These utility methods are used to create empty or non-empty Collection objects.

In Java SE 8 and earlier versions, We can use Collections class utility methods like unmodifiableXXX to create Immutable Collection objects. For instance, if we want to create an Immutable List, then we can use Collections.unmodifiableList method.

However these Collections.unmodifiableXXX methods are very tedious and verbose approach. To overcome those shortcomings, Oracle corp has added couple of utility methods to List, Set and Map interfaces.

List and Set interfaces have “of()” methods to create an empty or no-empty Immutable List or Set objects as shown below:

**Empty List Example**

List immutableList = List.of();

**Non-Empty List Example**

List immutableList = List.of("one","two","three");

Map has two set of methods: of() methods and ofEntries() methods to create an Immutable Map object and an Immutable Map.Entry object respectively.

**Empty Map Example**

jshell> Map emptyImmutableMap = Map.of()

emptyImmutableMap ==> {}

**Non-Empty Map Example**

jshell> Map nonemptyImmutableMap = Map.of(1, "one", 2, "two", 3, "three")

nonemptyImmutableMap ==> {2=two, 3=three, 1=one}

### 3.Private methods in Interfaces

In Java 8, we can provide method implementation in Interfaces using Default and Static methods. However we cannot create private methods in Interfaces.

To avoid redundant code and more re-usability, Oracle Corp is going to introduce private methods in Java SE 9 Interfaces. From Java SE 9 on-wards, we can write private and private static methods too in an interface using ‘private’ keyword.

These private methods are like other class private methods only, there is no difference between them.

public interface Card{

private Long createCardID(){

// Method implementation goes here.

}

private static void displayCardDetails(){

// Method implementation goes here.

}

}

### 4.Java 9 Module System

One of the big changes or java 9 feature is the Module System. Oracle Corp is going to introduce the following features as part of **Jigsaw Project**.

* Modular JDK
* Modular Java Source Code
* Modular Run-time Images
* Encapsulate Java Internal APIs
* Java Platform Module System

Before Java SE 9 versions, we are using Monolithic Jars to develop Java-Based applications. This architecture has lot of limitations and drawbacks. To avoid all these shortcomings, Java SE 9 is coming with Module System.

JDK 9 is coming with 92 modules (may change in final release). We can use JDK Modules and also we can create our own modules as shown below:

**Simple Module Example**

Here We are using ‘module’ to create a simple module. Each module has a name, related code and other resources.

### 5.Process API Improvements

Java SE 9 is coming with some improvements in Process API. They have added couple new classes and methods to ease the controlling and managing of OS processes.

Two new interfcase in Process API:

* java.lang.ProcessHandle
* java.lang.ProcessHandle.Info

**Process API example**

ProcessHandle currentProcess = ProcessHandle.current();

System.out.println ("Current Process Id: = " + currentProcess.getPid());

### 6.Try With Resources Improvement

We know, Java SE 7 has introduced a new exception handling construct: Try-With-Resources to manage resources automatically. The main goal of this new statement is “Automatic Better Resource Management”.

Java SE 9 is going to provide some improvements to this statement to avoid some more verbosity and improve some Readability.

**Java SE 7 example**

void testARM\_Before\_Java9() throws IOException{

BufferedReader reader1 = new BufferedReader(new FileReader("journaldev.txt"));

try (BufferedReader reader2 = reader1) {

System.out.println (reader2.readLine());

}

}

**Java 9 example**

void testARM\_Java9() throws IOException{

BufferedReader reader1 = new BufferedReader(new FileReader("journaldev.txt"));

try (reader1) {

System.out.println (reader1.readLine());

}

}

### 7.CompletableFuture API Improvements

In Java SE 9, Oracle Corp is going to improve CompletableFuture API to solve some problems raised in Java SE 8. They are going add to support some delays and timeouts, some utility methods and better sub-classing.

Executor exe = CompletableFuture.delayedExecutor(50L, TimeUnit.SECONDS);

Here delayedExecutor() is static utility method used to return a new Executor that submits a task to the default executor after the given delay.

### 8.Reactive Streams

Now-a-days, Reactive Programming has become very popular in developing applications to get some beautiful benefits. Scala, Play, Akka etc. Frameworks has already integrated Reactive Streams and getting many benefits. Oracle Corps is also introducing new Reactive Streams API in Java SE 9.

Java SE 9 Reactive Streams API is a Publish/Subscribe Framework to implement Asynchronous, Scalable and Parallel applications very easily using Java language.

Java SE 9 has introduced the following API to develop Reactive Streams in Java-based applications.

* java.util.concurrent.Flow
* java.util.concurrent.Flow.Publisher
* java.util.concurrent.Flow.Subscriber
* java.util.concurrent.Flow.Processor

### 9.Diamond Operator for Anonymous Inner Class

We know, Java SE 7 has introduced one new feature: Diamond Operator to avoid redundant code and verbosity, to improve readability. However in Java SE 8, Oracle Corp (Java Library Developer) has found that some limitation in the use of Diamond operator with Anonymous Inner Class. They have fixed that issues and going to release as part of Java 9.

public List getEmployee(String empid){

// Code to get Employee details from Data Store

return new List(emp){ };

}

Here we are using just “List” without specifying the type parameter.

### 10.Optional Class Improvements

In Java SE 9, Oracle Corp has added some useful new methods to java.util.Optional class. Here I’m going to discuss about one of those methods with some simple example: stream method

If a value present in the given Optional object, this stream() method returns a sequential Stream with that value. Otherwise, it returns an Empty Stream.

They have added “stream()” method to work on Optional objects lazily as shown below:

Stream<Optional> emp = getEmployee(id)

Stream empStream = emp.flatMap(Optional::stream)

Here Optional.stream() method is used convert a Stream of Optional of Employee object into a Stream of Employee so that we can work on this result lazily in the result code.

### 11.Stream API Improvements

In Java SE 9, Oracle Corp has added four useful new methods to java.util.Stream interface. As Stream is an interface, all those new implemented methods are default methods. Two of them are very important: dropWhile and takeWhile methods

If you are familiar with Scala Language or any Functions programming language, you will definitely know about these methods. These are very useful methods in writing some functional style code. Let us discuss about takeWhile utility method here.

This takeWhile() takes a predicate as an argument and returns a Stream of subset of the given Stream values until that Predicate returns false for first time. If first value does NOT satisfy that Predicate, it just returns an empty Stream.

jshell> Stream.of(1,2,3,4,5,6,7,8,9,10).takeWhile(i -> i < 5 )

.forEach(System.out::println);

1

2

3

4

### 12.Enhanced @Deprecated annotation

In Java SE 8 and earlier versions, @Deprecated annotation is just a Marker interface without any methods. It is used to mark a Java API that is a class, field, method, interface, constructor, enum etc.

In Java SE 9, Oracle Corp has enhanced @Deprecated annotation to provide more information about deprecated API and also provide a **Tool** to analyse an application’s static usage of deprecated APIs. They have add two methods to this Deprecated interface: **forRemoval** and **since** to serve this information.

### 13.HTTP 2 Client

In Java SE 9, Oracle Corp is going to release New HTTP 2 Client API to support HTTP/2 protocol and WebSocket features. As existing or Legacy HTTP Client API has numerous issues (like supports HTTP/1.1 protocol and does not support HTTP/2 protocol and WebSocket, works only in Blocking mode and lot of performance issues.), they are replacing this HttpURLConnection API with new HTTP client.

They are going to introduce new HTTP 2 Client API under “java.net.http” package. It supports both HTTP/1.1 and HTTP/2 protocols. It supports both Synchronous (Blocking Mode) and Asynchronous Modes. It supports Asynchronous Mode using WebSocket API.

**HTTP 2 Client Example**

jshell> import java.net.http.\*

jshell> import static java.net.http.HttpRequest.\*

jshell> import static java.net.http.HttpResponse.\*

jshell> URI uri = new URI("http://rams4java.blogspot.co.uk/2016/05/java-news.html")

uri ==> http://rams4java.blogspot.co.uk/2016/05/java-news.html

jshell> HttpResponse response = HttpRequest.create(uri).body(noBody()).GET().response()

response ==> java.net.http.HttpResponseImpl@79efed2d

jshell> System.out.println ("Response was " + response.body(asString()))

### 14.Мulti-Resolution Image API

In Java SE 9, Oracle Corp is going to introduce a new Мulti-Resolution Image API. Important interface in this API is MultiResolutionImage . It is available in java.awt.image package.

MultiResolutionImage encapsulates a set of images with different Height and Widths (that is different resolutions) and allows us to query them with our requirements.

### 15.Miscellaneous Java 9 Features

In this section, I will just list out some miscellaneous Java SE 9 New Features. I’m NOT saying these are less important features. They are also important and useful to understand them very well with some useful examples.

As of now, I did not get enough information about these features. That’s why I am going list them here for brief understanding. I will pickup these Features one by one and add to above section with a brief discussion and example. And final write a separate tutorial later.

* GC (Garbage Collector) Improvements
* Stack-Walking API
* Filter Incoming Serialization Data
* Deprecate the Applet API
* Indify String Concatenation
* Enhanced Method Handles
* Java Platform Logging API and Service
* Compact Strings
* Parser API for Nashorn
* Javadoc Search
* HTML5 Javadoc

# Java Inner Class

Java inner class is defined inside the body of another class. Java inner class can be declared private, public, protected, or with default access whereas an outer class can have only public or default access.

**static nested class**

If the nested class is static, then it’s called static nested class. Static nested classes can access only static members of the outer class. Static nested class is same as any other top-level class and is nested for only packaging convenience.

Static class object can be created with following statement.

OuterClass.StaticNestedClass nestedObject =

new OuterClass.StaticNestedClass();

Any non-static nested class is known as inner class in java. Java inner class is associated with the object of the class and they can access all the variables and methods of the outer class.

Since inner classes are associated with instance, we can’t have any static variables in them.

Object of java inner class are part of the outer class object and to create an instance of inner class, we first need to create instance of outer class.

Java inner class can be instantiated like this;

OuterClass outerObject = new OuterClass();

OuterClass.InnerClass innerObject = outerObject.new InnerClass();

There are two special kinds of java inner classes.

1. local inner class.

If a class is defined in a method body, it’s known as local inner class.

Since local inner class is not associated with Object, we can’t use private, public or protected access modifiers with it. The only allowed modifiers are abstract or final.

A local inner class can access all the members of the enclosing class and local final variables in the scope it’s defined.

Local inner class can be defined as:

public void print() {

//local inner class inside the method

class Logger {

String name;

}

//instantiate local inner class in the method to use

Logger logger = new Logger();

2. anonymous inner class

A local inner class without name is known as anonymous inner class. An anonymous class is defined and instantiated in a single statement.

Anonymous inner class always extend a class or implement an interface. Since an anonymous class has no name, it is not possible to define a constructor for an anonymous class.

Anonymous inner classes are accessible only at the point where it is defined.  
It’s a bit hard to define how to create anonymous inner class, we will see it’s real time usage in test program below.

Here is a java class showing how to define java inner class, static nested class, local inner class and anonymous inner class.

import java.io.File;

import java.io.FilenameFilter;

public class OuterClass {

private static String name = "OuterClass";

private int i;

protected int j;

int k;

public int l;

//OuterClass constructor

public OuterClass(int i, int j, int k, int l) {

this.i = i;

this.j = j;

this.k = k;

this.l = l;

}

public int getI() {

return this.i;

}

//static nested class, can access OuterClass static variables/methods

static class StaticNestedClass {

private int a;

protected int b;

int c;

public int d;

public int getA() {

return this.a;

}

public String getName() {

return name;

}

}

//inner class, non static and can access all the variables/methods of outer class

class InnerClass {

private int w;

protected int x;

int y;

public int z;

public int getW() {

return this.w;

}

public void setValues() {

this.w = i;

this.x = j;

this.y = k;

this.z = l;

}

@Override

public String toString() {

return "w=" + w + ":x=" + x + ":y=" + y + ":z=" + z;

}

public String getName() {

return name;

}

}

//local inner class

public void print(String initial) {

//local inner class inside the method

class Logger {

String name;

public Logger(String name) {

this.name = name;

}

public void log(String str) {

System.out.println(this.name + ": " + str);

}

}

Logger logger = new Logger(initial);

logger.log(name);

logger.log("" + this.i);

logger.log("" + this.j);

logger.log("" + this.k);

logger.log("" + this.l);

}

//anonymous inner class

public String[] getFilesInDir(String dir, final String ext) {

File file = new File(dir);

//anonymous inner class implementing FilenameFilter interface

String[] filesList = file.list(new FilenameFilter() {

@Override

public boolean accept(File dir, String name) {

return name.endsWith(ext);

}

});

return filesList;

}

}

Here is the test program showing how to instantiate and use inner class in java.

import java.util.Arrays;

//nested classes can be used in import for easy instantiation

import com.journaldev.nested.OuterClass.InnerClass;

import com.journaldev.nested.OuterClass.StaticNestedClass;

public class InnerClassTest {

public static void main(String[] args) {

OuterClass outer = new OuterClass(1,2,3,4);

//static nested classes example

StaticNestedClass staticNestedClass = new StaticNestedClass();

StaticNestedClass staticNestedClass1 = new StaticNestedClass();

System.out.println(staticNestedClass.getName());

staticNestedClass.d=10;

System.out.println(staticNestedClass.d);

System.out.println(staticNestedClass1.d);

//inner class example

InnerClass innerClass = outer.new InnerClass();

System.out.println(innerClass.getName());

System.out.println(innerClass);

innerClass.setValues();

System.out.println(innerClass);

//calling method using local inner class

outer.print("Outer");

//calling method using anonymous inner class

System.out.println(Arrays.toString(outer.getFilesInDir("src/com/journaldev/nested", ".java")));

System.out.println(Arrays.toString(outer.getFilesInDir("bin/com/journaldev/nested", ".class")));

}

}

Here is the output of above java inner class example program.

OuterClass

10

0

OuterClass

w=0:x=0:y=0:z=0

w=1:x=2:y=3:z=4

Outer: OuterClass

Outer: 1

Outer: 2

Outer: 3

Outer: 4

[NestedClassTest.java, OuterClass.java]

[NestedClassTest.class, OuterClass$1.class, OuterClass$1Logger.class, OuterClass$InnerClass.class, OuterClass$StaticNestedClass.class, OuterClass.class]

Notice that when OuterClass is compiled, separate class files are created for inner class, local inner class and static nested class.

**Benefits of Java Inner Class**

1. If a class is useful to only one class, it makes sense to keep it nested and together. It helps in packaging of the classes.
2. Java inner classes implements encapsulation. Note that inner classes can access outer class private members and at the same time we can hide inner class from outer world.
3. Keeping the small class within top-level classes places the code closer to where it is used and makes code more readable and maintainable.

## Java varargs

varargs in java enables a method to accept variable number of arguments. We use three dots (…) also known as ellipsis in the method signature to make it accept variable arguments. For example;

public static int sum(int i, int...js ){

//do something

}

## Important points about varargs in java

Few points to know about varargs in java are;

1. We can have only one varargs in the method.
2. Only the last argument of a method can be varargs.
3. According to java documentation, we should not overload a varargs method. We will see why it’s not a good idea.

## How java varargs work?

When we invoke a method with variable arguments, java compiler matches the arguments from left to right. Once it reaches to the last varargs parameter, it creates an [array](https://www.journaldev.com/763/java-array-add-elements) of the remaining arguments and pass it to the method. In fact varargs parameter behaves like an array of the specified type.

//method with variable arguments

public static int sum(int i, int...js ){

int sum = i;

for(int x : js){

sum+=x;

}

return sum;

}

//method with same implementation as sum with array as argument

public static int sumArray(int i, int[] js ){

int sum = i;

for(int x : js){

sum+=x;

}

return sum;

}

If you will look at both sum and sumArray methods, you will see that the implementation body is exactly same. So we should use varargs when API offers them, for example java.io.PrintStream.printf() method but we should not take it as a replacement for array.

public class VarargsExample {

public static void main(String[] args) {

System.out.println(sum(1));

System.out.println(sum(1,2)); //compiler error, ambiguous method

}

public static int sum(int i, int...js ){

System.out.println("sum1 called");

int sum = i;

for(int x : js){

sum+=x;

}

return sum;

}

public static int sum(int i, int k, Object...js ){

System.out.println("sum2 called");

int sum = i+k;

for(Object x : js){

sum+=1;

}

return sum;

}

}

In above example, you will notice that compiler will not complain when we overload methods with varargs. But when we try to use it, compiler get’s confused which method to use when mapping the second argument.

If there is only one argument, compiler is smart to use first method because it can work with minimum one argument but second method needs at least two arguments. Below image from Eclipse shows the error message as The method sum(int, int[]) is ambiguous for the type VarargsExample.

**Interview Questions**

1. **A result of expression involving byte, int, and literal numbers is promoted to which of these?**

* [A.](javascript:%20void(0)) int
* [B.](javascript:%20void(0)) long
* [C.](javascript:%20void(0)) byte
* [D.](javascript:%20void(0)) float

Answer: Option A

Explanation:

An expression involving bytes, ints, shorts, literal numbers, the result of the expression is promoted to next data type after calculation is done.

**2. What is the numerical range of a char in Java?**

* [A.](javascript:%20void(0)) -128 to 127
* [B.](javascript:%20void(0)) 0 to 256
* [C.](javascript:%20void(0)) 0 to 32767
* [D.](javascript:%20void(0)) 0 to 65535

Answer: Option D

Explanation:

In java Char is a Unicode char, which occupies 16-bit in memory, it supports ranging from 0 to 65535.

**3.Which of these values can a boolean variable contain?**

* [A.](javascript:%20void(0)) True & False
* [B.](javascript:%20void(0)) 0 & 1
* [C.](javascript:%20void(0)) Any integer value.
* [D.](javascript:%20void(0)) Both a & b

Answer: Option A

Explanation:

Boolean variable can contain only one of two possible values, true and false.

**4. Which one is a valid declaration of a boolean?**

* [A.](javascript:%20void(0)) boolean b1 = 1;
* [B.](javascript:%20void(0)) boolean b2 = ‘false’;
* [C.](javascript:%20void(0)) boolean b3 = false;
* [D.](javascript:%20void(0)) boolean b4 = ‘true’

Answer: Option C

Explanation:

Boolean can only be assigned true or false literals.

**5) What is the output of this program?**

class Test {

public static void main(String args[])

{

boolean var1 = true;

boolean var2 = false;

if (var1)

System.out.println(var1);

else

System.out.println(var2);

}

}

* [A.](javascript:%20void(0)) 0
* [B.](javascript:%20void(0)) 1
* [C.](javascript:%20void(0)) true
* [D.](javascript:%20void(0)) false

Answer: Option C

Explanation:

true

**6) Modulus operator, %, can be applied to which of these?**

* [A.](javascript:%20void(0)) Integers
* [B.](javascript:%20void(0)) Floating – point numbers
* [C.](javascript:%20void(0)) Both Integers and floating – point numbers.
* [D.](javascript:%20void(0)) None of the mentioned

Answer: Option C

Explanation:

Modulus operator can be applied to both integers and floating point numbers.

**7) With x = 0, which of the following are valid Java code for changing the value of x to 1?**

 1. x++;

 2. x = x + 1;

 3. x += 1;

 4. x =+ 1;

* [A.](javascript:%20void(0)) 1, 2 & 3
* [B.](javascript:%20void(0)) 1 & 4
* [C.](javascript:%20void(0)) 1, 2, 3 & 4
* [D.](javascript:%20void(0)) 3 & 2

Answer: Option A

Explanation:

Operator ++ increases value of variable by 1. x = x + 1 can also be written in shorthand form as x += 1. Also x =+ 1 will set the value of x to 1.

**8) What is the output of this program?**

class Test {

public static void main(String args[])

{

int a = 3;

System.out.print(++a \* 8);

}

}

* [A.](javascript:%20void(0)) 25
* [B.](javascript:%20void(0)) 24
* [C.](javascript:%20void(0)) 32
* [D.](javascript:%20void(0)) 33

Answer: Option C

Explanation:

Operator ++ is a pre-increment, thus a becomes 4 and when multiplied by 8 gives 32.

**9) What is the output of this program?**

class Test {

public static void main(String args[])

{

int x , y;

x = 10;

x++;

--x;

y = x++;

System.out.println(x + " " + y);

}

}

* [A.](javascript:%20void(0))

11 11

* [B.](javascript:%20void(0))

10 10

* [C.](javascript:%20void(0))

11 10

* [D.](javascript:%20void(0))

10 11

Answer: Option C

Explanation:

x is initialized to 10 then increased by 1 by ++ operator making it 11. x is again decreased by — operator making it 10, next x is incremented by post increment and intialized to y, here the value of x obtained before increment operator is executed, so value of y is 10 and value of x is 11.

**11) Which operator is used to invert all the digits in binary representation of a number?**

* [A.](javascript:%20void(0)) ~
* [B.](javascript:%20void(0)) >>>
* [C.](javascript:%20void(0)) ^
* D. !

Answer: Option A

Explanation:

Unary not operator, ~, inverts all of the bits of its operand in binary representation.

**12) What is the return value of relational operators?**

* [A.](javascript:%20void(0)) Integer
* [B.](javascript:%20void(0)) Boolean
* [C.](javascript:%20void(0)) Characters
* [D.](javascript:%20void(0)) Double

Answer: Option B

Explanation:

Boolean

**13)Which of the following operators can operate on a boolean variable?**

 1. &&

 2. ==

 3. ?:

 4. +=

* A. 3 & 2
* [B.](javascript:%20void(0)) 1 & 4
* [C.](javascript:%20void(0)) 1, 2 & 4
* [D.](javascript:%20void(0)) 1, 2 & 3

**Answer: Option D**

Explanation:

Operator &&, is equal to( ==) , ternary if-then-else, ?:, are boolean logical operators. += is an arithmetic operator it can operate only on numeric values.

14) What is the output of the following.

**public** **class** Test {

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

**int** i;

**for**( i=0;i++<=10;);

System.***out***.println(i);

}

}

A.10

B.11

C.12

D.13

**Answer: Option C**

15) Which of these is an incorrect array declaration?

[A.](javascript:%20void(0)) int arr[] = new int[5] ;

[B.](javascript:%20void(0)) int [] arr = new int[5] ;

[C.](javascript:%20void(0)) int arr[];

arr = new int[5];

[D.](javascript:%20void(0)) int arr[5] = new int[5]

Answer: Option D

Explanation:

Size of array is not valid at compile time.

**16) What is the out put of the following**

**public** **class** Test {

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

**int** [] arr = **new** **int**[5];

System.***out***.println(arr);

}

}

1. 0 0 0 0 0
2. 5 ( length of array )
3. 5 garbage values
4. Address of array

Answer : Option D

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **17. Which of the following are Java reserved words?  1) run 2) import 3) default 4) implements**   1. 2 and 3 2. 2 and 4 3. 2 , 3 and 4 4. 1 and 2   Answer : Option B   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **18) Which class or interface defines the wait(), notify(),and notifyAll() methods?**  A) Object  B) Runnable  C)Class  D) Thread  Answer : Option A  **19) Which of the following statements is preferred to create a string "Welcome to Java Programming"?**  **Options** A) String str = “Welcome to Java Programming”; B) String str = new String( “Welcome to Java Programming” ); C) String str;  str = “Welcome to Java Programming”; D) String str;  str = new String (“Welcome to Java Programming” );  Answer : A  Explanation: value of string is known. Compile time is the best.  **20) What is the difference between this() and super()**   1. super() constructor is invoked within a method of a class while this() constructor is used within the constructor of the sub class 2. this() constructor is invoked outside a method of a class while super() constructor is used within the constructor of the sub class 3. this() constructor is invoked within a method of a class while super() constructor is used within the constructor of the sub class 4. this() constructor is invoked within a method of a class while super() constructor is used outside the constructor of the sub class   Answer : Option C  **21) Which of the following is TRUE for serialization in JAVA?**     1. Process of converting classes’ instance into stream of bytes 2. Doesn’t help in persisting data 3. Both a and d 4. An operation in which an object’s internal state is converted into a stream of bytes   Answer : Option C  **22) The object of DataInputStream is used to**   1. To covert binary stream into character stream 2. To covert character stream into binary stream 3. To write data onto output object 4. All of the above  |  | | --- | | Answer : Option A | | **23) Which of the following is synchronized?**   1. Set 2. LinkedList 3. Vector 4. ArrayList  |  | | --- | |  | | Answer : Option C  **24) Which of the following statements is false ?**  **A)** An instance of a class is an object | | B) Objects can access both static and instance data  C) Object is the super class of all other classes  D) Objects do not permit encapsulation  Answer : Option D  25) **What is an aggregate object?**  **A)** An object with only primitive attributes  B) An instance of a class which has only static methods  C) An instance which has other objects  D) None of the above  Answer : Option C  **26) All the wrapper classes (Integer, Boolean, Float, Short, Long, Double and Character) in java**   1. are private 2. are serializable 3. are immutable 4. are final   Answer : Option B, C and D  **27) Select all the true statements from the following.**  **A)** AbstractSet extends AbstractCollection  B) AbstractList extends AbstractCollection  C) Vector extends AbstractList  D) All of the above  Answer : Option : D  **28) To execute the threads one after another**  A) the keyword synchronize is used B) the keyword synchronizable is used C) the keyword synchronized is used D) None of the above  CORRECT ANSWER : Option C  **29) When a thread terminates its processing, into what state that thread enters?**  A) Running state B)Waiting state C)Dead state C) Beginning state  ANSWER : Option C  30) **If result = 2 + 3 \* 5, what is the value and type of ‘result’ variable?**  A) 17, byte B) 25, byte C) 17, int D) 25, int  ANSWER : Option C  **31)Which of the following statements is true?**  A) The default char data type is a space( ‘ ‘ ) character. B) The default integer data type is ‘int’ and real data type is ‘float’ C) The default integer data type is ‘long’ and real data type is ‘float’ D) The default integer data type is ‘int’ and real data type is ‘double’  ANSWER : Option D  32)**What is the value of salaries [3]?**  **public** **class** Test {  **public** **static** **void** main(String[] args) {  **int** salaries[];  **int** index = 0;  salaries = **new** **int**[4];  **while** (index < 4) {  salaries[index] = salaries[index] + 10000;  index++;  }  System.***out***.println(salaries[3]);  }  }   1. 10000 2. 20000 3. 30000 4. 40000   Answer : Option A  33) **Which of the following is not a method of the Thread class.**  **A)** public void run()  B) public void start()  C) public void exit()  D) public final int getPriority()  **34) What is the output of the following**  **public** **class** Test {  **public** **static** **void** main(String[] args) {  **int** i=1;  **while**(i++<=12);  System.***out***.println(i);  }  }   1. 12 2. 13 3. 14 4. Infinite loop   Answer : Option C  **35) After the following code fragment, what is the value in fname?  String str; int fname; str = "Foolish boy."; fname = str.indexOf("fool");**   1. 0 2. 1 3. -1 4. 2   Answer : Option C  36) Consider the following code snippet. What will be assigned to the variable fourthChar, if the code is executed?  String str = new String(“Java”); char fourthChar = str.charAt(4);  **Options** A) ‘a’ B) ‘v’ C) throws StringIndexOutofBoundsException D) null characater  ANSWER : Option C  **37) Which statement is true?**  A) HashTable is a sub class of Dictionary B) ArrayList is a sub class of Vector C) LinkedList is a subclass of ArrayList D) Vector is a subclass of Stack  ANSWER : Option A  **38)What kind of thread is the Garbage collector thread is?**  A) Non daemon thread B) Daemon thread C)Thread with dead state D) None of the above  ANSWER : Option B  39) Which of the following is used to obtain length of String object?  [A.](javascript:%20void(0))length  [B.](javascript:%20void(0)) size()  [C.](javascript:%20void(0)) capacity()  [D.](javascript:%20void(0)) length()  Answer : Option D  40) What is the return type of split() in the string class  A) String  B) int  C) String []  D) boolean  Answer : Option C  **41) What is the final vale of s1**  String s1 = "one";  s1.concat("two");    System.***out***.println(s1);   1. onetwo 2. one 3. twoone 4. two   Answer : Option B  **41) What is the final vale of s1**  String s1 = "hyderabad";  String s2 = s1.replace("bad1","abc");    System.***out***.println(s2);   1. hyderaabc 2. hyderaabc1 3. hyderabad1 4. hyderabad   Answer : Option D  **42) In the following what are the final values of s1 and s2**  StringBuffer s1=**new** StringBuffer("one");  StringBuffer s2 = s1.append("two");       1. s1 value is “one” and s2 value is “two” 2. both contains same 3. s1 value is “one” and s2 value is “two” 4. s1 value is “one” and s2 value is “onetwo   Answer : Option B  **43) Which of the following are incorrect form of StringBuffer class constructor?**  [A.](javascript:%20void(0)) StringBuffer()  [B.](javascript:%20void(0)) StringBuffer(int size)  [C.](javascript:%20void(0)) StringBuffer(String str)  [D.](javascript:%20void(0)) StringBuffer(int size , String str)  Answer: Option D  **44) . Which of these process occur automatically by java run time system?**  A. Serialization  [B.](javascript:%20void(0)) Garbage collection  [C.](javascript:%20void(0)) File Filtering  [D.](javascript:%20void(0)) All of the mentioned  Answer: Option A  Explanation:  Serialization and deserialization occur automatically by java run time system, Garbage collection also occur automatically but is done by CPU or the operating system not by the java run time system.  **45) Which of these is a method of ObjectOutput interface used to finalize the output state so that any buffers are cleared?**  [A.](javascript:%20void(0)) clear()  [B.](javascript:%20void(0)) flush()  [C.](javascript:%20void(0)) fflush()  [D.](javascript:%20void(0)) close()  Answer: Option B  Explanation:  flush()  **46) Which of these is method of ObjectOutput interface used to write the object to input or output stream as required?**  [A.](javascript:%20void(0)) write()  [B.](javascript:%20void(0)) Write()  [C.](javascript:%20void(0)) StreamWrite()  [D.](javascript:%20void(0)) writeObject()  Answer: Option D  Explanation:  writeObject() is used to write an object into invoking stream, it can be input stream or output stream.  47) Which of these is a process of extracting/removing the state of an object from a stream?  [A.](javascript:%20void(0)) Serialization  [B.](javascript:%20void(0)) Externalization  [C.](javascript:%20void(0)) File Filtering  [D.](javascript:%20void(0)) Deserialization  Answer: Option D  Explanation:  Deserialization is a process by which the data written in the stream can be extracted out from the stream.  48) Which of these is a method of ObjectInput interface used to deserialize an object from a stream?  [A.](javascript:%20void(0)) int read()  [B.](javascript:%20void(0)) void close()  [C.](javascript:%20void(0)) Object readObject()  [D.](javascript:%20void(0)) Object WriteObject()  Answer: Option C  Explanation:  Object readObject()  49) When does Exceptions in Java arises in code sequence?  [A.](javascript:%20void(0)) Run Time  [B.](javascript:%20void(0)) Compilation Time  [C.](javascript:%20void(0)) Can Occur Any Time  [D.](javascript:%20void(0)) None of the mentioned  Answer: Option A  Explanation:  Exceptions in java are run-time errors.  50) Which of these keywords is not a part of exception handling?  [A.](javascript:%20void(0)) try  [B.](javascript:%20void(0)) final  [C.](javascript:%20void(0)) throws  [D.](javascript:%20void(0)) catch  Answer: Option B | |  | | |  | |  | |  |  |  | | --- | |  | |  | |  | |  | | |  | |  | |  | |  | |
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