

# SHREE H. N. SHUKLA COLLEGE OF I.T. & MGMT.

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## Lt. Shree Chimanbhai Shukla

### B.C.A./B.Sc.IT-SEMESTER-4

#### SUB :- JAVA

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## CHAPTER-1:

### Q-1 Explain history and features of Java

Ans:

❖ Java is a programming language that:

1. Is exclusively object oriented
2. Has full GUI support
3. Has full network support
4. Is platform independent
5. Executes stand-alone or “on-demand” in web browser as applets

Features:

1) Simple:

- Java inherits the C/C++ syntax and many of the object oriented features of C++,
- Java supports OOP and does not support pointer which makes it simpler.

2) Security:

- Java is best known for its security. With Java, we can develop virus-free systems. Java is secured because:
  - **No explicit pointer**
  - **Java Programs run inside a virtual machine sandbox**

3) Portable:

- Java is portable because it facilitates you to carry the Java bytecode to any platform. It doesn't require any implementation. It can be implemented in any OS.

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## 4) Object-Oriented:

- Object-oriented programming (OOPs) is a methodology that simplifies software development and maintenance by providing some rules.
- Basic concepts of OOPs are:
  - 1) [Object](#)
  - 2) Class
  - 3) [Inheritance](#)
  - 4) [Polymorphism](#)
  - 5) [Abstraction](#)
  - 6) [Encapsulation](#)

## 5) Robust (Healthy, Strong):

- It uses strong memory management.
- There is a lack of pointers that avoids security problems.
- Java provides automatic garbage collection which runs on the Java Virtual Machine to get rid of objects which are not being used by a Java application anymore.
- There are exception handling and the type checking mechanism in Java. All these points make Java robust.

## 6) Multi-threaded:

- A thread is like a separate program, executing concurrently. We can write Java programs that deal with many tasks at once by defining

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multiple threads. The main advantage of multi-threading is that it doesn't occupy memory for each thread. It shares a common memory area.

## 7) Architecture-neutral:

- Java is architecture neutral because there are no implementation dependent features, for example, the size of primitive types is fixed.
- In C programming, int data type occupies 2 bytes of memory for 32-bit architecture and 4 bytes of memory for 64-bit architecture. However, it occupies 4 bytes of memory for both 32 and 64-bit architectures in Java.

## 8) Interpreted:

- Usually a computer language is either compiled or interpreted. Java combines these approaches thus making java a two-stage system.
- Java compiler translates source code into byte code instructions. Byte codes are not machine instructions and so java interpreter generates machine code that can be directly executed by the machine that is running the java program.

## 9) High Performance:

- Java is faster than other traditional interpreted programming languages because Java bytecode is "close" to native code.
- Java does not support pointer which increases the performance.

## 10) Distributed:

- Java is distributed because it facilitates users to create distributed applications in Java. RMI and EJB are used for creating distributed applications.

## 11) Dynamic:

- Java is a dynamic language. It supports the dynamic loading of classes. It means classes are loaded on demand.

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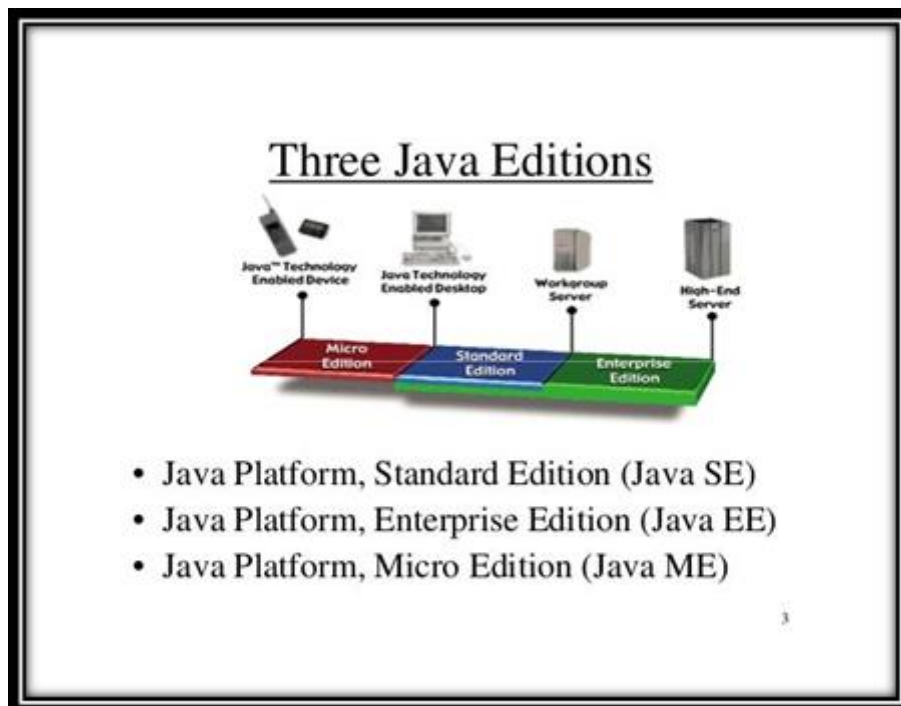
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MCQ		
Sr No.	Question	Answer
1	Which type of architecture java supports?	Neutral
2	Robust means.....	Strong/healthy
3	Java is .....programming language	OOP
4	Class and object are the concepts of .....	OOP

## Q-2 Explain editions of Java

Ans:



1) Java Platform, Micro Edition (J2ME):

- **Java ME**, is designed for mobile phones (especially feature phones) and set-top boxes. Java ME was formerly known as **Java 2 Platform, Micro Edition (J2ME)**.

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- Java ME was designed by Sun Microsystems, acquired by Oracle Corporation in 2010; the platform replaced a similar technology, PersonalJava.

## 2) Java Platform, Enterprise Edition (J2EE):

- ❖ J2EE stands for **Java 2 Platform, Enterprise Edition**. J2EE is the standard platform for developing applications in the enterprise and is designed for enterprise applications that run on servers.

## 3) Java Platform, Standard Edition (J2SE):

- ❖ It has concepts for developing software for Desktop based (standalone) CUI (command user interface) and GUI (graphical user interface) applications, applets.

MCQ		
Sr No.	Question	Answer
1	J2ME stands for .....	Java 2 platform Micro Edition
2	J2EE stands for .....	Java 2 platform Enterprise Edition
3	J2SE stands for .....	Java 2 Platform Standard Edition

## Q-3 Write a short note on JVM, JRE and JDK

Ans:

**JVM:**

- ❖ JVM stands for **Java Virtual Machine**.
- ❖ All language compilers translate source code into machine code for a specific computer. Java compiler also does the same thing.

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- ❖ Java compiler produces an intermediate code known as byte code for a machine that does not exist.
- ❖ **This machine is called the Java Virtual Machine** and it exists only inside the computer memory.



- ❖ The virtual machine code (Byte Code) is not machine specific.
- ❖ The machine specific code is generated by the Java Interpreter by acting as an intermediary between the virtual machine and the real machine as shown in fig. Interpreter is different for different machine.

## JRE:



- ❖ The Java Runtime Environment (JRE), also known as Java Runtime, is part of the Java Development Kit (JDK), a set of programming tools for developing Java applications. The Java Runtime Environment provides the minimum requirements for executing a Java application; it consists of the Java Virtual Machine (JVM), core classes, and supporting files.

## JDK:

- ❖ JDK stands for **Java Development Kit**.
- ❖ It is a collection of tools which are used for developing and running the java program.

## Components:-

- 1) **Applet viewer** :- it used to view the java applets without using the browser.

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- 2) **Javac** :- the java compiler translate source code to byte code.
- 3) **Java** :- java interpreter runs the applets and application by reading the byte code.
- 4) **Javadoc**: - it creates html format documentation from java source code.
- 5) **Javah** :- it produce header file.
- 6) **Javap** :- it enables to convert byte code into program description.
- 7) **Jdb** :- it is java debugger used for find errors from the programs.

MCQ		
Sr No.	Question	Answer
1	JVM stands for .....	Java Virtual Machine
2	JRE stands for .....	Java Runtime Environment
3	JDK stands for .....	Java Development Kit
4	What is javac?	Compiler of java
5	Which component of jdk produce header file?	javah
6	Which component of jdk is used to execute or run the application?	java
7	Which component of jdk is used to find the errors from the program	jdb

**Q-4 Write a short note on compiling and executing basic java program.**

**Ans:**

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

**Steps:**

**Step 1: Save the program with .java extension (Note: Name of the program must be same as the name of the class)**



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**Step 2: Open the command prompt and compile your program**

`javac hello.java` (where `hello.java` is the name of your file)

**Step 3: Execute/run the program**

`java hello`

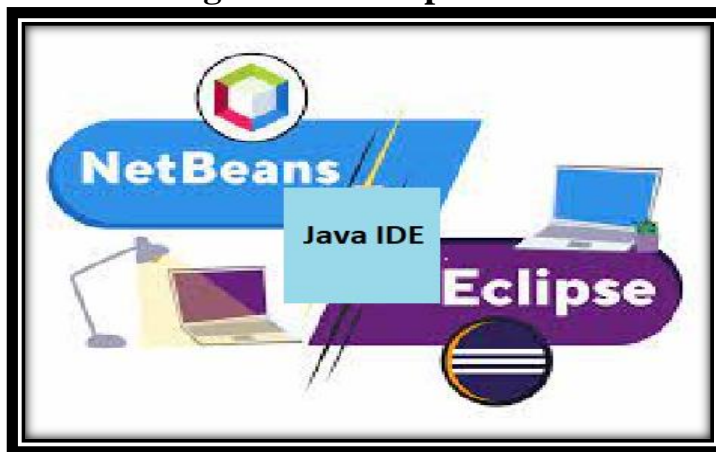
**Output: hello**

MCQ		
Sr No.	Question	Answer
1	The program of java should have the same name as .....	Program name
2	Java program should be saved with .....extension	.java

## Q-5 Write a short note on java IDE

**Ans:**

**IDE stands for Integrated Development Environment**



**Netbeans:**

- ❖ **NetBeans** is an integrated development environment (IDE) for developing primarily with Java, but also with other languages, in particular PHP, C/C++, and HTML5 .It is also an application platform framework for Java desktop applications and others.
- ❖ The NetBeans IDE is written in Java and can run on Windows, OS X, Linux, Solaris and other platforms supporting a compatible JVM.
- ❖ The NetBeans Platform allows applications to be developed from a set of modular software components called *modules*. Applications based on the

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NetBeans Platform (including the NetBeans IDE itself) can be extended by third party developers.

- ❖ **NetBeans IDE** is an open-source integrated development environment. NetBeans IDE supports development of all Java application types (Java SE (including JavaFX), Java ME, web, EJB and mobile applications).

## Eclipse:

- **Eclipse** is an integrated development environment (IDE). It started in 2001, when IBM released Eclipse into open source.
- It contains a base workspace and an extensible plug-in system for customizing the environment.
- **Eclipse** can be used to develop applications in Java. By means of various plug-ins, **Eclipse** may also be used to develop applications in other programming languages: Ada, C, C++, COBOL, Fortran,

MCQ		
Sr No.	Question	Answer
1	IDE stands for	Integrated Development Environment
2	Which editors or platform are provided by java?	NetBeans and Eclipse

## Q-6 Write a short note on data types in java

Ans:

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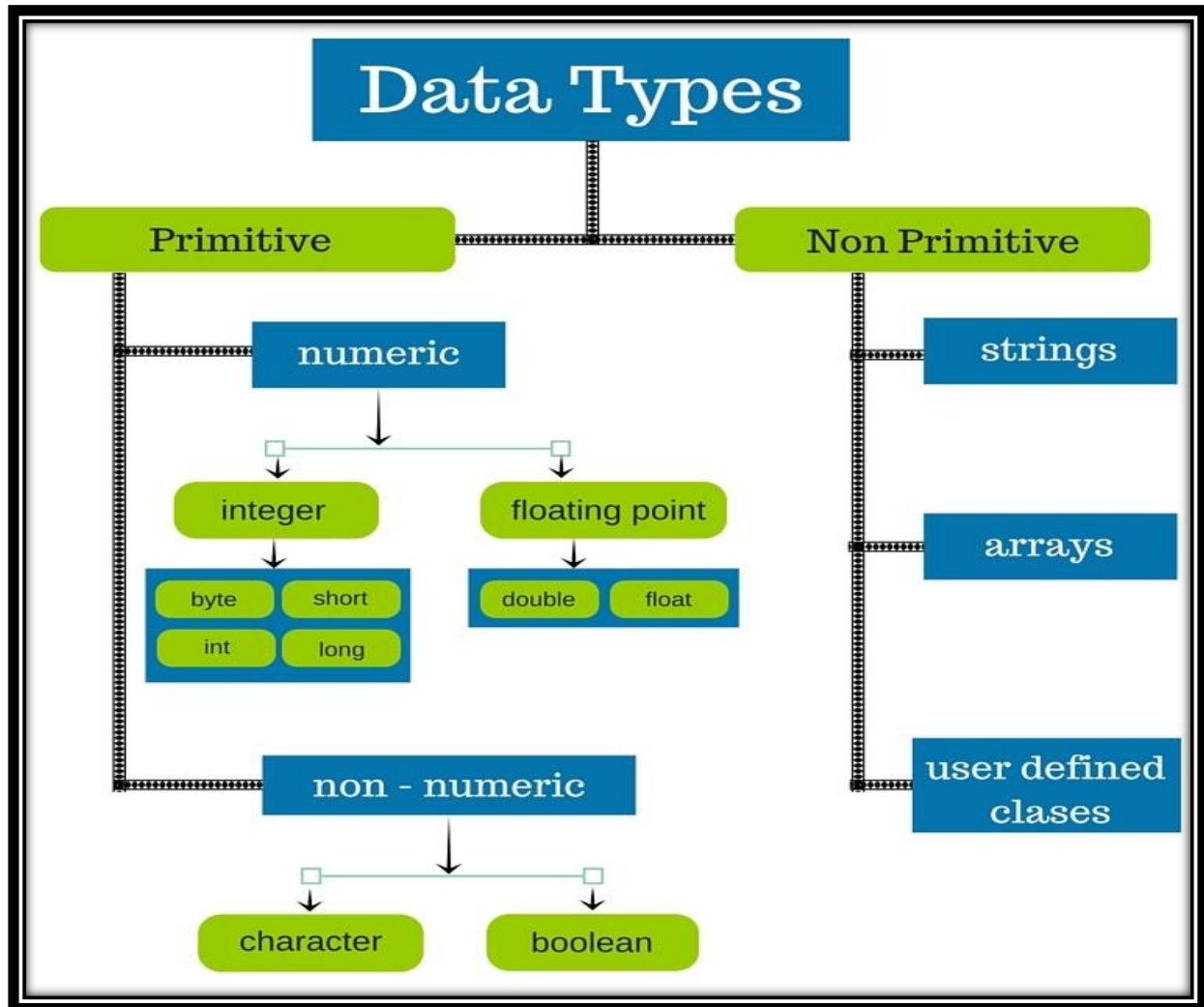
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❖ Data type means the type of data.



## Integer

- ❖ Java provides four integer types: byte, short, int, long.
- ❖ All of these are signed, positive and negative values.

Type	Size/bits	Range
Byte	8	-128 to 127
Short	16	-32,768 to 32,767
Int	32	-2,147,483,648 to 2,147,483,647

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Long	64	-9,223,372,036,854,775,808 9,223,372,036,854,775,807
------	----	---

## Floating-Point Types

- ❖ Floating-Point numbers, also known as real numbers, are used when evaluating expressions that require fractional precision.
- ❖ For example, calculations such as square root, or transcendental such as sine and cosine, result in a value whose precision requires a floating-point type.
- ❖ **There are two kinds of floating-point types, float and double, which represent single and double-precision numbers, respectively.**

Type	Size/bytes	Range
Float	32	1.4e – 045 to 3.4e + 038
Double	64	4.9e - 324 to 1.8e + 308

## Character

- ❖ The data type used to store characters is **char**.

Type	Size/bytes	Range
Char	16	0 to 65,536

## Boolean:

- ❖ Java has primitive type, called boolean, for logical values.
- ❖ It can have only one of two possible values, true or false.

Type	Size/bytes	Range
Boolean	1	True/False , Yes/No , 0/1

MCQ		
Sr No.	Question	Answer
1	short requires .....bits	16 bits(2 byte)

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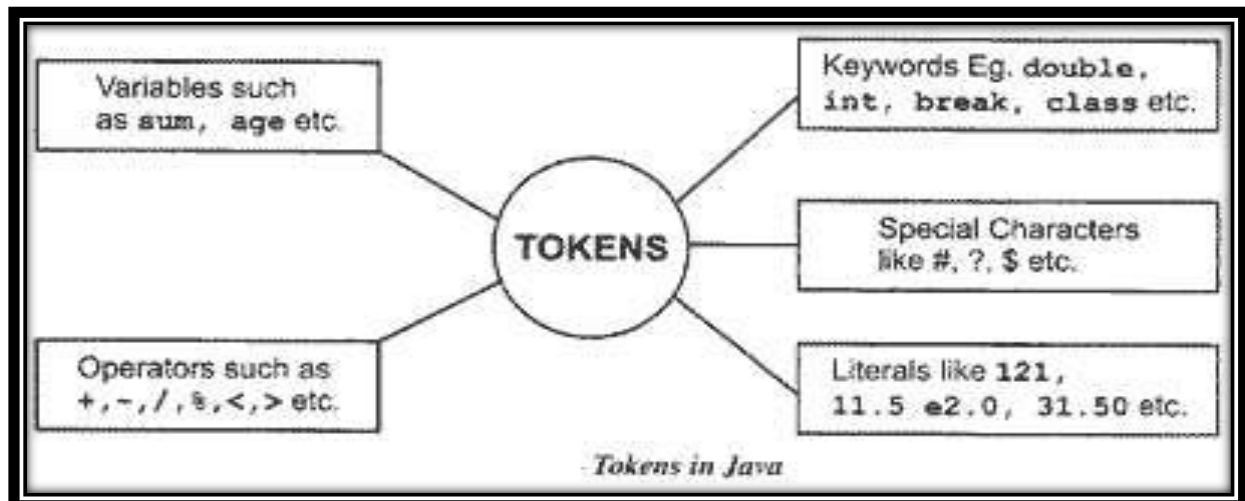
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2	int requires .....bits	32 bits (4 bytes)
3	Boolean data type can only the value either .....or .....	true, false
4	char requires .....	16 bits (2 bytes)

## Q-7 Write a short note on java tokens

Ans:

- ❖ **Token is the smallest individual unit of a program.**
- ❖ Tokens are the various Java program elements which are identified by the compiler
- ❖ Tokens supported in Java include keywords, variables, constants, special characters, operations etc.



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MCQ		
Sr No.	Question	Answer
1	The smallest individual unit of program is known as ....	Token
2	.....are the reserved words	keyword
3	Literals means the .....	value
4	How many tokens are available in java?	Variables, Operators, Keywords, Special Characters, Literals

## Q-8 Write a short note on Operators in java

**Ans:**

- ❖ An operator is a symbol that tells the computer to perform certain mathematical or logical manipulations.
- ❖ Following are the types of operators in java:
  - 1) Arithmetic
  - 2) Relational
  - 3) Logical
  - 4) Assignment
  - 5) Conditional
  - 6) Instance Of
  - 7) Sizeof
  - 8) Bitwise
  - 9) Increment/Decrement

### 1) Arithmetic Operators:

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Operators	Result
+	Addition of two numbers
-	Subtraction of two numbers
*	Multiplication of two numbers
/	Division of two numbers
%	(Modulus Operator)Divides two numbers and returns the remainder

## Example:

```
import java.util.*;
class arithmetic
{
public static void main(String args[])
{
int a,b;
Scanner sc=new Scanner(System.in);
System.out.println("Enter a");
a=sc.nextInt();
System.out.println("Enter b");
b=sc.nextInt();
System.out.println("Addition=" +(a+b));
System.out.println("Sub is" +(a-b));
System.out.println("Mul is" +(a*b));
System.out.println("Div is" +(a/b));
System.out.println("Modulas is" +(a%b));
}
}
```

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## 2) Relational Operators:

Operators	Operations
==	Equal to
!=	Not Equal to
>	Greater than
>=	Greater than equal to
<	Less than
<=	Less than equal to

### Example:

```
import java.util.*;
class arithmetic
{
public static void main(String args[])
{
int a,b;
Scanner sc=new Scanner(System.in);
System.out.println("Enter a");
a=sc.nextInt();
System.out.println("Enter b");
b=sc.nextInt();
System.out.println("> than" +(a>b));
System.out.println("< than" +(a<b));
System.out.println(">= is" +(a>=b));
System.out.println("<=" +(a<=b));
System.out.println("== is" +(a==b));
System.out.println("!= is" +(a!=b));
}
}
```



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Logical Operator	Java Operator
AND	&&
OR	
NOT	!

## Example:

```
import java.util.*;
class arithmetic
{
public static void main(String args[])
{
int a,b,c;
Scanner sc=new Scanner(System.in);
System.out.println("Enter a");
a=sc.nextInt();
System.out.println("Enter b");
b=sc.nextInt();
System.out.println("Enter c");
c=sc.nextInt();
if(a>b && a>c)
    System.out.println("a is max");
else if(b>c && b>a)
    System.out.println("b is max");
else
    System.out.println("c is max");
}
}
```

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$a=4, b=5$

$a=b$

In the above case, the value of b is assigned to a

Case 3: (Copy the expression to the variable)

$a=5, b=4$

$c=a+b$

In the above case, the value of a+b is assigned to c.

Note: Assignment operator is also known as shorthand operator because it represent shorthand ways to represent the variable.

Example:

$a=a+5$

$a+=5$

$a=a-4$

$a-=4$

$a=a*2$

$a*=2$

5) Conditional Operators:

- ❖ Conditional operator is indicated by ?
- ❖ It is also known as ternary operator because it requires 3 parts:

Syntax:

Condition? True part: false part

Example:

$(a>b) ? \text{“a is max”} : \text{“b is max”}$

6) Instance of Operator:

- ❖ It is used to test whether the object is an instance of the specified type
- ❖ It is also known as **type comparison operator** because it compares instance with the class type.

Syntax:

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`objectname=classname`

**Example:**

```
test t1=new test();
```

The above example checks whether the t1 is object of the class test or not

**7) size of Operator:**

❖ It is used to find the size of the variable or the type.

**Syntax:**

```
sizeof(variable name);
```

**Example:**

```
int a;  
sizeof(a)=4 bytes
```

**8) Bitwise Operator:**

❖ Bitwise operator operates on the bits(0 and 1)

❖ Following are the types of bitwise operators.

- Bitwise AND (&)
- Bitwise OR(|)
- Bitwise ExclusiveOR(^)

a	b	a&b	a b	a^b
0	0	0	0	0
0	1	0	1	1
1	0	0	1	1
1	1	1	1	0

**9) Increment/Decrement Operator:**

❖ This operator is used to increment or decrement the value by 1.

❖ There are 2 types of increment and decrement:

- pre-increment (++a)
- Post-increment(a++)
- pre-decrement(--a)

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- post-decrement(a--)

Pre-increment	Post-Increment
1) In this, value is increment first and then it is assigned to the variable	1) In this, value is first assigned to the variable and then it is incremented.
2) ++a	2) a++

## Example:

```
class inc
{
public static void main(String args[])
{
    int i=0,j=0;
    System.out.println(i++); //post increment
    System.out.println(++j); // pre-increment
}
```

Pre-decrement	Post-decrement
2) In this, value is decremented first and then it is assigned to the variable	3) In this, value is first assigned to the variable and then it is decremented.
4) --a	2) a--

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## Example:

```
class dec
{
public static void main(String args[])
{
    int i=0,j=0;
    System.out.println(i- -); //post increment
    System.out.println(- -j); // pre-increment
}
```

MCQ		
Sr No.	Question	Answer
1	Assignment Operator is also known as .....	Shorthand Operator
2	Conditional Operator is also known as ....	Ternary Operator
3	Which operator is used to test whether the object is an instance of the specified type?	instance of
4	Relational operator is also known as .....operator	Comparison

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## Q-9 Write a short note on Decision Control structures

Ans:

❖ Following are the types of decision control structures:

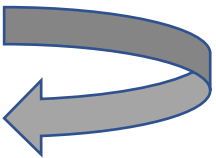
- ◆ if
- ◆ if-else
- ◆ Nested if
- ◆ else-if ladder
- ◆ switch case

1) if:

**Description:** This decision control structure only deals with the true part of the condition and it works only with one condition.

### Syntax:

```
if(condition)
{
    statements;
}
```



### Example:

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```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    if(a==b)
        System.out.println("Equal");
}
}
```

## 2) if-else:

**Description:** This decision control structure deals with the true and false part of the condition and it works only with one condition.

If the condition is true then statements inside if are executed and if the condition is false then statements inside false are executed.

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## Syntax:

```
if(condition)
{
    statement1;
}
else
{
    statement 2;
}
```

True part

False part

## Example:

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    if(a==b)
        System.out.println("Equal");
    else
        System.out.println("Not Equal");
}
}
```

## Description:

- ❖ Nested if means one if inside another if. It is used when you have more than 1 condition.



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- ❖ In Nested if, there are two if-else, one is inner if-else and other is outer if-else

## Syntax:

```
Outerif-else {
  if(condition1)
  {
    if(condition2)
    {
      Statement1;
    }
    else
    {
      Statement2;
    }
  }
  else
  {
    Statement 3;
  }
}
```

Inner if-else

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## Example:

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b,c;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    System.out.println("Enter c");
    c=sc.nextInt();

    if(a>b)
    {
        if(a>c)
            System.out.println("a is max");
        else
            System.out.println("c is max");
    }
    else
    {
        if(b>c)
            System.out.println("b is max");
        else
            System.out.println("c is max");
    }
}
}
```

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- ❖ If-elseif-elseif-elseif....else is known as else-if ladder.
- ❖ It is used when you have more than 2 conditions.
- ❖ In else-if ladder, when all the conditions are false then else part is executed

## Syntax:

```
if(condition1)
{
    statement1;
}
elseif(condition2)
{
    statement2;
}
elseif(condition3)
{
    statement3;
}
....
....
else
{
    statement4;
}
```

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## Example:

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b,c;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    System.out.println("Enter c");
    c=sc.nextInt();

    if(a>b && a>c)
        System.out.println("a is max");
    else if(b>c && b>a)
        System.out.println("b is max");
    else
        System.out.println("c is max");

}
}
```

## Description:

- ❖ switch case is used with multiple options.
- ❖ In switch case, the value of the variable is passed which is compared with the different cases, the case which matches the value is executed.
- ❖ switch case have 4 keywords: switch, case, default, break
- ❖ break keyword is used to exit from the particular case

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❖ When no case is executed, at that time default case is executed

## **Syntax:**

switch(variable)

{

    case 1: statement1;

        break;

    case 2: statement2;

        break;

    case 3: statement3;

        break;

    case4: statement4;

        break;

    default: statement5;

        break;

}

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## Example:

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b,ch;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    System.out.println("Enter 1.add 2.sub 3.mul 4.div");
    ch=sc.nextInt();
    switch(ch)
    {
        case 1: System.out.println(a+b);
                break;

        case 2: System.out.println(a-b);
                break;

        case 3: System.out.println(a*b);
                break;

        case 4: System.out.println(a/b);
                break;

        default: System.out.println("Invalid");
                break;
    }
}
}
```

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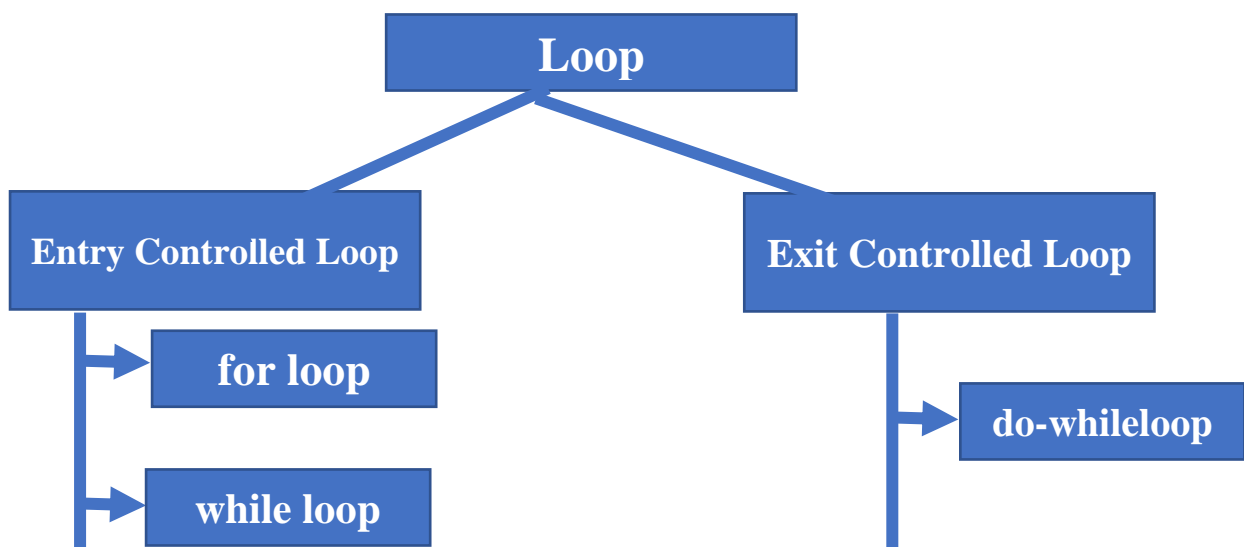
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MCQ		
Sr No.	Question	Answer
1	Which decision control structure is used when we have multiple options?	Switch case
2	In switch case, there are .....keywords	4
3	break in switch case is used to .....	Exit from the particular case
4	if inside another if is known as .....	Nested if
5	Which decision control structure only deals with true part	If

**Q-10 what is loop? List out types of looping structures and explain in detail**

**Ans:**

- ❖ When same task is to be performed multiple times, then in that case loop is used.
- ❖ Following are the types of loop



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## 1) Entry Controlled Loop:

- ❖ When the condition is checked in the starting of the loop, it is known as entry controlled loop.
- ❖ for loop and while loop are known as entry controlled loop.

**\* for loop:**

### Syntax:

for(initialization ;condition ;increment/decrement)

```
{  
    Statements;  
}
```

### Example:

```
class loop  
{  
public static void main(String args[])  
{  
    int i;  
    for(i=1;i<=5;i++)  
    {  
        System.out.println(i);  
    }  
}
```



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**\* while loop:**

## **Syntax:**

**Initialization;**  
**while(condition)**

```
{  
    Statements;  
    Increment/decrement;  
}
```

## **Example:**

```
class loop  
{  
public static void main(String args[])  
{  
    int i=1;  
    while(i<=5)  
    {  
        System.out.println(i);  
        i++;  
    }  
}
```

- ❖ When the condition is checked in the end of the loop, it is known as exit controlled loop.
- ❖ do-while loop is example of exit controlled loop
- ❖ In do-while loop, statements are executed atleast once without checking the condition.

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## Syntax:

Initialization;

do

{

    Statements;

    Increment/decrement;

} while (condition);

## Example:

```
class loop
{
public static void main(String args[])
{
    int i=1;
    do
    {
        System.out.println(i);
        i++;
    }while(i<=5);
}
```

## \*\*\* Difference between while and do-while loop

while loop	do-while loop
It is known as entry controlled loop	It is known as exit controlled loop
If the condition is true then only statements are executed	The statements are executed atleast once and after that the condition is checked.
While loop does not have semicolon	do-while loop have terminating semicolon

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MCQ		
Sr No.	Question	Answer
1	Which 3 things all the loops have?	initialization, condition, increment/decrement
2	for loop is known as .....	Entry controlled loop
3	do-while loop is known as .....	Exit controlled loop
4	Which loop have terminating semi-colon at the end?	do-while
5	In which loop, without checking the condition the statements are executed at least once?	do-while

## Q-11 Write a short note on jumping statements in java

Ans:

- ❖ Jumping statements transfers the control from one location to another location.
- ❖ Following are the types of jumping statements:
  - break
  - continue

### 1) break statement:

- ❖ This statement is used to exit immediately from the loop or program
- ❖ When the break statement is encountered in the program, the control directly moves to the end of the program.

### Syntax:

```
for( ; ; )  
{  
    if(condition)  
        break;  
}
```

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## Example:

```
class jm
{
public static void main(String args[])
{
    int i;
    for(i=1;i<=5;i++)
    {
        if(i==3)
        break;
        System.out.println(i);
    }
}
```

- ❖ This statement is used to continue back to the re-evaluation of the condition.
- ❖ Using continue statement, certain statements are bypassed.

## Syntax:

```
for( ; ; )
{
    if(condition)
    continue;
}
```

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## Example:

```
class jm
{
public static void main(String args[])
{
    int i;
    for(i=1;i<=5;i++)
    {
        if(i==3)
            continue;
        System.out.println(i);
    }
}
```

## \*\*\* Difference between break and continue statement

break	continue
it is used to exit immediately from the loop	It transfers the cursor back to the re-evaluation of the condition
Using break, certain statements cannot be bypassed	Using continue statement, certain statements can be bypassed/

MCQ		
Sr No.	Question	Answer
1	Which are the jumping statements in java?	break,continue
2	In which type of jumping statement, certain statements are bypassed	continue
3	Which jumping statement is used to immediately exit from the loop or program?	break

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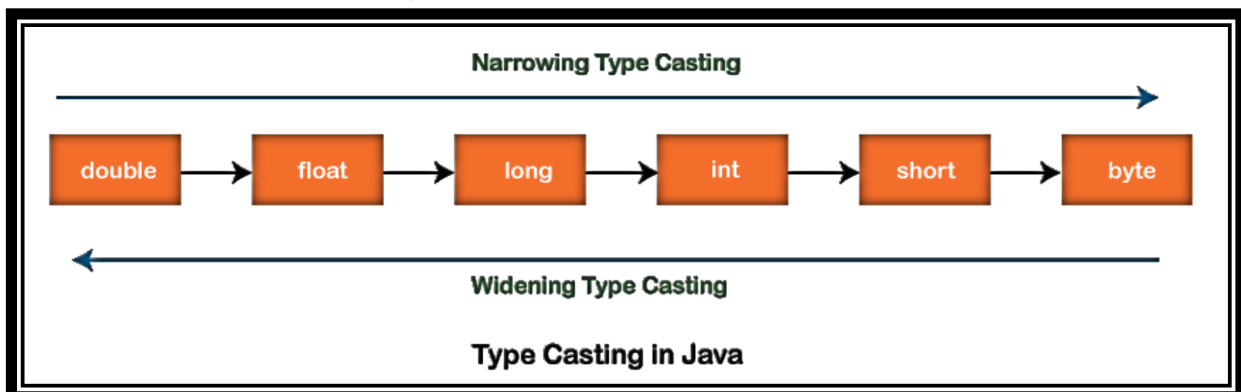
## Q-12 Write a short note on typecasting

Ans:

- ❖ Typecasting means converting one data type into another datatype.
- ❖ There are 2 types of type casting in java.

### 1) Widening data type

- ❖ Converting a lower data type into a higher one is called **widening** type casting. It is also known as **implicit conversion** or **casting down**. It is done automatically.



### Example:

```
class type
{
    public static void main(String args[])
    {
        int x=10;
        float y;
        y=x;
        System.out.println(y);
    }
}
```

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- ❖ Converting a higher data type into a lower one is called **narrowing** type casting. It is also known as **explicit conversion** or **casting up**. It is done manually by the programmer.

## Example:

```
class exp1
{
    public static void main(String args[])
    {
        int x;
        double f=2.5;
        x=(int)f;
        System.out.println(x);
    }
}
```

MCQ		
Sr No.	Question	Answer
1	Converting one data type into another data type is known as .....	Type casting
2	In which type of typecasting, smaller data type is automatically type casted to larger data type?	Widening
3	Narrowing data type is known as .....	Explicit type casting

## Q-13 Write a short note on Arrays

Ans:

- ❖ Array is the collection of elements that have same data type. All the elements of array share same array name

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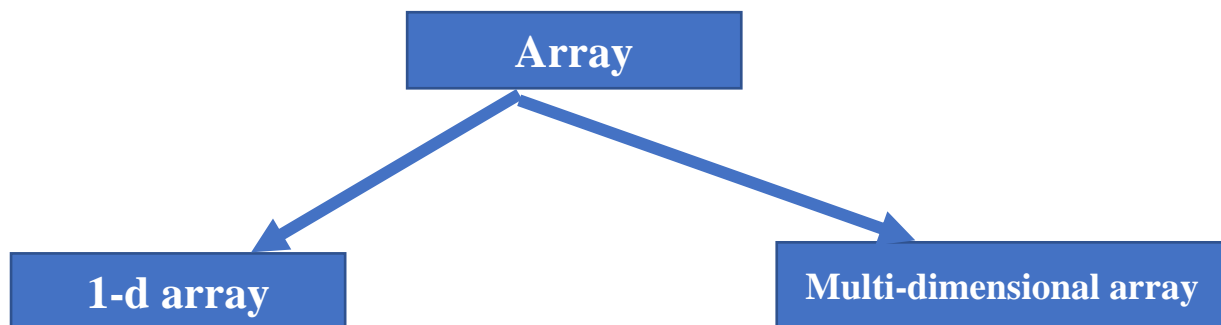
❖ The main concept of array is index

## Advantages:

- **Code Optimization:** It makes the code optimized, we can retrieve or sort the data efficiently.
- **Random access:** We can get any data located at an index position.

## Disadvantages:

**Size Limit:** We can store only the fixed size of elements in the array. It doesn't grow its size at runtime.



### 1) 1-d array (One Dimensional Array):

❖ The array having only one dimension is known as 1-d array.

#### Syntax:

#### Declaration of array:

datatype[] arrayname      OR  
datatype arrayname[]      OR

#### Initialization of array:

datatype arrayname[]=new datatype[size];

#### Example 1:



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```
class exp1
{
    public static void main(String args[])
    {
        int i;
        int a[]=new int[5];
        a[0]=10;
        a[1]=11;
        a[2]=12;
        a[3]=13;
        a[4]=14;
        for(i=0;i<a.length;i++)
            System.out.println(a[i]);
    }
}
```

## Example 2:

```
class exp1
{
    public static void main(String args[])
    {
        int i;
        int a[]={10,11,12,13,14};

        for(i=0;i<a.length;i++)
            System.out.println(a[i]);
    }
}
```

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```
import java.util.*;
class arr
{
    public static void main(String args[])
    {
        int i;
        int a[]=new int[5];
        Scanner sc=new Scanner(System.in);
        for(i=0;i<5;i++)
        {
            System.out.println("Enter array elements");
            a[i]=sc.nextInt();
        }
        for(i=0;i<5;i++)
        {
            System.out.println("Array ele" +a[i]);
        }
    }
}
```

## 2) Multi-Dimensional array:

- ❖ In this array, the data is stored in row and column based index (also known as matrix form)

### Syntax:

#### Declaration of array:

datatype[][] arrayname      OR  
datatype arrayname[][]      O

#### Initialization of array:

datatype arrayname[][]=new datatype[rowsize][columnsize];

#### Example 1:

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```
class array
{
    public static void main(String args[])
    {
        int i,j;
        int a[][]={{1,2},{3,4}};
        for(i=0;i<2;i++)
        {
            for(j=0;j<2;j++)
            {
                System.out.print(a[i][j] + " ");
            }
            System.out.println();
        }
    }
}
```

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```
import java.util.*;
class arr
{
    public static void main(String args[])
    {
        int i,j;
        int a[][]=new int[2][3];
        Scanner sc=new Scanner(System.in);
        for(i=0;i<2;i++)
        {
            for(j=0;j<3;j++)
            {
                System.out.println("Enter array elements");
                a[i][j]=sc.nextInt();
            }
        }
        for(i=0;i<2;i++)
        {
            for(j=0;j<3;j++)
            {
                System.out.println("Array ele" +a[i][j]);
            }
        }
    }
}
```

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MCQ		
Sr No.	Question	Answer
1	The collection of elements having same data type and same array name is known as .....	Array
2	Which type of array have both row and column size?	Multi-dimensional array
3	In which type of array, data is stored in matrix form?	Multi-dimensional array

## Q-14 Write a short note on Command Line arguments

Ans:

- ❖ The java command-line argument is an argument i.e. passed at the time of running the java program.
- ❖ The arguments passed from the console can be received in the java program and it can be used as an input.

### Example 1:

```
class cmd1
{
    public static void main(String args[])
    {
        System.out.println(args[0]);
    }
}
```

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```
class cmd1
{
    public static void main(String args[])
    {
        int i;
        for(i=0;i<args.length;i++)
        {
            System.out.println(args[i]);
        }
    }
}
```

MCQ		
Sr No.	Question	Answer
1	The arguments passed at runtime of program is known as.....	Command line arguments
2	Passing of arguments in command line arguments starts with .....	args[0]

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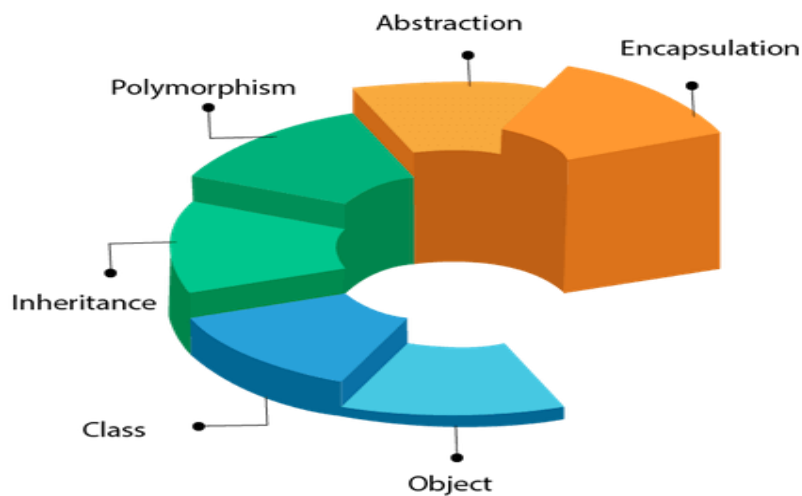


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## Unit 1 –Class Fundas (Part 2)

### OOPs (Object-Oriented Programming System)



### Q-1 Explain class and object

Ans:

- ❖ A class is a **template from which objects are created**. That is objects are instance of a class
- ❖ **When you create a class, you are creating a new data-type**. You can use this type to declare objects of that type.
- ❖ An entity that has state and behavior is known as an object e.g., chair, bike, marker, pen, table, car, etc.
- ❖ **An object is an instance of a class.**
- ❖ Class **defines structure and behavior (data & code)** that will be shared by a set of objects
- ❖ Each object contains its own copy of each variable defined by the class

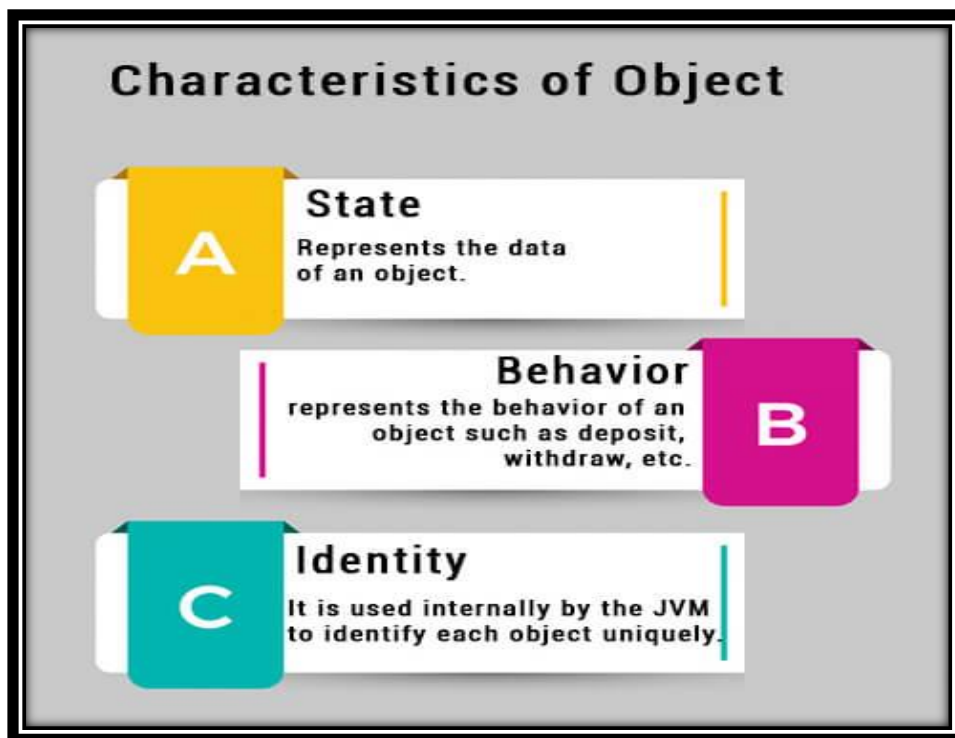
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## Syntax:

```
class ClassName  
{
```

```
    type instance variable1;  
    type instance variable2;
```

Instance

```
    type methodname1 (parameter list)
```

```
    {
```

```
        body of method;
```

```
    }
```

```
    type methodname2 (parameter list)
```

Method of class



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```
{  
    body of method;  
}  
  
}
```

## Example:

```
class student  
{  
    int roll;  
    String name;  
}  
class sample  
{  
    public static void main(String args[])  
    {  
        student s=new student();  
        s.roll=1;  
        s.name="xyz";  
        System.out.println(s.roll);  
        System.out.println(s.name);  
    }  
}
```

MCQ		
Sr No.	Question	Answer
1	Which are the features or characteristics of object?	state,behavior,identity
2	A ..... is a template from which objects are created	class

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.....and .....are the  
main concept of OOP

class, object

## Q-2 Explain Encapsulation

Ans:

- ❖ **Encapsulation is one of the fundamental concept of OOP**
- ❖ Encapsulation in Java is a mechanism of wrapping the data (variables) and code acting on the data (methods) together as a single unit.
- ❖ In encapsulation, the variables of a class will be hidden from other classes, and can be accessed only through the methods of their current class. Therefore, it is also known as **data hiding**.

**To achieve encapsulation in Java:**

- ❖ Declare the variables of a class as private.
- ❖ Provide public setter and getter methods to modify and view the variables values.
- ❖ **To achieve encapsulation in Java :**

**Advantages of Encapsulation:**

- ❖ The fields of a class can be made read-only or write-only.
- ❖ A class can have total control over what is stored in its fields.

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## Example:

```
class test
{
    private int age;
    public void get()
    {
        System.out.println(age);
    }
    public void set(int age)
    {
        this.age=age;
    }
}

class enc
{
    public static void main(String args[])
    {
        test t=new test();
        t.set(1);
        t.get();
    }
}
```

MCQ		
Sr No.	Question	Answer
1	Wrapping of variables and methods in single unit is known as.....	Encapsulation
2	The main concept of encapsulation is .....	Data Hiding

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3	To achieve encapsulation, the variables have to be declared .....	Private
4	To access the private variable of the class which methods are used?	get() and set()

## Q-3 Write a short note on Inheritance

Ans:

- ❖ **Inheritance in Java** is a mechanism in which one object acquires all the properties and behaviours of a parent object. It is an important part of **OOPs** (Object Oriented programming system).

**Terms used in inheritance:**

- 1) **Class:** A class is a group of objects which have common properties. It is a template or blueprint from which objects are created.
- 2) **Sub Class/Child Class:** Subclass is a class which inherits the other class. It is also called a derived class, extended class, or child class.
- 3) **Super Class/Parent Class:** Superclass is the class from where a subclass inherits the features. It is also called a base class or a parent class

**Advantage of Inheritance:**

**Reusability:** As the name specifies, reusability is a mechanism which facilitates you to reuse the fields and methods of the existing class when you create a new class. You can use the same fields and methods already defined in the previous class.

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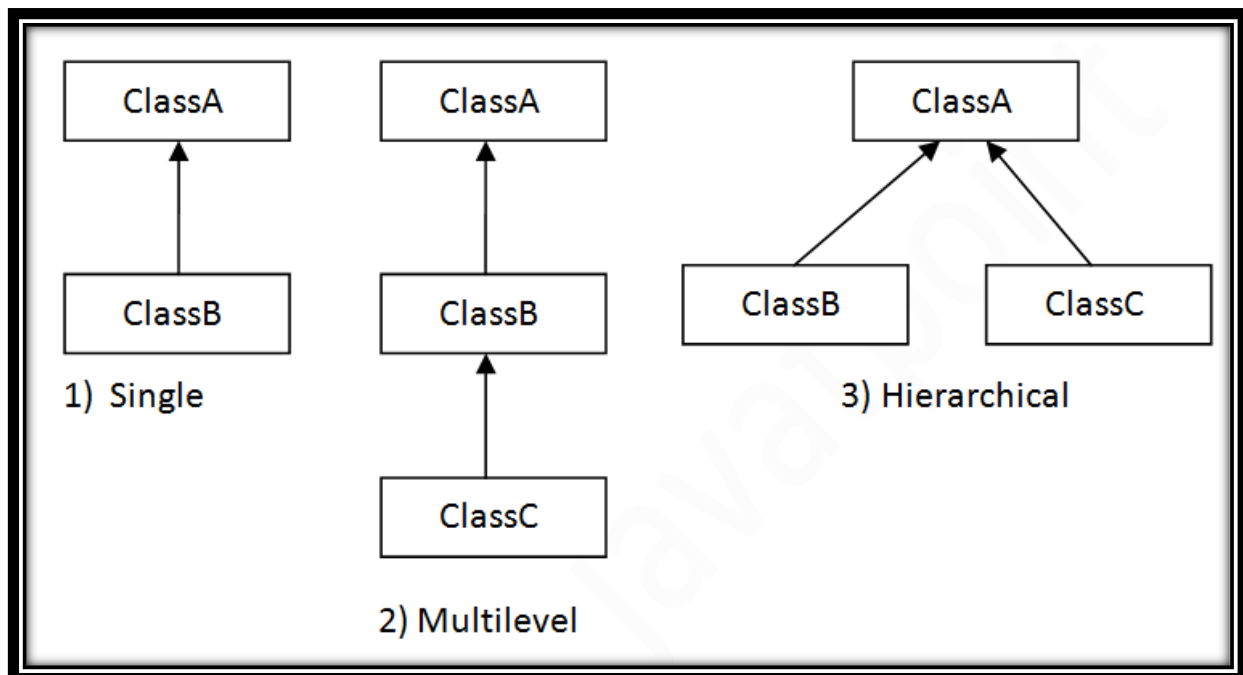
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## Syntax:

```
class subclass extends superclass  
{  
    //methods and fields  
}
```

The **extends** keyword indicates that you are making a new class that derives from an existing class.

## Types of Inheritance:



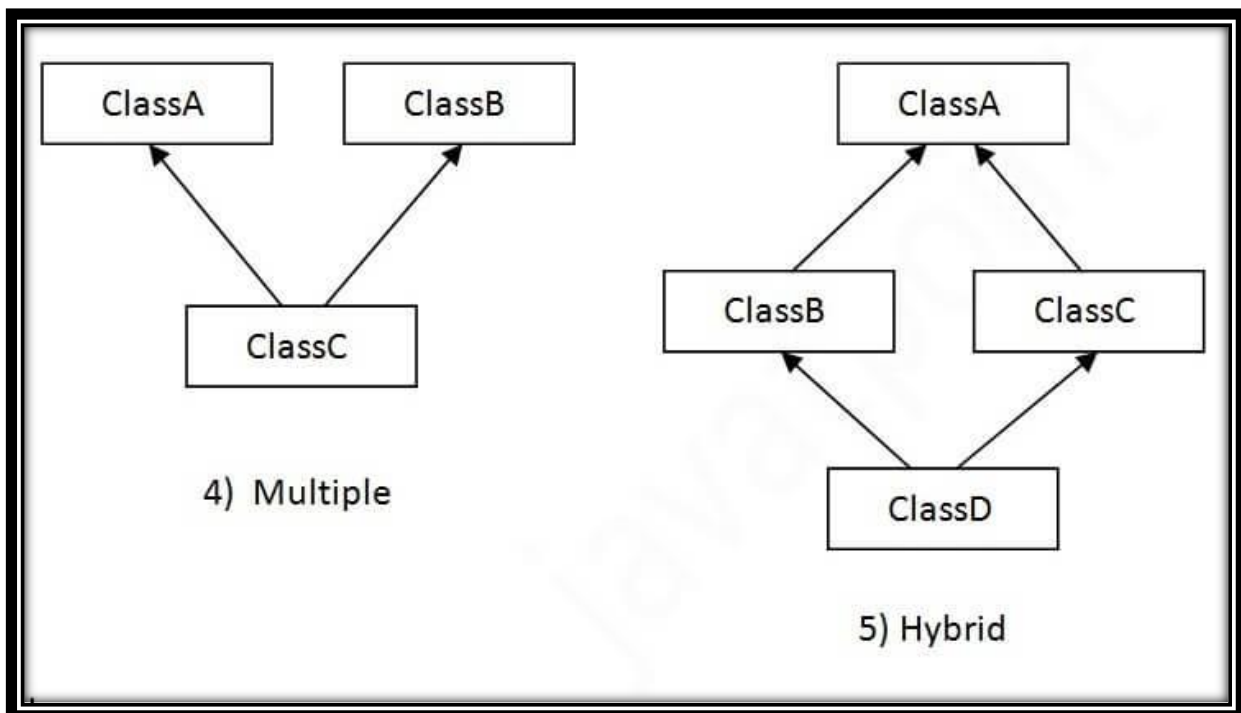
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**Note:** Multiple inheritance is not supported in Java through class.

## 1) Single Inheritance :

- ❖ When a class inherits another class, it is known as a *single inheritance*.

### Example:

In the below example, Dog is the subclass and Animal is the Parent Class. So Dog inherits the method of the Animal Class and also it have its own method.

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```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}

class Dog extends Animal
{
    void bark()
    {
        System.out.println("Barking");
    }
}

class single
{
    public static void main(String args[])
    {
        Dog d=new Dog();
        d.bark();
        d.eat();
    }
}
```

## 2) Multilevel Inheritance :

- ❖ When there is a chain of inheritance, it is known as *multilevel inheritance*.

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- ❖ In Multilevel inheritance, one class inherits from another class, another class inherits from next class and so on.

```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}

class Dog extends Animal
{
    void bark()
    {
        System.out.println("Barking");
    }
}

class BabyDog extends Dog
{
    void sleep()
    {
        System.out.println("Sleeping");
    }
}

class single
{
    public static void main(String args[])
    {
        BabyDog bd=new BabyDog();
        d.bark();
        d.eat();
        d.sleep();
    }
}
```



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## 3) Hierarchical Inheritance :

```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}
class Dog extends Animal
{
    void bark()
    {
        System.out.println("Barking");
    }
}
class cat extends Animal
{
    void sleep()
    {
        System.out.println("Sleeping");
    }
}
class single
{
    public static void main(String args[])
    {
        cat c=new cat();
        c.eat();
        c.sleep();
        Dog d=new Dog();
        d.bark();
        d.eat();
    }
}
```

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## 4) Multiple Inheritance :

- ❖ Multiple inheritance is not supported in java by class. The reason is suppose A, B, and C are three classes. The C class inherits A and B classes. If A and B classes have the same method and you call it from child class object, there will be ambiguity to call the method of A or B class.

### Example:

```
class A
{
    void msg()
    {
        System.out.println("Hello");
    }
}
class B
{
    void msg()
    {
        System.out.println("Hi");
    }
}
class C extends A,B
{
    public static void main(String args[])
    {
        C c1=new C();
        c1.msg();//Which msg() method will be called?
    }
}
```

Will generate compile time error

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## 5) Hybrid Inheritance :

- ❖ Hybrid inheritance is the combination of more than 1 type of inheritance.

### Example:

```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}

class Dog extends Animal //Single level inheritance
{
    void bark()
    {
        System.out.println("Barking");
    }
}

class cat extends Animal //Multilevel inheritance
{
    void sleep()
    {
        System.out.println("Sleeping");
    }
}

class single
{
    public static void main(String args[])
    {
        cat c=new cat();
        c.eat();
        c.sleep();
        Dog d=new Dog();
        d.bark();
        d.eat();
    }
}
```

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MCQ		
Sr No.	Question	Answer
1	The parent child concept is known as .....	Inheritance
2	The main advantage of inheritance is .....	reusability
3	Which inheritance is not supported in java?	Multiple Inheritance
4	In .....inheritance, there is one parent class and multiple child class and all child class access same parent class	Hierarchical
5	Which inheritance is known as chain of inheritance?	Multilevel
6	.....inheritance is the combination of more than one type of inheritance	Hybrid

## Q-3 Write a short note on Polymorphism

Ans:

- ❖ Polymorphism **Polymorphism in Java** is a concept by which we can perform a *single action in different ways*.
- ❖ Polymorphism is derived from 2 Greek words: poly and morphs. The word "poly" means many and "morphs" means forms. So polymorphism means many forms.

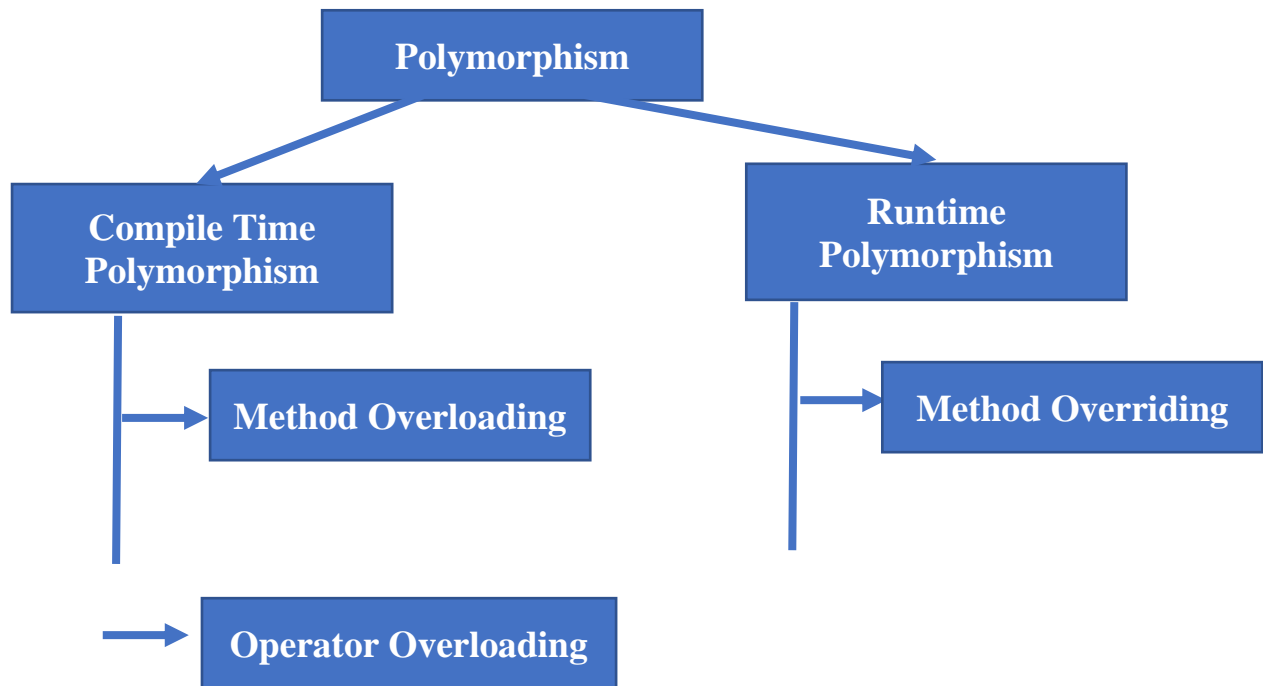
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**NOT SUPPORTED BY JAVA**

## 1) Compile time Polymorphism:

- ❖ It is also known as static polymorphism which is achieved by method overloading.
- ❖ Method overloading means methods with same name but different parameters.
- ❖ Method can be overloaded by change in number of arguments or change in type of arguments.

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## Example:

```
class overload
{
    void add(int a,int b,int c)
    {
        System.out.println(a+b+c);
    }
    void add(int a,int b)
    {
        System.out.println(a+b);
    }
}
class method1
{
    public static void main(String args[])
    {
        overload o1=new overload();
        o1.add(2,3,4);
        o1.add(1,2);
    }
}
```

## 2) Run time Polymorphism:

- ❖ It is also known as dynamic polymorphism which is achieved by method overriding.
- ❖ It is a process in which a function call to the overridden method is resolved at Runtime.
- ❖ In the below example, When an object of child class is created, then the method inside the child class is called. This is because the method in the parent class is overridden by the child class. Since the method is overridden, this method has more priority than the parent method inside the child class. So, the body inside the child class is executed.

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Rules for Java Method Overriding

- STEP 01: Method must have same name as in the parent class.
- STEP 02: Method must have same parameter as in the parent class.
- STEP 03: There must be IS-A relationship (inheritance).

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## Example:

```
class A
{
    void run()
    {
        System.out.println("Hello");
    }
}

class B extends A
{
    void run()
    {
        System.out.println("Hi");
    }
}

class sam
{
    public static void main(String args[])
    {
        B b1=new B();
        b1.run();
    }
}
```



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Compile Time Polymorphism	Runtime polymorphism
1) This type of polymorphism is known as Static binding or early binding	1) This type of polymorphism is known as dynamic binding or late binding
2) It is achieved by method overloading as operator overloading is not supported by java	2) It is achieved by method overriding
3) Inheritance is not used in this type of inheritance	3) Inheritance is used in this type of polymorphism to achieve method overrding.

MCQ		
Sr No.	Question	Answer
1	Compile time polymorphism is also known as .....	Static binding
2	Runtime polymorphism is also known as....	Dynamic Binding
3	Compile time polymorphism is achieved by .....	Method overloading
4	The methods with same name but different parameters is known as .....	Method overloading
5	Operator overloading is supported by java? (T/F)	False. Not supported
6	Runtime polymorphism is achieved by .....	Method overriding
7	In ....., child class overwrites the method of parent class	Method overriding

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## Q-4 Write a short note on Constructor.

Ans:

- ❖ A constructor is a special method which have same name as class name
- ❖ It is automatically called when object of class is created.

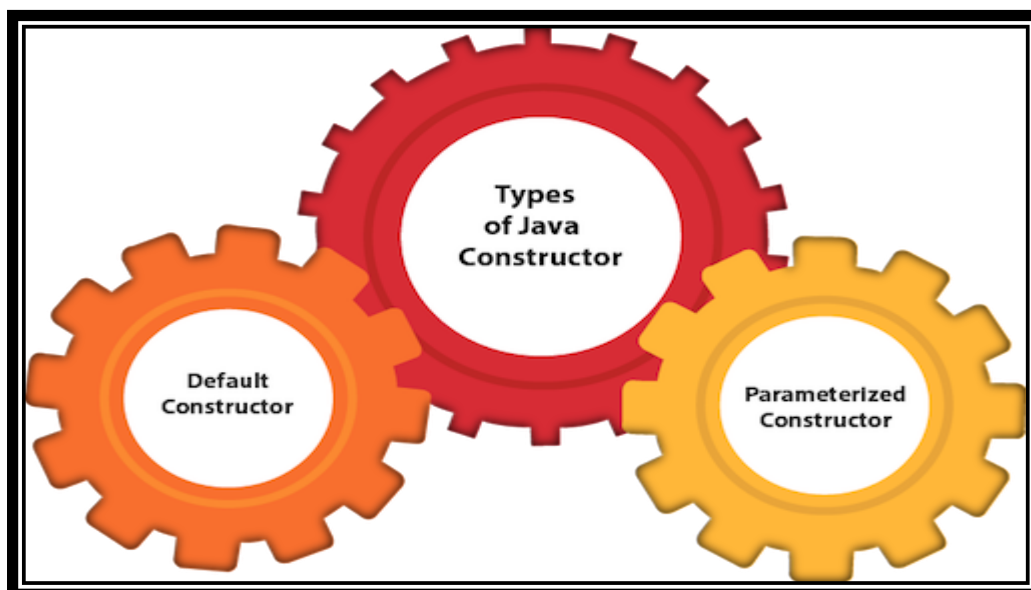
## Rules for creating Java constructor

There are two rules defined for the constructor.

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

## Types of Java constructor

- ❖ There are two types of constructors in Java:
  - 1) Default constructor (no-arg constructor)
  - 2) Parameterized constructor



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## 1) Default Constructor:

- ❖ A constructor with zero parameter or no argument is known as default constructor.

## Example:

```
class A
{
    A()
    {
        System.out.println("Default constructor");
    }
}

class inhe
{
    public static void main(String args[])
    {
        A a1=new A();
    }
}
```

## 2) Parameterised Constructor:

- ❖ A constructor with parameters is known as parameterised constructor.

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## Example:

```
class A
{
    int roll;
    A(int r)
    {
        roll=r;
    }
    void display()
    {
        System.out.println(roll);
    }
}

class inhe
{
    public static void main(String args[])
    {
        A a1=new A(10);
        a1.display();
    }
}
```

MCQ		
Sr No.	Question	Answer
1	Which method have same name as class name	Constructor
2	Constructor does not have return type (T/F)	True
3	The constructor with no or 0 arguments is known as.....	Default constructor
4	The constructor with parameters is known as .....	Parameterized constructor

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5	When constructor is called?	When object of class is created.
---	-----------------------------	----------------------------------

## Q-5 Write a short note on Constructor overloading

Ans:

- ❖ A constructor with same name but different parameters is known as constructor overloading.

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## Example:

```
class cons
{
    int roll;
    String name;
    cons()
    {
        System.out.println("Hello");
    }
    cons(int r)
    {
        roll=r;
    }
    cons(int r,String n)
    {
        roll=r;
        name=n;
    }
    void display()
    {
        System.out.println(roll);
        System.out.println(name);
    }
}
class consoverload
{
    public static void main(String args[])
    {
        cons c=new cons();
        cons c1=new cons(10);
        cons c2=new cons(10,"xyz");
        c1.display();
        c2.display();
    }
}
```

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MCQ		
Sr No.	Question	Answer
1	Constructor with same name but different parameters is known as .....	Constructor overloading

## Q-6 Write a short note on static and non-static members in java

Ans:

### Static Variables:

- ❖ When a variable is declared as static, then a single copy of the variable is created and shared among all objects at a class level. Static variables are, essentially, global variables. All instances of the class share the same static variable.
- ❖ We can create static variables at class-level only

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## Example:

```
class test
{
    static int a=20;
    void display()
    {
        a++;
        System.out.println(a);
    }
}
class sample
{
    public static void main(String args[])
    {
        test t1=new test();
        test t2=new test();
        test t3=new test();
        t1.display();
        t2.display();
        t3.display();
    }
}
```

- ❖ When a variable is declared as non-static, then individual copy of the variable is created for the different objects. Static variables are, essentially, local variables. All object of the class share the different non-static variable.



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## Example:

```
class test
{
    int a=20;
    void display()
    {
        a++;
        System.out.println(a);
    }
}
class sample
{
    public static void main(String args[])
    {
        test t1=new test();
        test t2=new test();
        test t3=new test();
        t1.display();
        t2.display();
        t3.display();
    }
}
```

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Static Members	Non-static Members
1) Static members can be accessed directly using classname	1) Non-static members can be accessed using object of class
2) Static variables can be accessed by static and non-static methods both	2) Non-static variables cannot be accessed inside static method
3) All the objects of class share same static variables	3) All the objects of the class have its own non-static variable.
4) Static variables are like global variables	4) Non-static variables are like local variables.
5) static keyword is used to declare the static members.	5) No keyword is required to declare non-static members.

MCQ		
Sr No.	Question	Answer
1	In .....variable, only 1 copy of variable is shared by all the objects of the class	static
2	Which keyword is used to declare static variable?	static
3	In ....variable, all the objects have their own copy of variable	Non-static
4	Static variables can be accessed by both .....and .....methods	static and non-static
5	Static variables are like .....variables	global
6.	Non-static variables are like .....variables	local

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## Q-7 Write a short note on varargs

**Ans:**

- ❖ The varargs allows the method to accept zero or multiple arguments.
- ❖ If we don't know how many argument we will have to pass in the method, varargs is the better approach.
- ❖ The varargs uses ellipsis i.e. three dots after the data type. Syntax is as follows:

**Syntax:**

```
return_type method_name(data_type... variableName)
```

```
{  
}
```

**Example:**

```
class varg  
{  
    static void display(int...values)  
    {  
        System.out.println("hello");  
  
        for(int i:values)  
            System.out.println(i);  
    }  
    public static void main(String args[])  
    {  
        display();  
        display(1,2,3,4);  
        display(12,22);  
    }  
}
```

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MCQ		
Sr No.	Question	Answer
1	If we don't know how many argument we will have to pass in the method, ..... is the better approach	varargs
2	varargs uses .....	ellipsis (...)

## Q-8 Write a short note on IIB block in java

Ans:

- ❖ IIB stands for instance initializer block
- ❖ **Instance Initializer block** is used to initialize the instance data member
- ❖ It run each time when object of the class is created.

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## Example:

```
class iib
{
    int age;
    iib()
    {
        System.out.println(age);
    }
    {
        age=10;
    }
}

class im
{
    public static void main(String args[])
    {
        iib i=new iib();
        iib i2=new iib();
    }
}
```

**IIB Block**

MCQ		
Sr No.	Question	Answer
1	IIB stands for .....	Instance Intializer Block
2	IIB runs each time the .....is created	object of class

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## Unit-2:- Inheritance and java packages

### **Q-1 Explain Universal class**

**Ans:**

- ❖ The Object class is the parent class of all the classes in java by default. In other words, it is the topmost class of java.
- ❖ Object class is present in java. Lang package. Every class in Java is directly or indirectly derived from the Object class.
- ❖ If a class does not extend any other class then it is a direct child class of Object and if extends another class then it is indirectly derived.
- ❖ Therefore the Object class methods are available to all Java classes.
- ❖ Hence object class acts as a root of inheritance hierarchy in any Java Program.
- ❖ The Object class is beneficial if you want to refer any object whose type you don't know.
- ❖ Following are the methods of object class.

Sr No.	Method Name	Description
1	toString()	It is used to convert an object to string Note: It is always recommended to override toString() method to get our own string representation.
2	hashCode()	It returns a hashvalue that is used to search the object in the collection Note: For every object, JVM generates unique number which is known as hascode.
3	equals	It compares given object to “this” object (the object on which method is called)
4	getClass()	It returns the class of the object and is used to get actual runtime class of the object.

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5	<b>finalize()</b>	This method is called just before an object is garbage collected. It is called on an object when garbage collector determines that there are no references to the object. Note: finalize() is just called once on an object
6	<b>clone()</b>	It returns the new object that is exactly same as this object
7	<b>notify()</b>	wakes up single thread, waiting on object's monitor
8	<b>notifyall()</b>	wakes up all thread, waiting on object's monitor
9	<b>wait()</b>	Causes the current thread to wait for the specified milliseconds until another thread notifies.

MCQ		
Sr No.	Question	Answer
1	Which is the universal class in java?	Object
2	Object class is present in .....package	java.lang
3	Which method of object class is used to return a hash value that is used to search the object in collection?	hashCode()
4	Which method of object class generates exactly same object as this object?	clone()
5	Which method of object class is called just before the object is garbage collected?	finalize()

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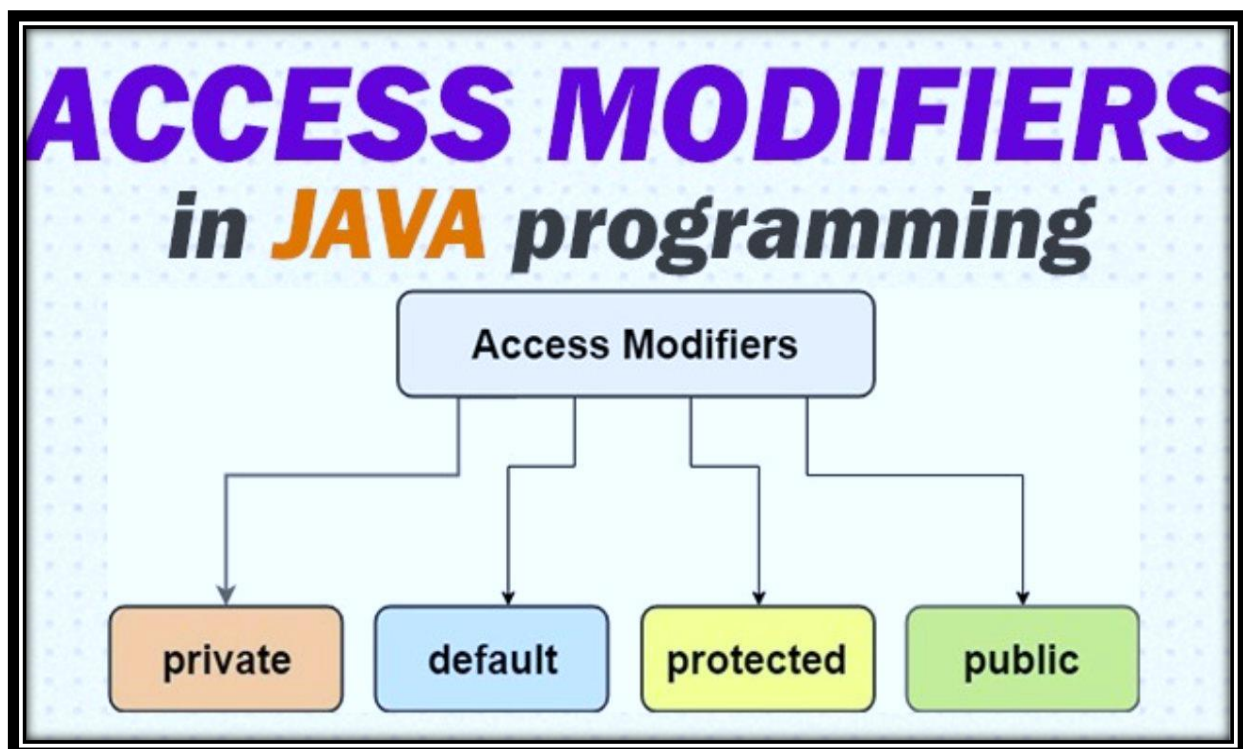
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## Q-2 Write a short note on Access Specifier

Ans:

- ❖ The access modifiers in Java specifies the accessibility or scope of a field, method, constructor, or class. We can change the access level of fields, constructors, methods, and class by applying the access modifier on it.
- ❖ There are 4 types of java access modifiers



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



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```
class A
{
    private int data=40;
    private void msg()
    {
        System.out.println("Hello java");
    }
}
class Simple
{
    public static void main(String args[])
    {
        A obj=new A();
        System.out.println(obj.data);//Compile Time Error
        obj.msg();//Compile Time Error
    }
}
```

It cannot be accessed from outside the package. If you do not specify any access level, it will be the default.

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**//Save this with A.java (Package 1)**

```
package pack;
class A
{
    void display()
    {
        System.out.println("Hello");
    }
}
```

**//Save this with B.java (Package 2)**

```
package mypack;
import pack.*;
class B
{
    public static void main(String args[])
    {
        A obj=new A();
        obj.display();
    }
}
```

## Note:

- ❖ In the above example, the scope of class A and its method msg() is default so it cannot be accessed from outside the package.

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3. **Protected:** The access level of a protected modifier is within the package and outside the package through the inheritance. The protected access modifier can be applied on the data member, method and constructor. It cannot be applied on class.

**//Save this with A.java (Package 1)**

```
package pack;
public class A
{
    protected void display()
    {
        System.out.println("Hello");
    }
}
```

**//Save this with B.java (Package 2)**

```
package mypack;
import pack.*;
class B extends A
{
    public static void main(String args[])
    {
        B obj=new B();
        obj.display();
    }
}
```

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4. **Public:** The access level of a public modifier is everywhere. It can be accessed from within the class, outside the class, within the package and outside the package.

**//Save this with A.java (Package 1)**

```
package pack;
public class A
{
    public void display()
    {
        System.out.println("Hello");
    }
}
```

**//Save this with B.java (Package 2)**

```
package mypack;
import pack.*;
class B
{
    public static void main(String args[])
    {
        A obj=new A();
        obj.display();
    }
}
```

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MCQ		
Sr No.	Question	Answer
1	.....modifier is accessible from everywhere	public
2	The access level of .....modifier is within the package and outside the package through inheritance	protected
3	Which is the default access modifier?	default

## Q-3 Write a short note on Constructor in inheritance

**Ans:**

- ❖ A constructor in Java is similar to a method with a few differences. Constructor has the same name as the class name. A constructor doesn't have a return type.
- ❖ A Java program will automatically create a constructor if it is not already defined in the program. It is executed when an instance of the class is created.
- ❖ A constructor cannot be static, abstract, final or synchronized. It cannot be overridden.
- ❖ When the constructor is used in inheritance, then the constructor of base class is executed first and then constructor of child class is executed.

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## Constructor in single level inheritance

```
class parent
{
    parent()
    {
        System.out.println("Parent class constructor");
    }
}
class child extends parent
{
    child()
    {
        System.out.println("Child class constructor");
    }
}
class sample
{
    public static void main(String args[])
    {
        child c=new child();
    }
}
```

## Constructor in single level inheritance

```
class parent
{
    parent()
    {
        System.out.println("Parent class constructor");
    }
}
class child extends parent
{
    child()
    {
        System.out.println("Child class constructor");
    }
}
```

```
class child extends child
{
    {
```

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MCQ		
Sr No.	Question	Answer
1	.....modifier is accessible from everywhere	public
2	The access level of .....modifier is within the package and outside the package through inheritance	protected
3	Which is the default access modifier?	default

MCQ		
Sr No.	Question	Answer
1	In case of constructor in single inheritance, the order of execution of constructor will be .....	parent class constructor child class constructor
2	In case of constructor in multilevel inheritance, the order of execution of constructor will be.....	parent class constructor child class constructor child1 constructor

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## Q-4 Write a short note on Interface

**Ans:**

- ❖ An **interface in Java** is a blueprint of a class. It has static constants and abstract methods.
- ❖ Interface in java is used to achieve abstraction and multiple inheritance
- ❖ Interface can only have abstract methods that is methods without body
- ❖ “Implements” keyword is used when the class implements interface.

**Syntax:**

**interface** interfacename

{

    returntype methodname();

}



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## Example:

```
interface draw
{
void print();
}

class rectangle implements draw
{
    public void print()
    {
        System.out.println("draw rectangle");
    }
}

class circle implements draw
{
    public void print()
    {
        System.out.println("draw circle");
    }
}

class test
{
    public static void main(String args[])
    {
        circle c1=new circle();
        c1.print();
        rectangle r=new rectangle();
        r.print();
    }
}
```

- ❖ Multiple inheritance is not supported by java. But through the interface multiple inheritance is achieved in java.

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## Example:

```
interface a
{
    void display();
}
interface b
{
    void display1();
}
class mul implements a,b
{
    public void display()
    {
        System.out.println("hello");
    }
    public void display1()
    {
        System.out.println("hi");
    }
}

class multiple
{
    public static void main(String args[])
    {
        sam s=new sam();
        s.display();
        s.display1();
    }
}
```

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MCQ		
Sr No.	Question	Answer
1	class .....interface	implements
2	Which keyword is used to declare the interface?	interface
3	interface can have only .....methods	abstract
4	Multiple inheritance in java is achieved using .....	interface

## Q-5 Write a short note on Object cloning

**Ans:**

- ❖ The object cloning is a way to create exact copy of an object.
- ❖ The clone() method of Object class is used to clone an object.
- ❖ The **clone() method** is defined in the Object class.
- ❖ Every class that implements clone() should call super.clone() to obtain the cloned object reference.
- ❖ The class must also implement java.lang.Cloneable interface whose object clone we want to create otherwise it will throw CloneNotSupportedException when clone method is called on that class's object.

**Syntax:**

public Object clone() **throws** CloneNotSupportedException

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## Example:

```
class stu implements Cloneable
{
    int rollno;
    String name;

    stu(int r,String n)
    {
        this.rollno=r;
        this.name=n;
    }
    public Object clone()throws CloneNotSupportedException
    {
        return super.clone();
    }

    public static void main(String args[])
    {
        try
        {
            stu s1=new stu(1,"xyz");
            stu s2=(stu)s1.clone();

            System.out.println(s2.rollno);
            System.out.println(s2.name);
        }catch(CloneNotSupportedException c)
        {

        }
    }
}
```

## MCQ

Sr No.	Question	Answer
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1	Which method is used to create exact copy of the object?	clone()
2	To use clone(), which interface class should implement?	Cloneable
3	Every class that implements clone() should call ..... to obtain the cloned object reference.	super.clone()

## Q-6 Write a short note on Nested and Inner Class

### Ans:

- ❖ **Java inner class** or nested class is a class that is declared inside the class or interface.
- ❖ We use inner classes to logically group classes and interfaces in one place to be more readable and maintainable.
- ❖ Additionally, it can access all the members of the outer class, including private data members and methods.

### Syntax:

```
class Java_Outer_class
{
    //code
    class Java_Inner_class
    {
        //code
    }
}
```

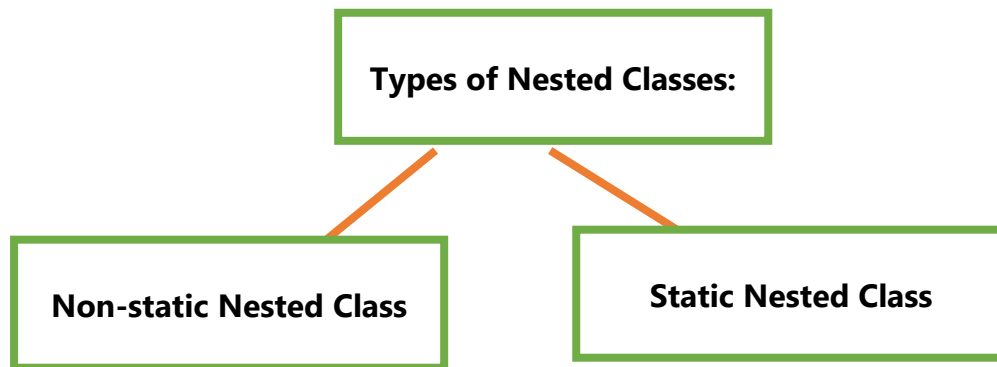
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## 1) Non-Static Nested class:

- ❖ A non-static nested class is a class within another class. It has access to members of the enclosing class (outer class). It is commonly known as inner class
- ❖ As inner class exists inside outer class, the object of outer class must be created in order to create object of inner class.

## Example:

```
class outer
{
    int x=10;
    class inner
    {
        int y=4;
    }
}

class nested
{
    public static void main(String args[])
    {
        outer o=new outer();
        outer.inner i=o.new inner();
        System.out.println(i.y);
        System.out.println(o.x);
    }
}
```

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## Note:

Dot operator(.) is used to create the object of inner class using outer class

## 2) Static Nested class:

- ❖ Static class inside another class is known as static nested class.
- ❖ Static nested class are not known as static inner class.
- ❖ The main difference between static nested class and inner class is that a static nested class can not access member variables of the outer class.it is because the static nested class does not require you to create an object of outer class.

## Example:

```
class outer
{
    int x=10;
    static class inner
    {
        int y=4;
    }
}

class nested
{
    public static void main(String args[])
    {
        outer.inner i=new outer.inner();
        System.out.println(i.y);
        System.out.println(i.x);//will generate error
    }
}
```

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Non-static nested class	Static Nested Class
1) In non-static nested class, static keyword is not used	1) In static nested class, static keyword is used
2) Non-static nested class is known as inner class	2) Static nested class is not known as inner class
3) Non-static nested class requires object of outer class	3) Static nested class does not require object of outer class
4) Non-static nested class can access the members of outer class	4) Static nested class cannot access members of the outer class

MCQ		
Sr No.	Question	Answer
1	Which keyword is used to declare static nested class?	Static
2	In ....., object of outer class is required	non-static
3	.....can access members of outer class	Non-static nested class

## Q-6 Write a short note on abstract class and final class

**Ans:**

### Abstract Class:

- ☐ A class which is declared as abstract is known as an **abstract class**.
- ☐ It can have abstract and non-abstract methods.
- ☐ It needs to be extended and its method implemented.



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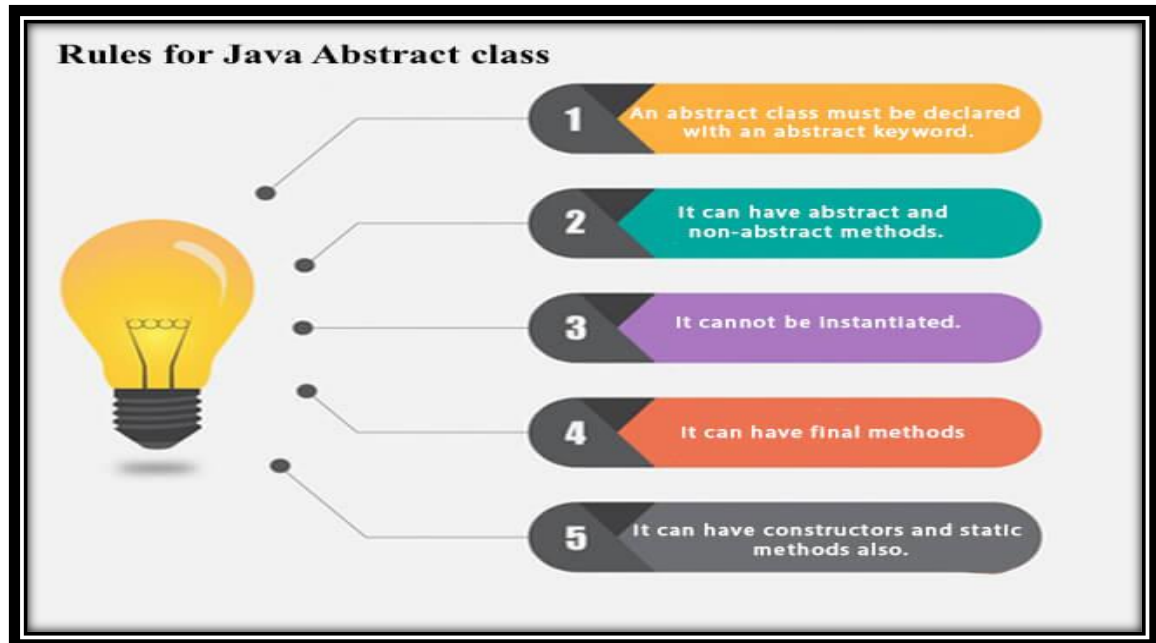
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☐ It cannot be instantiated.



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## Example:

```
abstract class bike
{
    abstract void run();
    void display()
    {
        System.out.println("hello");
    }
}

class honda extends bike
{
    public void run()
    {
        System.out.println("hi");
    }
}

class sampe
{
    public static void main(String args[])
    {
        honda h=new honda();
        h.run();
        h.display();
    }
}
```

## Final:

- ❖ The **final keyword** in java is used to restrict the user. The java final keyword can be used in many context. Final can be:
  - Variable
  - Method

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- Class

Final Variable	→	To create constant variables
Final Methods	→	Prevent Method Overriding
Final Classes	→	Prevent Inheritance

❖ A class which cannot be inherited or extended is known as final class.

## Example:

```
final class bike
{
}

class ja extends bike
{
    void display()
    {
        System.out.println("hi");
    }
    public static void main(String args[])
    {
        bike b=new bike();
        b.display(); //Compile time error
    }
}
```

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MCQ		
Sr No.	Question	Answer
1	Which keyword is used to declare the class as abstract?	abstract
2	Can we create the object of abstract class?	No
3	Abstract class can contain non-abstract methods?	True
4	When final keyword is applied to the class it prevents .....	Inheritance

## Q-7 Write a short note on normal import and static import

**Ans:**

### Normal import:

- ❖ The import allows the java programmer to access classes of a package without package qualification
- ❖ The import provides accessibility to classes and interface

```
class ke
{
    public static void main(String args[])
    {
        System.out.println(Math.sqrt(25));
        System.out.println(Math.pow(2,2));
    }
}
```

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## static import:

- ❖ In Java, static import concept is introduced in 1.5 version.
- ❖ With the help of static import, we can access the static members of a class directly without class name or any object.
- ❖ For Example: we always use `sqrt()` method of `Math` class by using `Math` class i.e. `Math.sqrt()`, but by using static import we can access `sqrt()` method directly.

```
import static java.lang.Math.*;

class ke
{
    public static void main(String args[])
    {
        System.out.println(sqrt(25));
        System.out.println(pow(2,2));
    }
}
```

## \*\* Difference between normal import and static import

normal import	Static import
1) The normal import provides access to class and interface	1) static import provides access to the static members of the class.
2) The normal import allows to access the class of the package without package qualification	2) Static import feature allows to access the static members of a class without class qualification.

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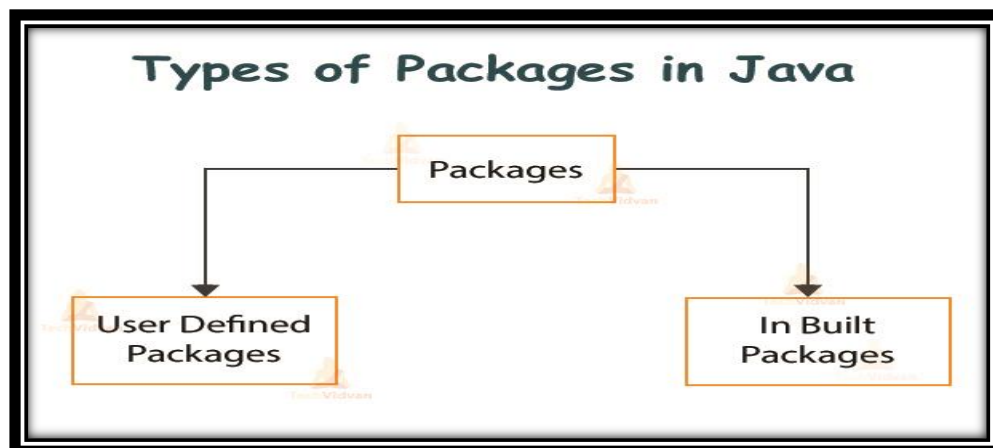
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MCQ		
Sr No.	Question	Answer
1	.....import provides access to class and interface	normal
2	.....import provides access to the static members of the class	static

## Q-8 what is package? List out the packages in java

**Ans:**

- ❖ Package in Java is a mechanism to encapsulate a group of classes, sub packages and interfaces. Packages are used for: **Preventing naming conflicts**
- ❖ For example there can be two classes with name Employee in two packages, college.staff.cse.Employee and college.staff.ee.Employee



- ❖ Following are the types of in built packages:

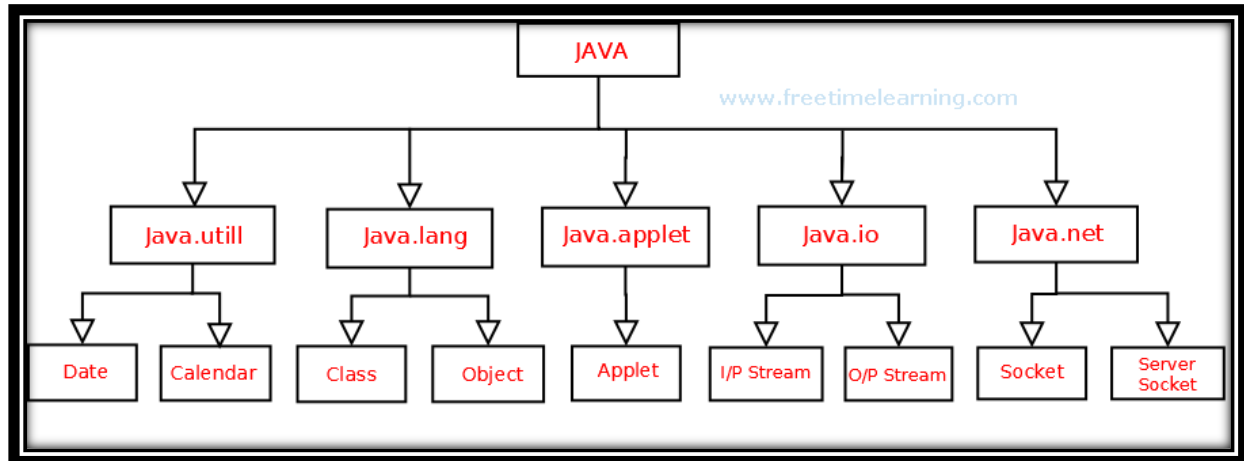
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## Built-in Packages:

- ❖ These packages consist of a large number of classes which are a part of Java API.
- ❖ Some of the commonly used built-in packages are:
  - **java.lang:** Contains language support classes(e.g classed which defines primitive data types, math operations). This package is automatically imported.
  - **java.io:** Contains classed for supporting input / output operations.
  - **java.util:** Contains utility classes which implement data structures like Linked List, Dictionary and support ; for Date / Time operations.
  - **java.applet:** Contains classes for creating Applets.
  - **java.awt:** Contain the classes for implementing the components of graphical user in java.applet terfaces like button, menus etc.
  - **java.net:** Contain classes for supporting networking operations.

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## java.lang Package

- ❖ Provides classes that are fundamental to the design of the Java programming language.
- ❖ Following are few important classes of java.lang package
  1. Math
  2. Wrapper Classes
  3. String
  4. String Buffer

### Math Class of java.lang package

- ❖ The **java.lang.Math** class contains various methods for performing basic numeric operations such as the logarithm, cube root, and trigonometric functions etc. The various java math methods are as follows:
- ❖ All the methods of the Math class are static so it can be called by class name
- ❖ **Basic Math methods**

Method	Description
Math.abs()	It will return the Absolute value of the given value.
Math.max()	It returns the Largest of two values.
Math.min()	It is used to return the Smallest of two values.
Math.round()	It is used to round of the decimal numbers to the nearest value.
Math.sqrt()	It is used to return the square root of a number.
Math.cbrt()	It is used to return the cube root of a number.
Math.pow()	It returns the value of first argument raised to the power to second argument.
Math.ceil()	It is used to find the smallest integer value that is greater than or equal to the argument or mathematical integer.
Math.floor()	It is used to find the largest integer value which is less than or equal to the argument and is equal to the mathematical integer of a double value.
Math.random()	It returns a double value with a positive sign, greater than or equal to 0.0 and less than 1.0.
Math.cos()	Returns the trigonometric cosine of an angle.
Math.sin()	Returns the trigonometric sine of an angle.



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Math.tan( )	Returns the trigonometric tangent of an angle.
Math.log( )	Returns the natural logarithm (base e) of a double value.

MCQ		
Sr No.	Question	Answer
1	Math.ceil gives .....	Maximum round value of floating point number
2	Math.sqrt() gives.....	Square root of number
3	Math class is included in .....	java.lang
4	.....is the default package	java.lang

## Wrapper class in java.lang package

- ❖ The wrapper class in Java provides the mechanism to convert primitive into object and object into primitive.
- ❖ **autoboxing** and **unboxing** feature convert primitives into objects and objects into primitives automatically. The automatic conversion of primitive into an object is known as autoboxing and vice-versa unboxing.

Primitive Type	Wrapper Class	Primitive Type	Wrapper Class
byte	Byte	float	Float
boolean	Boolean	int	Integer
char	Character	long	Long
double	Double	short	Short

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## Autoboxing:

- ❖ The automatic conversion of primitive data type into its corresponding wrapper class is known as autoboxing, for example, byte to Byte, char to Character, int to Integer, long to Long, float to Float, boolean to Boolean, double to Double, and short to Short.

## Example:

```
class wrapper1
{
    public static void main(String args[])
    {
        int a=20;
        Integer j=a; //Converting primitive data type to Integer wrapper class
        System.out.println(j);
    }
}
```

## Unboxing:

- ❖ The automatic conversion of wrapper type into its corresponding primitive type is known as unboxing. It is the reverse process of unboxing.

```
class wrapper1
{
    public static void main(String args[])
    {
        Integer a=new Integer(3);
        int i=a; //Converting Wrapper class into primitive data type
        System.out.println(i);
    }
}
```

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## MCQ

Sr No.	Question	Answer
1	.....Provides the mechanism to convert primitive into object and object into primitive.	Wrapper Class
2	The process of converting primitive data type into object is known as .....	autoboxing
3	The process of converting object into primitive data type is known as ....	unboxing

## String class in java.lang package

- ❖ The **java.lang.String** class represents character strings. All string literals in Java programs, such as "abc", are implemented as instances of this class. Strings are constant, their values cannot be changed after they are created.

Method	Description
char charAt(int index)	Returns char value for the particular index
int length()	Returns string length
String substring(int beginIndex)	Returns substring for given begin index.
String substring(int beginIndex, int endIndex)	Returns substring for given begin index and end index.
boolean contains(Char Sequences)	Returns true or false after matching the sequence of char value.
boolean equals(Object another)	Checks the equality of string with the given object.
Boolean isEmpty()	Checks if string is empty.
String concat(String str)	Concatenates the specified string.

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String replace(char old, char new)	Replaces all occurrences of the specified char value.
static String equalsIgnoreCase(String another)	Compares another string. It doesn't check case.
int indexOf(int ch)	Returns the specified char value index.
String toLowerCase()	Returns a string in lowercase.
String toUpperCase()	Returns a string in uppercase.
String trim()	Removes beginning and ending spaces of this string.
int compareTo(String)	Compares this String to another specified String if match then return zero(0) otherwise not zero(0).
int compareToIgnoreCase(String)	Compares two strings lexicographically, ignoring case differences.

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## Example:

```
class stringfunctions
{
    public static void main(String args[])
    {
        String s="hello";
        String s1="hello";
        String s3="karishma";
        String s4="rupani";
        String s5="hi";
        String s6="Hi";
        System.out.println("Charat" +s.charAt(1));
        System.out.println("length" +s.length());
        System.out.println("substring" +s.substring(1));
        System.out.println("substring" +s.substring(1,3));
        System.out.println("index" +s.contains("el"));
        System.out.println("Equality" +s.equals(s1));
        System.out.println("Empty" +s.isEmpty());
        System.out.println("Concate"+s3.concat(s4));
        System.out.println("replace"+s.replace('l','k'));
        System.out.println("Uppercase" +s3.toUpperCase());
        System.out.println("Lowercase" +s3.toLowerCase());
        System.out.println("IndexOf" +s.indexOf('o'));
        System.out.println("ignorecase" +s5.equalsIgnoreCase(s6));
    }
}
```

## MCQ

Sr No.	Question	Answer
1	Which class contains the string functions?	String class

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2	substring(startind,endind) gives .....	Substring from start index to end index.
3	Which function of string class is used to merge 2 strings?	concat()
4	Which function returns the index of the given character	indexOf()

## StringBuffer class in java.lang package

- ❖ **StringBuffer** is a peer class of **String** that provides much of the functionality of strings.
- ❖ The string represents fixed-length, immutable character sequences while StringBuffer represents growable and writable character sequences
- ❖ **StringBuffer** may have characters and substrings inserted in the middle or appended to the end.
- ❖ It will automatically grow to make room for such additions and often has more characters preallocated than are actually needed, to allow room for growth.

Method	Description
append(String s)	Is used to append the specified string with this string.
insert(int offset, String s)	Is used to insert the specified string with this string at the specified position.
replace(intstartIndex, intendIndex, String str)	Is used to replace the string from specified startindex and endindex.
delete(int startIndex, int endIndex)	Is used to delete the string from specified startindex and endindex.
reverse()	Is used to reverse the string.
capacity()	Is used to return the current capacity.
charAt(int index)	Is used to return the character at the specified position.
length()	Is used to return the length of the string i.e. Total number of characters.

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substring(int beginIndex)	Is used to return the substring from the specified begin index.
int indexOf(String str)	returns the index within this string of the first occurrence of the specified substring.

## Example:

```
class stringfunctions
{
    public static void main(String args[])
    {
        StringBuffer s=new StringBuffer("hello");
        System.out.println("Length" +s.length());
        System.out.println("Specified" +s.insert(2,"hi"));
        System.out.println("Replace" +s.replace(1,3,"ee"));
        System.out.println("Deleting" +s.delete(1,3));
        System.out.println("Reversing" +s.reverse());
        System.out.println("Capacity" +s.capacity());
        System.out.println("Charat" +s.charAt(2));
        System.out.println("Substring" +s.substring(1));
    }
}
```

## MCQ

Sr No.	Question	Answer
1	.....is the peer class of the String class	StringBuffer
2	.....is the growable sequence of characters	StringBuffer
3	Which method is used to add insert the string in the specified string?	insert()

java.util Package

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- ❖ The **java.util** packages provide support for the event model, collections framework, date and time facilities, and contain various utility classes.
- ❖ Following are the classes in java.util package
  - ❖ Random
  - ❖ Date
  - ❖ GregorianCalendar
  - ❖ Vector
  - ❖ HashTable
  - ❖ StringTokenizer
  - ❖ Collections in Java : Linked List, SortedSet, Stack, Queue, Map

## Random class in java.lang package

- ❖ Java Random class is used to generate a stream of pseudorandom numbers
- ❖ This class provides various method calls to generate different random data types such as float, double, int.

Methods	Description
<b>doubles()</b>	Returns an unlimited stream of pseudorandom double values.
<b>ints()</b>	Returns an unlimited stream of pseudorandom int values.
<b>longs()</b>	Returns an unlimited stream of pseudorandom long values.
<b>next()</b>	Generates the next pseudorandom number.
<b>nextBoolean()</b>	Returns the next uniformly distributed pseudorandom boolean value from the random number generator's sequence
<b>nextByte()</b>	Generates random bytes and puts them into a specified byte array.
<b>nextDouble()</b>	Returns the next pseudorandom Double value between 0.0 and 1.0 from the random number generator's sequence
<b>nextFloat()</b>	Returns the next uniformly distributed pseudorandom Float value between 0.0 and 1.0 from this random number generator's sequence



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<b>nextInt()</b>	Returns a uniformly distributed pseudorandom int value generated from this random number generator's sequence
<b>nextLong()</b>	Returns the next uniformly distributed pseudorandom long value from the random number generator's sequence.

## Example:

```
import java.util.*;
class randomn
{
    public static void main(String args[])
    {
        Random r=new Random();
        System.out.println("Integer val" +r.nextInt());
        System.out.println("Next decimal" +r.nextDouble());
    }
}
```

MCQ		
Sr No.	Question	Answer
1	Random class comes in which package?	Java.util
2	Which class generates pseudorandom numbers?	Random()

## Date class in java.lang package

❖ The java.util.Date class represents date and time in java.

Method	Description
boolean after(Date date)	Tests if current date is after the given date.
boolean before(Date date)	Tests if current date is before the given date.
int compareTo(Date date)	Compares current date with given date.

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boolean equals(Date date)	Compares current date with given date for equality.
long getTime()	Returns the time represented by this date object.
void setTime(long time)	Changes the current date and time to given time.

## Example:

```
import java.util.*;

public class main1
{
    public static void main(String[] args)
    {
        Date d=new Date();
        Date d1=new Date(21-11-2010);
        Date d2=new Date(25-6-2022);
        // Creating date
        System.out.println("Current date: " +d);
        System.out.println("Checking"+d1.before(d));
        System.out.println("after" +d.after(d2));
        System.out.println("Clone object" +d.clone());
        System.out.println("Compare" +d.compareTo(d1));
        System.out.println("Equlas" +d.equals(d1));
        System.out.println("Time" +d.getTime());
        System.out.println("Hashcode" +d.hashCode());
    }
}
```

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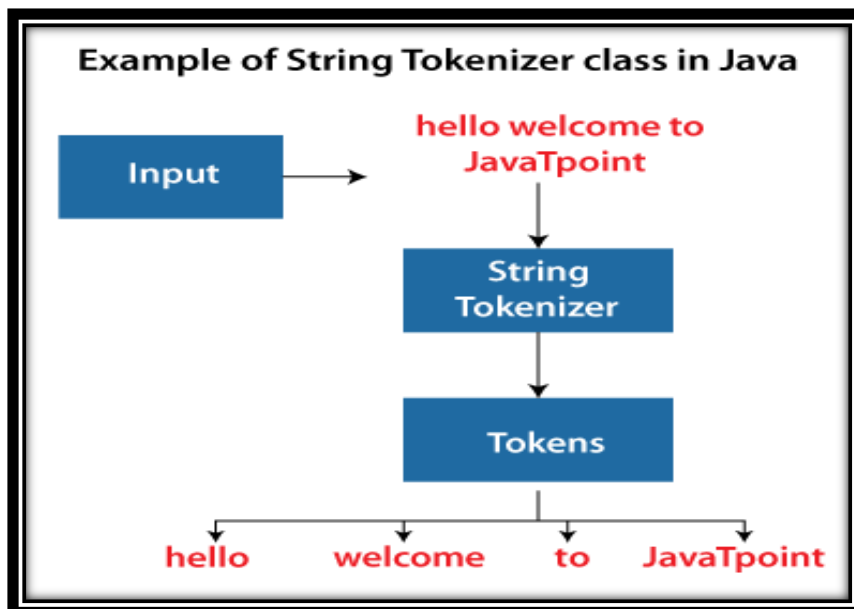
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MCQ		
Sr No.	Question	Answer
1	Which class of java.util package is used to give date and time	Date
2	Which method is used to check that current date is before given date or not?	before()
3	Which method of Date class is used to generate unique ID of Date object	hashCode

## StringTokenizer class in java.util package

- ❖ The java.util.StringTokenizer class allows you to break a string into tokens. It is simple way to break string.



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Method	Description
booleanhasMoreTokens()	Checks if there is more tokens available.
String nextToken()	Returns the next token from the stringtokenizer object.
String nextToken(String delim)	Returns the next token based on the delimiter.
booleanhasMoreElements()	Same as hasmoretokens() method.
Object nextElement()	Same as nexttoken() but its return type is Object.
intcountTokens()	Returns the total number of tokens.

## Example:

```
import java.util.*;

public class main1
{
    public static void main(String[] args)
    {
        StringTokenizer st=new StringTokenizer("my name is karishma");
        System.out.println("Total number of Tokens: "+st.countTokens());
        while(st.hasMoreTokens())
        {
            System.out.println(st.nextToken());
        }
    }
}
```

## MCQ

Sr No.	Question	Answer
--------	----------	--------

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1	Which class of java.util package allows you to break the string into tokens?	StringTokenizer
2	Which method is used to count total no. of tokens in the string?	countTokens()
3	Which method is used to print next token of the string?	nextToken()

## Gregorian calendar class in java.util package

- ❖ Gregorian calendar is a concrete subclass(one which has implementation of all of its inherited members either from interface or abstract class) of a **Calendar**.
- ❖ The major difference between Gregorian calendar and Calendar class are that the Calendar class being an abstract class cannot be instantiated.

**Calendar cal = Calendar.getInstance();**

- ❖ **GregorianCalendar** Class being a concrete class, can be instantiated. So an object of the **GregorianCalendar** Class

**GregorianCalendar gcal = new GregorianCalendar();**

### Example:

```
import java.util.*;
class greg
{
    public static void main(String args[])
    {
        Calendar cal=Calendar.getInstance();
        GregorianCalendar c=new GregorianCalendar();
        System.out.println("Calendar date:"+cal.getTime());
        System.out.println("Greg" +c.getTime());
    }
}
```

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## MCQ

Sr No.	Question	Answer
1	.....is the subclass of Calendar Class	Gregorian Calendar
2	We cannot create object of Calendar Class directly (T/F)?	True
3	Which method is used to create the object of calendar class?	getInstance()

## Collection class in java.util package

- ❖ The Collection interface is the root interface of the collections framework hierarchy. A Collection represents a single unit of objects, i.e., a group.
- ❖ Java does not provide direct implementations of the Collection interface but provides implementations of its sub interfaces like List, Set, and Queue.
- ❖ Java Collections can achieve all the operations that you perform on a data such as searching, sorting, insertion, manipulation, and deletion.
- ❖ Following are the collections in java:
  - Vector
  - HashTable
  - Linked List
  - Sorted Set
  - Stack
  - Queue
  - Map

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## Vector class in java.util package

- ❖ **Vector** is like the *dynamic array* which can grow or shrink its size. Unlike array, we can store n-number of elements in it as there is no size limit.

void add(int index, Object element)	Inserts the element at the given position.
void add()	Adds the elements in vector
void clear( )	Removes all of the elements from this.
int lastElement()	Returns the last element of vector
int firstElement()	Returns the first element of vector
int indexOf(Object element)	Searches for the first occurrence of the given argument.
boolean remove(Object o)	Removes the first occurrence of the specified element.
void removeElementAt(int index)	Deletes the component at the specified index.
void clone()	Creates the clone of vector.
int capacity()	Returns the capacity of vector.
int size( )	Returns the number of components in this vector.
boolean contains()	Checks whether the element is contained in vector or not.

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```
import java.util.*;
class greg
{
    public static void main(String args[])
    {
        Vector<Integer>ve=new Vector<Integer>(5);
        ve.add(10);
        ve.add(20);
        ve.add(30);
        ve.addElement(40);
        System.out.println("Elements of vector" +ve);
        System.out.println("Clone" +ve.clone());
        System.out.println("Capacity" +ve.capacity());
        System.out.println("Size" +ve.size());
        System.out.println("Firstelement" +ve.firstElement());
        System.out.println("Firstelement" +ve.lastElement());
        System.out.println("Index" +ve.indexOf(20));
        System.out.println("Contains" +ve.contains(10));
        ve.remove(0);
        System.out.println("Elements after removal" +ve);
    }
}
```

**Hashtable class in java.util package**



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- ❖ The **Hashtable** class implements a hash table, which maps keys to values.

put(key,value)	Maps the specified key to the specified value in hashtable
remove(key)	Removes the element specified at key in the hashtable
size()	Returns the number of keys in the hashtable
replace(key,value)	Replaces the value at given key in the hashtable
Boolean containsKey(key)	Checks if hashtable contains specified key or not
Boolean containsValue(value)	Checks if hashtable contains specified value or not

```
import java.util.*;
class hash1
{
    public static void main(String args[])
    {
        Hashtable<Integer,String> h=new Hashtable<Integer,String>();
        h.put(1,"abc");
        h.put(2,"xyz");
        System.out.println("Mapping" +h);
        h.put(2,"ddd");
        System.out.println("Mapping" +h);
        h.remove(2);
        System.out.println("Mapping" +h);
        System.out.println("Check key:" +h.containsKey(1));
        System.out.println("Check value: "+h.containsValue("abc"));
    }
}
```

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## Linked List class in java.util package

- ❖ Linked List is a part of the [Collection framework](#) present in [java.util package](#).
- ❖ This class is an implementation of the [LinkedList data structure](#) which is a linear data structure where the elements are not stored in contiguous locations and every element is a separate object with a data part and address part.
- ❖ The elements are linked using pointers and addresses.
- ❖ Each element is known as a node.

add(ele)	Adds the element in the linked list
addFirst(ele)	Adds the element in the first node of the linked list
addLast(ele)	Adds the element in the last node of the linked list
remove(ele)	Removes the given element from the linked list
removeFirst()	Removes the first element from the linked list
removeLast()	Removes the last element from the linked list

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```
import java.util.*;
class linked
{
    public static void main(String args[])
    {
        LinkedList<String>s=new LinkedList<String>();
        s.add("A");
        s.add("B");
        s.add("C");
        s.addLast("D");
        s.addFirst("E");
        System.out.println(s);
        s.remove("C");
        s.removeFirst();
        s.removeLast();
        System.out.println(s);
    }
}
```

## Stack class in java.util package

- ❖ Java [Collection framework](#) provides a Stack class that models and implements a **Stack data structure**.
- ❖ The class is based on the basic principle of last-in-first-out. In addition to the basic push and pop operations, the class provides three more functions of empty, search, and peek.

push(ele)	Insert the element in the stack
-----------	---------------------------------

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pop()	Removes the last element inserted in the stack
search(ele)	Searches the given element in the stack
peek()	Returns the first element of the stack
empty()	Returns the Boolean value after checking whether the stack is empty or not

```
import java.util.*;
class stack
{
    public static void main(String args[])
    {
        Stack<Integer> s=new Stack<Integer>();
        s.push(10);
        s.push(11);
        s.push(12);
        s.push(13);
        s.push(14);
        System.out.println(s);
        s.pop();
        System.out.println(s);
        System.out.println("Stack empty :"+s.empty());
        System.out.println("Search :"+s.search(11));
        System.out.println("Peek: "+s.peek());
    }
}
```

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## Queue class in java.util package

- ❖ Java [Collection framework](#) provides a Queue class that models and implements a **Queue data structure**.
- ❖ The class is based on the basic principle of First-in-first-out.

add(ele)	It is used to insert the element in the queue
remove()	Removes the head element from the queue
poll()	Used to retrieve and removes the head of queue
peek()	Returns the head element of the stack

```
import java.util.*;
class que
{
    public static void main(String args[])
    {
        PriorityQueue<String> p=new PriorityQueue<String>();
        p.add("abc");
        p.add("xyz");
        p.add("aaa");

        System.out.println("Queue ele: "+p);
        p.remove();
        System.out.println("After removal: "+p);
        System.out.println("Poll: "+p.poll());
        System.out.println("After poll:" +p);
        System.out.println("Peek: "+p.peek());
    }
}
```

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MCQ		
Sr No.	Question	Answer
1	.....class allows to insert and remove the elements unlike array	Vector
2	.....is the collection which represents element in key value form?	Hashtable
3	Which Class works on LIFO?	Stack
4	To create the queue, .....is used	Priority Queue

## Q-8 what is User define package? How to create the package

**Ans:**

- ❖ The package which is created by the user is known as User Define Package.
- ❖ Following are the steps to create the package

Step 1: Create the notepad file

```
package mypackage;
public class Demo
{
    public void display()
    {
        System.out.println("hi");
    }
}
```

Step 2: Create the folder named “mypackage” and save the above file with Demo.java

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Step 3: Create the file and import the created package

```
import mypackage.*;
public class sample
{

    Demo d=new Demo();
    d.display();
}
```

Step 4: Save the file in the root directory outside the “mypackage” folder as sample.java

Step 5: Compile Package (javac Demo.java)

Step 6: Compile the file in which you imported package (javac sample.java)

Step 7: Run the File

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## Unit-3

### Exception Handling, Threading and Streams (Input and Output)

#### Q-1 what is Exception Handling?

Ans:

- ❖ The **Exception Handling in Java** is one of the powerful *mechanism to handle the runtime errors* so that the normal flow of the application can be maintained.
- ❖ The core advantage of exception handling is **to maintain the normal flow of the application**. An exception normally disrupts the normal flow of the application; that is why we need to handle exceptions.



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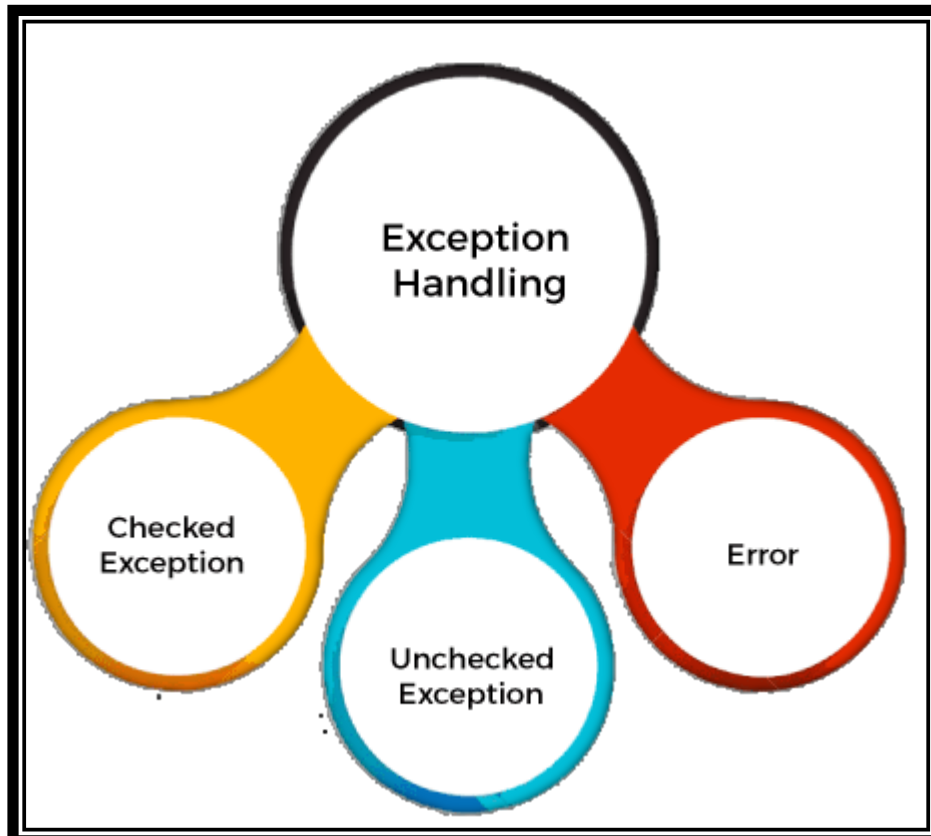
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## Types of Java Exceptions



### 1) Checked Exception:

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

### 2) UnChecked Exception:

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

### 3) Error:

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

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## Java Exception Keywords

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

```
class exc
{
    public static void main(String args[])
    {
        try
        {
            int a=5/0;
        }catch(ArithmeticException e)
        {
            System.out.println(e);
        }
        finally
        {
            System.out.println("hi");
        }
    }
}
```

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## \*\* Difference between checked and unchecked exception

Checked Exception	Unchecked Exception
1) Checked Exceptions are declared at compile time	1) Unchecked Exceptions are declared at runtime
2) This class inherits Throwable Class except Runtime Exception	2) This class inherits Runtime Exception class
3) Example: IO Exception	3) Example: Arithmetic Exception

## \*\* Difference between throw and throws in java

throw	Throws
1) throw keyword is used to throw the exception explicitly in the code, inside the function or the block of code.	1) throws keyword is used to declare the exception in the method signature
2) It is followed by an instance of the exception to be thrown	2) It is followed by the class name of exception to be thrown
3) Only 1 exception can be thrown at a time	3) We can declare multiple exceptions using throws keyword.

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MCQ	
1) Which is the superclass of all the errors and exceptions?	Throwable
2) Which keyword is used to write the code that contains error or exception?	Try
3) Which keyword is used to write the code that must be compulsory executed?	Finally
4) .....Exception is declared at compile time	Checked Exception

## Q-2 what is User Defined Exception? How to create it

### Ans:

- ❖ Creating our own Exception is known as custom exception or user-defined exception. Basically, Java custom exceptions are used to customize the exception according to user need.
- ❖ This can be done by extending the class Exception.

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```
class userdefinedexception
{
    public static void main(String args[])
    {
        try
        {
            throw new myexception(400);
        }
        catch(myexception e)
        {
            System.out.println(e);
        }
    }
}

class myexception extends Exception
{
    int n1;
    myexception(int n2)
    {
        n1=n2;
    }
    public String toString()
    {
        return ("Status: " +n1);
    }
}
```

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## MCQ

1) Creating the customized exception is known as .....	User defined exception
2) User defined exception should extend .....Class	Exception

### Q-3 what is thread? Explain life cycle of thread

#### Ans:

- ❖ A *thread* is a single sequential flow of control within a program. A process can have multiple *threads*, all executing at the same time.
- ❖ There can be more than one thread inside a process. Each thread of the same process makes use of a separate program counter
- ❖ In Java, a thread always exists in any one of the following states. These states are:
  1. New
  2. Active
  3. Blocked / Waiting
  4. Timed Waiting
  5. Terminated

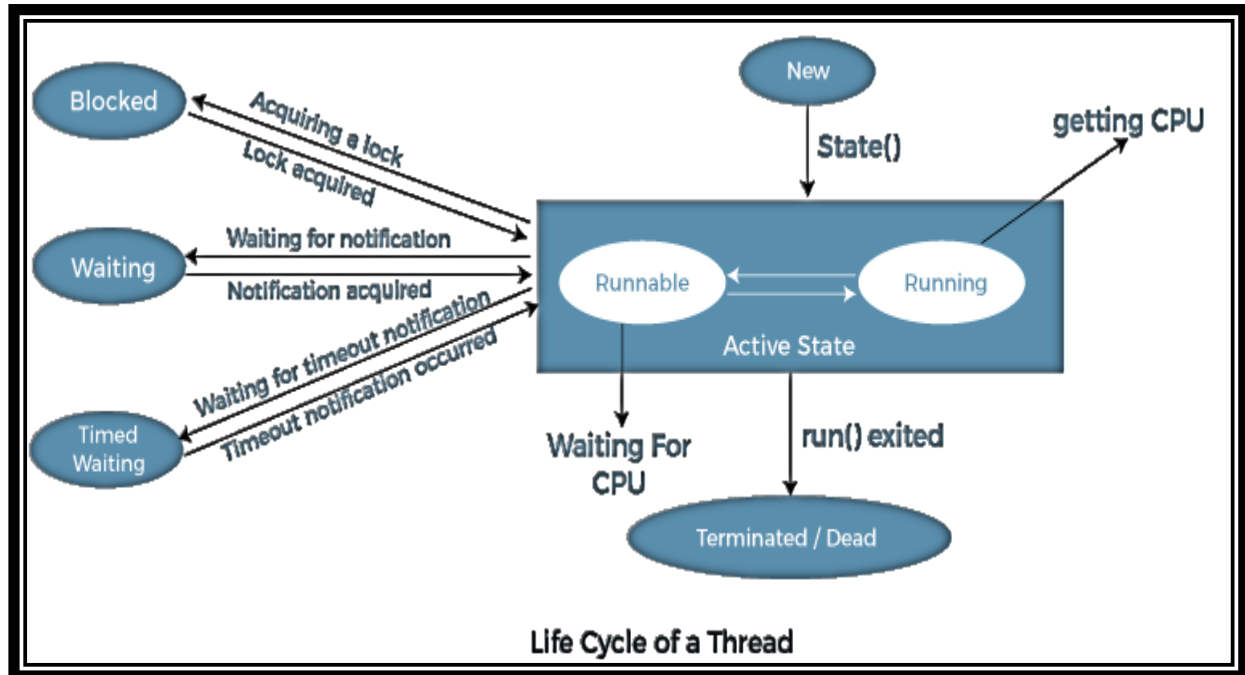
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## 1) New:

- ❖ Whenever a new thread is created, it is always in the new state. For a thread in the new state, the code has not been run yet and thus has not begun its execution.

## 2) Active:

- ❖ When a thread invokes the start() method, it moves from the new state to the active state. The active state contains two states within it: one is **runnable**, and the other is **running**.

### Runnable:

- ❖ A thread that is ready to run is then moved to the runnable state. In the runnable state, the thread may be running or may be ready to run at any given instant of time.
- ❖ It is the duty of the thread scheduler to provide the thread time to run, i.e., moving the thread the running state.

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## Running:

- ❖ When the thread gets the CPU, it moves from the runnable to the running state

## 3) Blocked/Waiting:

- ❖ Whenever a thread is inactive for a span of time (not permanently) then, either the thread is in the blocked state or is in the waiting state.
- ❖ For example, a thread (let's say its name is A) may want to print some data from the printer. However, at the same time, the other thread (let's say its name is B) is using the printer to print some data.
- ❖ Therefore, thread A has to wait for thread B to use the printer. Thus, thread A is in the blocked state.

## 4) Timed Waiting:

- ❖ Sometimes, waiting for leads to starvation. For example, a thread (its name is A) has entered the critical section of a code and is not willing to leave that critical section.
- ❖ In such a scenario, another thread (its name is B) has to wait forever, which leads to starvation. To avoid such scenario, a timed waiting state is given to thread B.
- ❖ Thus, thread lies in the waiting state for a specific span of time, and not forever.
- ❖ A real example of timed waiting is when we invoke the sleep() method on a specific thread. The sleep() method puts the thread in the timed wait state.
- ❖ After the time runs out, the thread wakes up and start its execution from when it has left earlier.

## 5) Terminated:

- ❖ A thread reaches the termination state because of the following reasons:
- ❖ When a thread has finished its job, then it exists or terminates normally.



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- ❖ **Abnormal termination:** It occurs when some unusual events such as an unhandled exception or segmentation fault.

MCQ	
1) .....is a sequential flow of the control within the program	Thread
2) There can be more than one thread inside the process (T/F)?	True
3) The active state of thread contains ..... and .....states	Runnable, Running
4) Which process occurs when some unusual events such as an unhandled exception or segmentation fault?	Abnormal Termination

**Q-4) what is Thread Class? Explain its methods.**

**Ans:**

- ❖ Thread can be created using following methods:
  - Extending Thread Class
  - Implementing Runnable interface
  - Explicitly creating thread object using Thread Class

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## 1) Extending Thread Class:

- ❖ Thread class provide constructors and methods to create and perform operations on a thread.

```
class m extends Thread
{
    public void run()
    {
        System.out.println("Running");
    }
    public static void main(String args[])
    {
        m m1=new m();
        m1.start();
    }
}
```

## 2) Implementing Runnable Interface:

- ❖ The Runnable interface should be implemented by any class whose instances are intended to be executed by a thread.
- ❖ Runnable interface have only one method named run().

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```
class m extends implements Runnable
{
    public void run()
    {
        System.out.println("Running");
    }
    public static void main(String args[])
    {
        m m1=new m();
        Thread t1=new Thread(m1);
        t1.start();
    }
}
```

### 3) Explicitly creating thread object using Thread Class:

- ❖ If we don't extend the Thread class, then object of thread class is created explicitly.

```
class m extends
{
    public static void main(String args[])
    {
        Thread t1=new Thread("First Thread");
        t1.start();
        System.out.println("Thread Name: "+t1.getName());
    }
}
```

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## Methods of Thread Class:

Methods	Description
void run()	Used to perform action for thread
void start()	Starts the execution of thread. JVM calls run() on thread
public String getName()	It is used to get the name of thread
public void setName(String)	It is used to change or set the name of the given thread.
public int getPriority()	It is used to get the priority of the thread
public int setPriority()	It is used to set the priority of the thread
public void suspend()	It is used to suspend the given thread
public void resume()	It is used to resume the suspended thread
public void sleep(long milliseconds)	Waits for a thread to die for the specified milliseconds
public void yield()	Causes currently executing thread object to temporarily pause and allow other threads to execute.
public Boolean isDaemon()	Tests if the thread is daemon thread or not

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```
class th
{

    public static void main(String args[])
    {
        Thread t1=new Thread("First Thread");
        System.out.println("Thread Priority:
"+t1.getPriority());
        t1.setPriority(6);
        t1.start();
        t1.setName("My Thread");
        System.out.println("Thread Name: "+t1.getName());
        System.out.println("Thread Priority:
"+t1.getPriority());
        System.out.println("Daemon Thread: "+t1.isDaemon());

    }
}
```

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```
class th1 extends Thread
{
    public void run()
    {
        for(int i=1;i<=5;i++)
        {
            try
            {
                Thread.sleep(1000);
            }
            catch(InterruptedException e)
            {
                System.out.println(e);
            }
            System.out.println(i);
        }
    }

    public static void main(String args[])
    {
        th1 t=new th1();
        t.start();
    }
}
```

## MCQ

1) Thread can be created by  
implementing  
.....interface

Runnable

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2) Which method of thread class moves the thread from new state to active state?	start()
3) Which method of thread class is called on the start () of thread?	run()
4) Runnable interface have only 1 method. Which is that?	run()
5) Which method causes currently executing thread object to temporarily pause and allow other threads to execute	yield()

**Q-5) Write a short note on Thread Synchronization? OR  
Write a short note on Multithreading**

**Ans:**

- ❖ Synchronization in Java is the capability to control the access of multiple threads to any shared resource.
- ❖ Java Synchronization is better option where we want to allow only one thread to access the shared resource.
- ❖ Synchronization can be achieved by:
  - Using Synchronized method
  - Using Synchronized block
  - Using Static Synchronization

**Why use Synchronization?**

- ❖ The synchronization is mainly used to

1. To prevent thread interference.

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2. To prevent consistency problem.

- ❖ Below example shows the scenario where synchronization is not there. In the below example, thread t1 and thread t2 are not synchronized so thread t1 prints table of 5 and simultaneously thread t2 prints table of 10. So in this case, synchronization is required.



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```
class table
{
    void printtable(int n)
    {
        for(int i=1;i<=5;i++)
        {
            System.out.println(n*i);
            try
            {
                Thread.sleep(500);
            }
            catch(InterruptedException e)
            {
                System.out.println(e);
            }
        }
    }
}
class mythread1 extends Thread
{
    table t;
    mythread1(table t)
    {
        this.t=t;
    }
    public void run()
    {
        t.printtable(5);
    }
}
class mythread2 extends Thread
{
    table t;
    mythread2(table t)
    {
        this.t=t;
    }
    public void run()
    {
        t.printtable(10);
    }
}
```

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```
class synch
{
    public static void main(String args[])
    {
        table o=new table();
        mythread1 t1=new mythread1(o);
        mythread2 t2=new mythread2(o);
        t1.start();
        t2.start();
    }
}
```

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## Example with synchronization:

```
class table
{
    synchronized void printable(int n)
    {
        for(int i=1;i<=5;i++)
        {
            System.out.println(n*i);
            try
            {
                Thread.sleep(500);
            }
            catch(InterruptedException e)
            {
                System.out.println(e);
            }
        }
    }
}

class mythread1 extends Thread
{
    table t;
    mythread1(table t)
    {
        this.t=t;
    }
    public void run()
    {
        t.printtable(5);
    }
}
```

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```
class mythread2 extends Thread
{
    table t;
    mythread2(table t)
    {
        this.t=t;
    }
    public void run()
    {
        t.printtable(5);
    }
}

class synch
{
    public static void main(String args[])
    {
        table o=new table();
        mythread1 t1=new mythread1(o);
        mythread2 t2=new mythread2(o);
        t1.start();
        t2.start();
    }
}
```

## MCQ

1) .....is the capability to control the access of multiple threads to any shared resource.	Synchronization
2) What are the advantages of Synchronization?	1) To reduce conflicts among threads

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2) To avoid interference among threads

## Q-6) Write a short note on Daemon and Non-Daemon Thread

**Ans:**

### Daemon Thread:

- ❖ Daemon thread in java is a low-priority thread that runs in the background to perform tasks such as garbage collection.
- ❖ Daemon thread in java is also a service provider thread that provides services to the user thread.

### Non-Daemon Thread:

- ❖ Non-Daemon thread in java is a thread that does not run in the background.
- ❖ Non-daemon thread in java are not service provider

Daemon Threads	User Threads (Non-daemon)
Daemon threads are created by JVM	User threads are created by an application itself
JVM does not wait for its execution	JVM waits until the execution completes
Low Priority threads	High priority threads
Used for background tasks(not critical)	Used for foreground tasks(critical)
Life is dependent on user threads	Life is independent

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## Q-7) what is Stream? Explain types

Ans:

- ❖ A stream is a sequence of data. In Java, a stream is composed of bytes. It's called a stream
- ❖ Java uses the concept of a stream to make I/O operation fast. The java.io package contains all the classes required for input and output operations.
- ❖ In general, a Stream will be an input stream or, an output stream.
  - **InputStream** – this is used to read data from a source.
  - **OutputStream** – this is used to write data to a destination.
- ❖ Based on the data they handle there are two types of streams –
  - **Byte Streams** – these handle data in bytes (8 bits) i.e., the byte stream classes read/write data of 8 bits. Using these you can store characters, videos, audios, images etc.
  - **Character Streams** – these handle data in 16 bit Unicode. Using these you can read and write text data only.

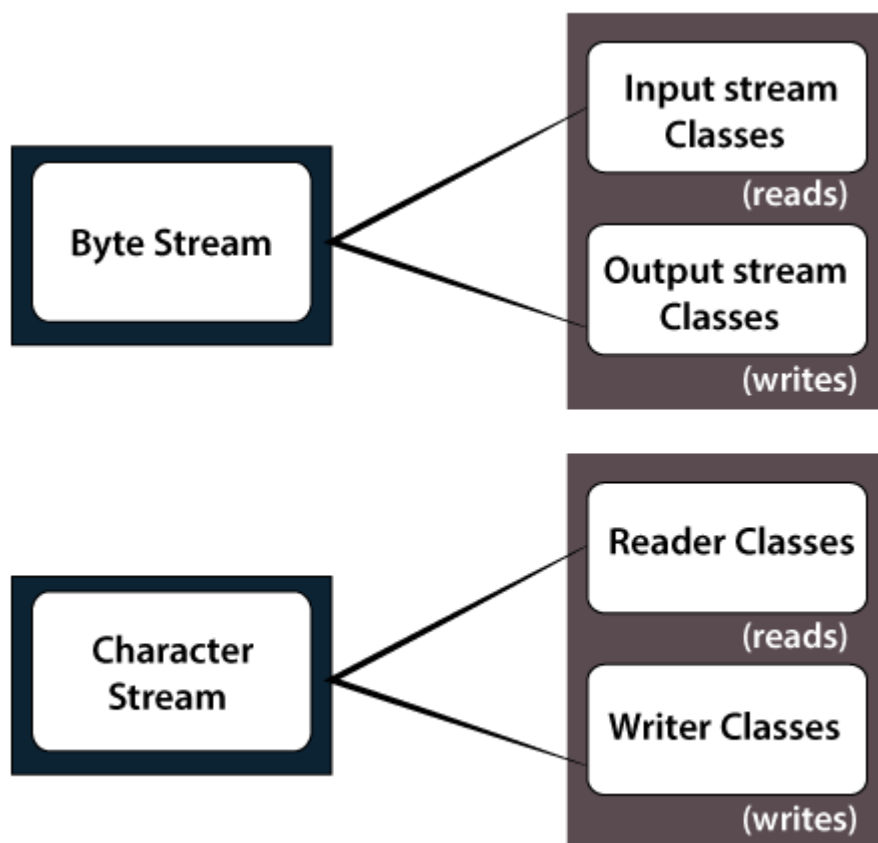
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## Brief classification of I/O streams

\*\* Difference between byte stream and character stream:

Byte Stream	Character Stream
Java Byte streams are used to perform input and output of 8-bit bytes	Java Character streams are used to perform input and output for 16-bit Unicode.
Byte stream are not tied to any data type. Data of any data type can be read	Character stream are tied to data type. Only string or character data type can be read.
Byte stream reads byte by byte	Character stream reads character by character
Byte stream are known as data streams-Data input stream and Data Output Stream	Character streams are also known as reader and writer streams.

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MCQ	
1) .....is sequence of data	Stream
2) Which package contains all the class for input and output operations?	java.io package
3) Which streams are used to perform input and output for 8-bit bytes	Byte Stream
4) Which stream are tied to data type?	Character Stream

## Q-8) what is File Class?

**Ans:**

- ❖ The File class is an abstract representation of file and directory pathname.
- ❖ A pathname can be either absolute or relative.
- ❖ The File class have several methods for working with directories and files such as creating new directories or files, deleting and renaming directories or files, listing the contents of a directory etc.



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## Example:

```
import java.io.*;
class filedemo
{
    public static void main(String args[])
    {
        File f=new File("d:\\th123.java");
        if(f.isFile())
            System.out.println("\n File Exists");
        else
            System.out.println("\n File does not exists");
    }
}
```

## File Operations in Java



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## Creating a new file:

- ❖ **Create a File** operation is performed to create a new file.
- ❖ We use the `createNewFile()` method of file.
- ❖ The `createNewFile()` method returns true when it successfully creates a new file and returns false when the file already exists.

## Example:

```
import java.io.*;
import java.io.IOException;

class crf
{
    public static void main(String args[])
    {
        try
        {
            File f=new File("D:\\hel.txt");
            if(f.createNewFile())
                System.out.println("Created");
            else
                System.out.println("Not Created");
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

## Getting the file information:

- ❖ The operation is performed to get the file information. We use several methods to get the information about the file like name, absolute path, is readable, is writable and length.

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## Example:

```
import java.io.*;
import java.io.IOException;

class crf
{
    public static void main(String args[])
    {
        File f=new File("D:\\hel.txt");
        if(f.exists())
        {
            System.out.println("Name of file: "+f.getName());
            System.out.println("Path of file:
"+f.getAbsolutePath());
            System.out.println("Path of file: "+f.length());
        }
        else
        {
            System.out.println("Does not exists");
        }
    }
}
```

## Write into file:

- ❖ In order to write data into a file, we will use the **FileWriter** class and its **write()** method together. We need to close the stream using the **close()** method to retrieve the allocated resources.

## Example:

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```
import java.io.*;
import java.io.IOException;

class crf
{
    public static void main(String args[])
    {
        try
        {
            FileWriter w=new FileWriter("d:\\hel.txt");
            w.write("Hello");
            w.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }

    }
}
```

- ❖ In order to write data into a file, we will use the **Scanner** class. Here, we need to close the stream using the **close()** method.
- ❖ We will create an instance of the Scanner class and use the **hasNextLine()** method **nextLine()** method to get data from the file.

**Example:**

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```
import java.io.*;
import java.io.FileNotFoundException;
import java.util.*;

class crf
{
    public static void main(String args[])
    {
        try
        {
            File f=new File("D:\\hel.txt");
            Scanner s=new Scanner(f);
            while(s.hasNextLine())
            {
                String fd=s.nextLine();
                System.out.println(fd);
            }
            s.close();
        }
        catch(FileNotFoundException e)
        {
            System.out.println(e);
        }
    }
}
```

## Delete from the file:

- ❖ In order to delete a file, we will use the **delete()** method of the file. We don't need to close the stream using the **close()** method because for deleting a file

## **Example:**

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```
import java.io.*;

class del
{
    public static void main(String args[])
    {
        File f=new File("D:\\hel.txt");
        if(f.delete())
            System.out.println("Deleted");
        else
            System.out.println("Not Deleted");
    }
}
```

## MCQ

1) Which method is used to create the file?	createNewFile()
2) createNewFile() must be used with .....exception	IOException
3) In order to write the data into file, which class is used?	FileWriter
4) Which class is used to read the data from the file?	Scanner
5) hasNextLine() and nextLine() are the methods of .....class	Scanner
6) .....method is used to delete the file	delete()

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## Q-9) what is Random Access File Class?

**Ans:**

- ❖ A sequential file structure is the common way where records are stored in order by the record key field.
- ❖ Random file access is the superimposed mechanism implemented through Java code to access individual records directly and quickly without searching through records in the file
- ❖ The RandomAccessFile class allows you to write programs that can seek to any location in a file and read or write data at that point.
- ❖ This type of functionality is very valuable in some programs.

Method	Description
Void close()	Close the file.
Long getFilePointer()	Returns the current position of the file pointer. This identifies the point at which the next byte is read or written.
Long length()	Returns the number of bytes in the file.
Int read()	Reads and returns a byte from the file. Waits until data is available.
Int read(byte buffer[], int index, int size)	Attempts to read size bytes from the file and places these in buffer starting at position index. Returns the number of bytes actually read. Waits until data is available.
Int read(byte buffer[])	Reads bytes form the file and places these in buffer. Returns the number of bytes read. Waits until data is available.
Void seek(long n)	Positions the file pointer at n bytes form the beginning of the file. The next read or write occurs at this position.

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Int skipBytes(int n)

Adds n to the file pointer. Returns the actual number of bytes skipped. If n is negative, no bytes are skipped.

## Example

```
import java.io.*;
class Random1
{
    public static void main(String args[])
    {
        try
        {
            RandomAccessFile f=new RandomAccessFile("test1.txt","rw");
            f.writeChar('k');
            f.writeInt(10);
            f.writeDouble(10.2);
            f.seek(0);

            System.out.println(f.readChar());
            System.out.println(f.readInt());
            System.out.println(f.readDouble());
            f.seek(2);
            System.out.println(f.readInt());
            f.close();
        }

        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```



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MCQ	
1) Random Access is used to perform .....and .....operations both simultaneously	read,write
2) In random access file, the file can be moved to any location using .....method	seek()

## Q-10) Write a short note on character stream class

**Ans:**

- ❖ The java.io package provides character stream classes to overcome the limitations of byte stream classes which can only handle 8 bit and is not compatible to work directly with characters.
- ❖ Character stream classes are used to work with 16 bit.
- ❖ Generally, character stream classes are used to read the characters from the source and write them into destination.

Classes of Character Stream	
Class	Description
BufferedReader	This class provides the methods to read characters from buffer
FileReader	This class provides the methods to read characters from the file
BufferedWriter	This class provides the methods to write the characters to the buffer
FileWriter	This class provides the methods to write the characters to the file.

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## File Reader Class and File Writer Class:

- ❖ Java FileWriter and FileReader classes are used to write and read data from text files
- ❖ Unlike FileOutputStream class, you don't need to convert string into byte array because it provides method to write string directly.

Methods of File Reader and File Writer	
Methods	Description
int read()	This method returns the integral representation of the next character present in the input.
void write()	This method is used to write the data to the output stream
void flush()	This method is used to flush the output stream
FileWriter	This class provides the methods to write the characters to the file.

## Example of File Reader and File Writer

```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileReader f=new FileReader("D:\\myf.txt");
            int i;
            while((i=f.read())!=-1)
                System.out.println((char)i);
            f.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileWriter f=new FileWriter("D:\\myf6.txt");
            f.write("Hello");
            f.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

- ❖ characters output stream (Text based) in an efficient way. The Chain-Of-Characters can be Arrays, Strings etc. The "**BufferedReader**" class is used to read stream of text from a character based input stream.
- ❖ The **BufferedReader** and **BufferedWriter** class provides support for writing and reading

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## Example of Buffered Reader and Buffered Writer:

```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileWriter f=new FileWriter("D:\\myf7.txt");
            BufferedWriter b=new BufferedWriter(f);
            f.write("Hello");
            f.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileReader f=new FileReader("D:\\myf7.txt");
            BufferedReader b=new BufferedReader(f);
            int i;
            while(i=f.read())!=-1)
            {
                System.out.println((char)i);
            }
            b.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

## MCQ

1) Character Stream class works on .....bits	16
2) BufferedReader inherits from .....	FileReader

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## Q-11) Write a short note on Byte stream class

**Ans:**

- ❖ Byte Stream classes are used to read bytes from the input stream and write bytes to the output stream. In other words, we can say that Byte Stream classes read/write the 8-bits.
- ❖ The Byte Stream classes are divided into two types of classes, i.e., Input Stream and Output Stream.

### InputStreamClass:

- ❖ The Input Stream class provides methods to read bytes from a file, console or memory. It is an abstract class and can't be instantiated.
- ❖ The subclass of Input Stream class are:

SN	Class	Description
1	<a href="#"><u>BufferedInputStream</u></a>	This class provides methods to read bytes from the buffer.
2	<a href="#"><u>ByteArrayInputStream</u></a>	This class provides methods to read bytes from the byte array.
3	<a href="#"><u>DataInputStream</u></a>	This class provides methods to read Java primitive data types.
4	<a href="#"><u>FileInputStream</u></a>	This class provides methods to read bytes from a file.
5	<a href="#"><u>FilterInputStream</u></a>	This class contains methods to read bytes from the other input streams, which are used as the primary source of data.
6	<a href="#"><u>ObjectInputStream</u></a>	This class provides methods to read objects.

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7	<a href="#"><u>PipedInputStream</u></a>	This class provides methods to read from a piped output stream to which the piped input stream must be connected.
---	---	---

Methods of File InputStream	
Methods	Description
<b>int read()</b>	It is s used to read the byte from the current stream
<b>void flush()</b>	<b>This method is used to flush the input stream</b>
<b>void close()</b>	<b>It is used to close the input stream</b>

## OutputStreamClass:

- ❖ The **Java.io.OutputStream** class is the superclass of all classes representing an output stream of bytes. An output stream accepts output bytes and sends them to some sink.

SN	Class	Description
1	<a href="#"><u>BufferedOutputStream</u></a>	This class provides methods to write bytes in the buffer.
2	<a href="#"><u>ByteArrayOutputStream</u></a>	This class provides methods to write bytes from the byte array.
3	<a href="#"><u>DataOutputStream</u></a>	This class provides methods to write Java primitive data types.
4	<a href="#"><u>FileOutputStream</u></a>	This class provides methods to write bytes in a file.
5	<a href="#"><u>FilterOutputStream</u></a>	This class contains methods to write bytes in the other input streams, which are used as the primary source of data.

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6	<a href="#"><u>ObjectOutputStream</u></a>	This class provides methods to write objects.
7	<a href="#"><u>PipedOutputStream</u></a>	This class provides methods to write in a piped output stream to which the piped input stream must be connected.

Methods of File OutputStream	
Methods	Description
<b>int write()</b>	It is s used to write the byte in the current stream
<b>void flush()</b>	<b>This method is used to flush the output stream</b>
<b>void close()</b>	<b>It is used to close the output stream</b>

## FileInputStreamClass

- ❖ Java FileInputStream class obtains input bytes from a file.
- ❖ It is used for reading byte-oriented data (streams of raw bytes) such as image data, audio, video etc.

Methods of File Input Stream	
Methods	Description
<b>int read()</b>	It is s used to read the byte from the current stream
<b>void flush()</b>	<b>This method is used to flush the input stream</b>
<b>void close()</b>	<b>It is used to close the input stream</b>

## FileOutputStreamClass

- ❖ FileOutputStream is an output stream used for writing data to a file.
- ❖ If you have to write primitive values into a file, use FileOutputStream class.
- ❖ You can write byte-oriented as well as character-oriented data through FileOutputStream class.



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## Methods of File Output Stream

Methods	Description
<b>int write()</b>	It is used to write the byte in the current stream
<b>void flush()</b>	<b>This method is used to flush the output stream</b>
<b>void close()</b>	<b>It is used to close the output stream</b>

## Example of FileOutputStream and FileInputStream:

```
import java.io.*;

class inp
{
    public static void main(String args[])
    {
        try
        {
            FileOutputStream f=new
FileOutputStream("D:\\myf9.txt");
            f.write(10);
            FileInputStream f1=new FileInputStream("D:\\myf9.txt");
            int i;
            while((i=f1.read())!=-1)
            {
                System.out.println(i);
            }
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

## DataInputStreamClass and DataOutputStream Class:

- ❖ The DataInputStream class read primitive Java data types from an underlying input stream in a machine-independent way. While the DataOutputStream class write primitive Java data types to an output stream in a portable way.

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## Example of DataInputStream and DataOutputStream:

```
import java.io.*;
class da
{
    public static void main(String args[])throws IOException
    {
        FileOutputStream f=new
FileOutputStream("D:\\myf10.txt");
        DataOutputStream f1=new DataOutputStream(f);
        f1.write(10);
        FileInputStream f2=new FileInputStream("D:\\myf10.txt");
        DataInputStream f3=new DataInputStream(f2);
        int i;
        while((i=f3.read())!=-1)
        {
            System.out.println(i);
        }

        f1.close();
        f3.close();
    }
}
```

## Program: Write a program to copy the data of one file into another file

```
import java.io.*;
class cop
{
    public static void main(String args[])throws IOException
    {
        FileInputStream f=new FileInputStream("D:\\myf1.txt");
        FileOutputStream f1=new
FileOutputStream("D:\\copy.txt");
        int i;
        while((i=f.read())!=-1)
        {
            f1.write((char)i);
        }
        f.close();
        f1.close();
    }
}
```

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## MCQ

1) Byte stream class works on .....bits	8 ibts
2) Which subclass of byte stream class is used to read and write the primitive data types	DataInputStream and DataOutputStream

### Q-12) Write a short note on Stream Tokenizer Class

#### Ans:

- ❖ The **Java.io.StreamTokenizer** class takes an input stream and parses it into "tokens", allowing the tokens to be read one at a time.
- ❖ The stream tokenizer can recognize identifiers, numbers, quoted strings, and various comment styles.
- ❖ For StreamTokenizer, the source is a character stream, Reader.
- ❖ Following constant variables used to decide the type of the token:

int ttype	When the nextToken() returns a token, this field can be used to decide the type of the token.
int TT_EOF	This field is used to know the end of file is reached.
int TT_EOL	This field is used to know the end of line is reached.
int TT_NUMBER	This field is used to decide the token returned by the nextToken() method is a number or not.
int TT_WORD	This field is used to decide the token returned by the nextToken() method is a word or not.
String sval	If the token is a word, this filed contains the word that can be used in programming.
double nval	If the token is a word, this filed contains the number that can be used in programming.

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```
import java.io.*;

class stto
{
    public static void main(String args[])throws IOException
    {
        FileReader r=new FileReader("D:\\myf1.txt");
        StreamTokenizer st=new StreamTokenizer(r);
        double sum=0;
        int n=0;
        while(st.nextToken()!=st.TT_EOF)
        {
            if(st.ttype==StreamTokenizer.TT_NUMBER)
                sum=sum+st.nval;
            else if(st.ttype==StreamTokenizer.TT_WORD)
                n++;
        }
        System.out.println("Sum:" +sum);
        System.out.println("Total Words: "+n);
    }
}
```

## MCQ

1) Which class takes an input stream and parses it in to tokens?	Stream Tokenizer
2) Which constant is used to indicate type of token?	ttype
3) TT_EOF indicates .....	End of File
4) Which constant is used to check whether the returned token is number or not?	TT_NUMBER
5) Which constant is used to check whether the returned token is word or not?	TT_WORD

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## Q-13) Write a short note on Piped Input and Output Stream

**Ans:**

- ❖ The PipedInputStream and PipedOutputStream classes can be used to read and write data simultaneously.
- ❖ Both streams are connected with each other using the connect() method of the PipedOutputStream class.

```
import java.io.*;

class pipe
{
    public static void main(String args[])
    {
        PipedOutputStream out=new PipedOutputStream();
        PipedInputStream in=new PipedInputStream();
        try
        {
            in.connect(out);
            out.write(23);
            out.write(24);
            for(int i=0;i<2;i++)

                System.out.println(in.read());
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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## MCQ

1) Which method is used to connect piped input stream with piped output stream	connect()
2) What is main Feature of piped stream?	Allows to read and write the data simultaneously

### Q-14) Write a short note on Bridge Class

**Ans:**

#### **InputStreamReader:**

- ❖ An InputStreamReader is a bridge from byte streams to character streams: It reads bytes and decodes them into characters using a specified charset.

```
import java.io.*;
class br
{
    public static void main(String args[])throws IOException
    {
        FileInputStream f=new FileInputStream("D:\\myf3.txt");
        InputStreamReader r=new InputStreamReader(f);
        int i;
        while((i=r.read())!=-1)
        {
            System.out.println((char)i);
        }
        r.close();
    }
}
```

- ❖ OutputStreamWriter is a which is used to convert character stream to byte stream, the characters are encoded into byte using a specified

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charset. write() method calls the encoding converter which converts the character into bytes.

```
import java.io.*;
class br
{
    public static void main(String args[])throws IOException
    {
        FileOutputStream f=new
FileOutputStream("D:\\myf100.txt");
        OutputStreamWriter w=new OutputStreamWriter(f);
        w.write("hello world");
        w.close();
    }
}
```

## ObjectInputStream and ObjectOutputStream:

- ❖ The objectinputstream class is mainly used to deserialize the primitive data and objects which are written by using ObjectOutputStream.

```
import java.io.*;
class br
{
    public static void main(String args[])throws IOException
    {
        int i=10;
        FileOutputStream f=new FileOutputStream("d:\\myfile101.txt");
        ObjectOutputStream o=new ObjectOutputStream(f);
        o.writeInt(i);

        FileInputStream f1=new FileInputStream("d:\\myfile101.txt");
        ObjectInputStream o1=new ObjectInputStream(f1);
        System.out.println("Integer:" +o1.readInt());
;
        f.close();
        f1.close();
    }
}
```

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## MCQ

1) .....class is used to convert byte stream to character stream class?

InputStreamReader

2) Which class is used to convert character stream to byte stream class?

OutputStreamWriter



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## Unit-4

### Applet and Layout Managers

#### **Q-1 what is Applet? Explain life cycle of Applet**

**Ans:**

- ❖ In Java, an applet is a special type of program embedded in the web page to generate dynamic content.
- ❖ Applet is a class in java.
- ❖ Appletviewer is a program that can run applet
- ❖ In java, non-applet programs are called applications.
- ❖ The Applet package is the package that is specially designed for working with applets.

**Advantage:**

- 1) It works at client side so less time
- 2) Secured
- 3) It can be executed by browsers running under many platforms, including Linux, Mac OS etc

<b>Java Application</b>	<b>Applet</b>
1) Java application contains main()	1) Applet does not contain main()
2) Does not require internet connection to execute	2) Requires internet connection to execute
3) It is stand alone application	3) It is a part of web page.
4) Can be executed without browser	4) Requires compatible browser
5) Used for Console Programs	5) Used for GUI Interfaces

**Applet Life Cycle:**

- ❖ The applet life cycle can be defined as the process of how the object is created, started, stopped, and destroyed during the entire execution of its application. It basically has five core methods namely init(), start(), stop(), paint() and destroy(). These methods are invoked by the browser to execute.

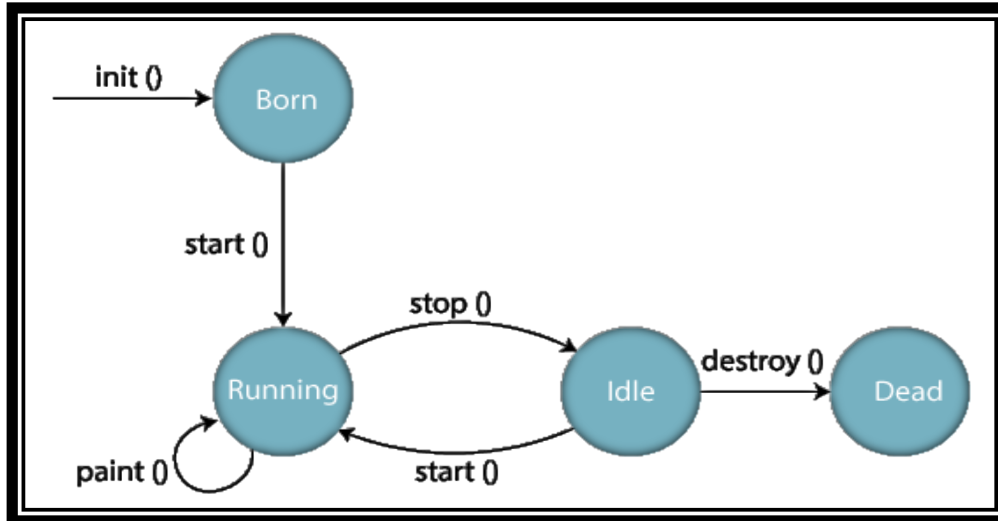
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❖ Following are the methods that are executed during life cycle of an applet.

## 1) **init():**

- ❖ It is used to initialize the applet
- ❖ It is invoked when applet is first loaded
- ❖ It is invoked only once

## 2) **start():**

- ❖ It is invoked after the `init()`
- ❖ It is invoked when the applet is started or restarted

## 3) **paint():**

- ❖ This method is invoked immediately after the `start()`
- ❖ It is called anytime when the applet needs to repaint itself in the browser.

## 4) **stop():**

- ❖ It is used to stop the applet
- ❖ It is invoked when the applet stop or browser is minimized

## 5) **destroy():**

- ❖ It is used to destroy the applet
- ❖ It is invoked only once
- ❖ It is invoked when the browser unloads the applet

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```
import java.applet.*;
import java.awt.*;
/*<applet code="ap" width=200 height=200>
</applet>*/
public class ap extends Applet {
String msg="";
public void init()
{
msg+="init()called";
}
public void start()
{
msg+="start() called";
}
public void paint(Graphics g)
{
g.drawString(msg,30,30);
}
public void stop()
{
msg+="stop() called";
}
public void destroy()
{
msg+="destroy called";
}
}
```

## MCQ

1) An ..... is a special type of program embedded in the web page to generate dynamic content...

applet

2) .....method of the applet is used to initialize the applet

init()

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3) .....method of the applet is used to repaint in the browser	paint()
4) .....method of applet is used to stop the applet	stop()

## Q-2 How to pass parameters in Applet.

### Ans:

- ❖ To pass the parameters to the Applet we need to use the **param** attribute of **<applet>** tag.
- ❖ To retrieve a parameter's value, we need to use the **getParameter()** method of **Applet** class.

```
import java.applet.*;
import java.awt.*;
/*<applet code="par" width=200 height=100>
<param name="Stuname" value="xyz">
<param name="roll" value="12">
</applet>*/

public class par extends Applet
{
    String name1;
    String roll;
    Font f1;
    public void init()
    {
        f1=new Font("Arial",Font.BOLD,32);
        name1=getParameter("Stuname");
        roll=getParameter("roll");
    }
    public void paint(Graphics g)
    {
        g.setFont(f1);
        g.drawString("Name:" + name1,50,20);
        g.drawString("Roll:" +roll,250,20);
    }
}
```

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## MCQ

1) Which method is used to get the parameter when the parameters are passed in the applet	getParameter()
---	----------------

### Q-3 Write a short note on graphics class

**Ans:**

❖ Following is the list of graphics class:

- Flow Layout
- Border Layout
- Card Layout
- Grid Layout
- GridBag Layout

### Flow Layout

❖ The Java FlowLayout class is used to arrange the components in a line, one after another (in a flow). It is the default layout of the applet or panel

```
import java.applet.*;
import java.awt.*;
/*<applet code="flowl" width=200 height=200>
</applet>*/
```

```
public class flowl extends Applet
{
    Label b1,b2,b3;
    public void init()
    {
        setLayout(new FlowLayout());
        b1=new Label("OK");
        b2=new Label("Open");
        b3=new Label("Close");
        add(b1);
        add(b2);
        add(b3);
    }
}
```

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## Border Layout:

- ❖ The BorderLayout is used to arrange the components in five regions: north, south, east, west, and center. Each region (area) may contain one component only. It is the default layout of a frame or window. The BorderLayout provides five constants for each region:

1. **public static final int NORTH**
2. **public static final int SOUTH**
3. **public static final int EAST**
4. **public static final int WEST**
5. **public static final int CENTER**

```
import java.applet.*;
import java.awt.*;
/*<applet code="flow1" width=200 height=200>
</applet>*/

public class flow1 extends Applet
{
    Button b1,b2,b3,b4,b5;
    public void init()
    {
        setLayout(new BorderLayout());
        b1=new Button("NORTH");
        b2=new Button("SOUTH");
        b3=new Button("EAST");
        b4=new Button("WEST");
        b5=new Button("CENTER");
        add(b1, BorderLayout.NORTH);
        add(b2, BorderLayout.SOUTH);
        add(b3, BorderLayout.EAST);
        add(b4, BorderLayout.WEST);
        add(b5, BorderLayout.CENTER);
    }
}
```

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## Card Layout:

- ❖ The **Java CardLayout** class manages the components in such a manner that only one component is visible at a time. It treats each component as a card that is why it is known as CardLayout.

## Example:

```
import java.applet.*;
import java.awt.*;
import java.awt.event.*;

/*<applet code="card" width=200 height=200>
</applet>*/

public class card extends Applet
{
    Button b1,b2,b3;
    Font f;

    public void init()
    {
        f=new Font("Arial", Font.BOLD,32);
        setLayout(new CardLayout);
        b1=new Button("OK");
        b2=new Button("Cancel");
        b3=new Button("Close");
        b1.setFont(f);
        b2.setFont(f);
        b3.setFont(f);
        add(b1);
        add(b2);
        add(b3);
    }
}
```

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```
import java.applet.*;
import java.awt.*;

/*<applet code="gri" width=200 height=200>
</applet>*/

public class gri extends Applet
{
    Button b1,b2,b3,b4,b5;
    Font f;
    public void init()
    {
        setLayout(new GridLayout(3,3));
        f=new Font("Arial",Font.BOLD,32);
        b1=new Button("1");
        b2=new Button("2");
        b3=new Button("3");
        b4=new Button("4");
        b5=new Button("5");
        b1.setFont(f);
        b2.setFont(f);
        b3.setFont(f);
        b4.setFont(f);
        b5.setFont(f);
        add(b1);
        add(b2);
        add(b3);
        add(b4);
        add(b5);
    }
}
```



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## Example:

```
import java.applet.*;
import java.awt.*;

/*<applet code="gri" width=200 height=200>
</applet>*/

public class gri extends Applet
{
    Button b1,b2;
    public void init()
    {
        setLayout(new GridBagLayout());
        Button b1=new Button("Ok");
        Button b2=new Button("Cancel");
        Button b3=new Button("Close");
        Button b4=new Button("Hi");
        GridBagConstraints gc=new GridBagConstraints();
        gc.fill=GridBagConstraints.HORIZONTAL;
        gc.gridx=0;
        gc.gridy=0;
        this.add(b1,gc);
        gc.gridx=0;
        gc.gridy=1;
        this.add(b2,gc);
        gc.gridx=1;
        gc.gridy=0;
        this.add(b3,gc);
        gc.gridx=2;
        gc.gridy=2;
        gc.gridwidth=2;
        this.add(b4,gc);
    }
}
```

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## MCQ

1) Which layout is used to arrange the components line by line?	FlowLayout
2) Which layout can arrange the components in different 5 areas?	BorderLayout
3) In which layout only 1 component is displayed at one time?	Card Layout
4) Which layout arranges the components in row and columns?	Grid Layout

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## Unit-5:

### GUI using swing and Event Handling

#### **Q-1 what is Awt? What is Swing?**

**Ans:**

**Awt:**

- ❖ AWT and Swing are used to develop window-based applications in Java.
- ❖ Awt is an abstract window toolkit that provides various component classes like Label, Button, TextField, etc., to show window components on the screen. All these classes are part of the Java.awt package.

**Swing:**

- ❖ On the other hand, Swing is the part of JFC (Java Foundation Classes) built on the top of AWT and written entirely in [Java](#). The javax.swing API provides all the component classes like JButton, JTextField, JCheckbox, JMenu, etc.
- ❖ The components of Swing are platform-independent, i.e., swing doesn't depend on the operating system to show the components. Also, the Swing's components are lightweight.

MCQ	
1) .....is a window toolkit that provides various components like babel, button, textfield etc.	AWT
2) .....is the part of JFC built on top of AWT and written entirely in java	Swing

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3) JFC stands for .....	Java Foundation Class
4) The components of swing are platform independent (T/F)?	True

## Q-2 Differentiate Awt and Swing Components

**Ans:**

### Difference between Awt and Swing Components:

Awt Components	Swing Components
1) Awt components classes are provided by jawa.awt package	1) Swing components are provided by javax.swing package
2) The Components used in AWT are mainly dependent on the operating system.	The Components used in Swing are not dependent on the operating system. It is completely scripted in Java.
3) The AWT is heavyweight since it uses the resources of the operating system.	3) The Swing is mostly lightweight since it doesn't need any Operating system object for processing. The Swing Components are built on the top of AWT.
4) The Appearance of AWT Components is mainly not configurable. It generally depends on the operating system's look and feels.	4) The Swing Components are configurable and mainly support pluggable look and feel
5) The Java AWT provides a smaller number of components in comparison to Swing.	5) Java Swing provides a greater number of components than AWT, such as list, scroll panes, tables, color choosers, etc.
6) Java AWT has 21 peers There is one peer for each control Peers are provided by the operating system in the form of widgets themselves.	6) Java Swing has only one peer in the form of OS's window object, which provides the drawing surface used to draw the Swing's widgets
7) Java AWT needs a higher amount of memory for the execution.	7) Java Swing needs less memory space as compared to Java AWT.

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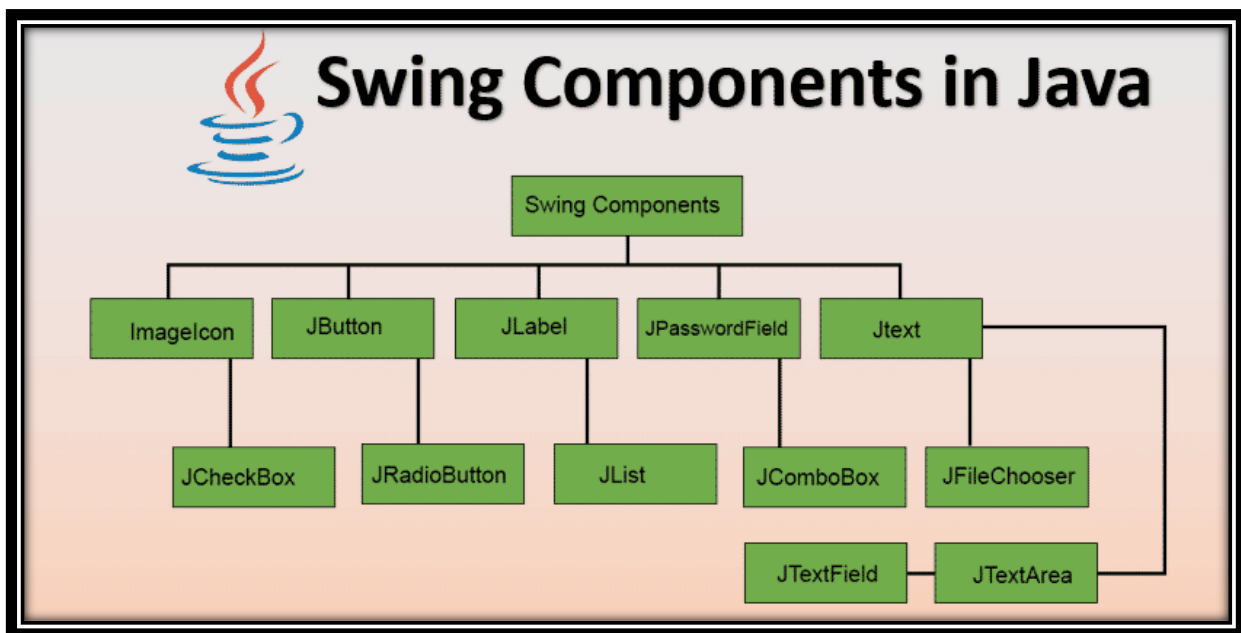
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8) Java AWT is slower than swing in terms of performance.

8) Java Swing is faster than the AWT.

## Q-3 Write a short note on Swing Components:

Ans:



### 1) Image Icon:

- ❖ The ImageIcon component creates an icon sized-image from an image residing at the source URL.

#### Example:

```
ImageIcon homeIcon = new  
ImageIcon("src/images/home.jpg");
```

- ❖ This returns an icon of a home button. The string parameter is the path at which the source image is present.

### 2) JButton:

- ❖ JButton class is used to create a push-button on the UI.
- ❖ The button can contain some display text or image.

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- ❖ It generates an event when clicked and double-clicked.
- ❖ A JButton can be implemented in the application by calling one of its constructors.

## Example:

```
JButton okBtn = new JButton("Ok");
```

- ❖ This constructor returns a button with text Ok on it.

```
JButton homeBtn = new JButton(homeIcon);
```

- ❖ It returns a button with a homeIcon on it.

```
JButton btn2 = new JButton(homeIcon, "Home");
```

## 3) JLabel:

- ❖ JLabel class is used to render a read-only text label or images on the UI. It does not generate any event.

## Example:

```
JLabel textLbl = new JLabel("This is a text label.");
```

- ❖ This constructor returns a label with text.

```
JLabel imgLabel = new JLabel(homeIcon);
```

- ❖ It returns a label with a home icon.

## 4) JTextField:

- ❖ JTextField renders an editable single-line text box.
- ❖ A user can input non-formatted text in the box.
- ❖ To initialize the text field, call its constructor and pass an optional integer parameter to it. This parameter sets the width of the box measured by the number of columns.
- ❖ It does not limit the number of characters that can be input in the box.

## Example:

```
JTextField txtBox = new JTextField(20);
```

- ❖ It renders a text box of 20 column width.

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## 5) JTextArea:

- ❖ JTextArea class renders a multi-line text box. Similar to the JTextField, a user can input non-formatted text in the field.
- ❖ The constructor for JTextArea also expects two integer parameters which define the height and width of the text-area in columns.
- ❖ It does not restrict the number of characters that the user can input in the text-area.

### Example:

```
JTextArea txtArea = new JTextArea("This text is default text for text area.", 5, 20);
```

- ❖ The above code renders a multi-line text-area of height 5 rows and width 20 columns, with default text initialized in the text-area.

## 6) JPasswordField:

- ❖ JPasswordField is a subclass of JTextField class. It renders a text-box that masks the user input text with bullet points. This is used for inserting passwords into the application.

### Example:

```
JPasswordField pwdField = new JPasswordField(15);  
var pwdValue = pwdField.getPassword();
```

- ❖ It returns a password field of 15 column width. The getPassword method gets the value entered by the user.

## 7) JCheckBox:

- ❖ JCheckBox renders a check-box with a label. The check-box has two states – on/off. When selected, the state is on and a small tick is displayed in the box.

### Example:

```
CheckBox chkBox = new JCheckBox("Show Help", true);
```

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- ❖ It returns a checkbox with the label Show Help. The second parameter in the constructor. It is a boolean value that indicates the default state of the check-box. True means the check-box is defaulted to on state.

## 8) JRadioButton:

- ❖ JRadioButton is used to render a group of radio buttons in the UI. A user can select one choice from the group.

### Example:

```
ButtonGroup radioGroup = new ButtonGroup();  
JRadioButton rb1 = new JRadioButton("Easy", true);  
JRadioButton rb2 = new JRadioButton("Medium");  
JRadioButton rb3 = new JRadioButton("Hard");  
radioGroup.add(rb1);  
radioGroup.add(rb2);  
radioGroup.add(rb3);
```

- ❖ The above code creates a button group and three radio button elements. All three elements are then added to the group. This ensures that only one option out of the available options in the group can be selected at a time.

## 9) JList:

- ❖ JList component renders a scrollable list of elements. A user can select a value or multiple values from the list. This select behavior is defined in the code by the developer.

### Example:

```
DefaultListItem cityList = new DefaultListItem();  
cityList.addElement("Mumbai");  
cityList.addElement("London");  
cityList.addElement("New York");  
cityList.addElement("Sydney");  
cityList.addElement("Tokyo");
```



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```
JList cities = new JList(cityList);  
cities.setSelectionModel(ListSelectionModel.SINGLE_SELECTION);
```

- ❖ The above code renders a list of cities with 5 items in the list
- ❖ . The selection restriction is set to SINGLE\_SELECTION. If multiple selections is to be allowed, set the behaviour to MULTIPLE\_INTERVAL\_SELECTION.

## 10) JComboBox:

- ❖ JComboBox class is used to render a dropdown of the list of options.

### Example:

```
String[] cityStrings = { "Mumbai", "London", "New York", "Sydney",  
"Tokyo" };  
JComboBox cities = new JComboBox(cityList);  
cities.setSelectedIndex(3);
```

- ❖ The default selected option can be specified through the setSelectedIndex method. The above code sets Sydney as the default selected option.

## 11) JFileChooser

- ❖ JFileChooser class renders a file selection utility. This component lets a user select a file from the local system.

### Example:

```
JFileChooser fileChooser = new JFileChooser();  
JButton fileDialogBtn = new JButton("Select File");  
fileDialogBtn.addActionListener(new ActionListener(){  
fileChooser.showOpenDialog();  
})  
var selectedFile = fileChooser.getSelectedFile();
```

- ❖ The above code creates a file chooser dialog and attaches it to the button.
- ❖ The button click would open the file chooser dialog.
- ❖ The selected file is returned through the getSelectedFile method.

## 12) JTabbedPane:

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- ❖ JTabbedPane is another very useful component that lets the user switch between tabs in an application. This is a highly useful utility as it lets the user browse more content without navigating to different pages.

## Example:

```
JTabbedPane tabbedPane = new JTabbedPane();  
tabbedPane.addTab("Tab 1", new JPanel());  
tabbedPane.addTab("Tab 2", new JPanel());
```

- ❖ The above code creates a two tabbed panel with headings Tab 1 and Tab 2.

## 13) JSlider:

- ❖ JSlider component displays a slider which the user can drag to change its value. The constructor takes three arguments – minimum value, maximum value, and initial value.

## Example:

```
JSlider volumeSlider = new JSlider(0, 100, 50);  
var volumeLevel = volumeSlider.getValue();
```

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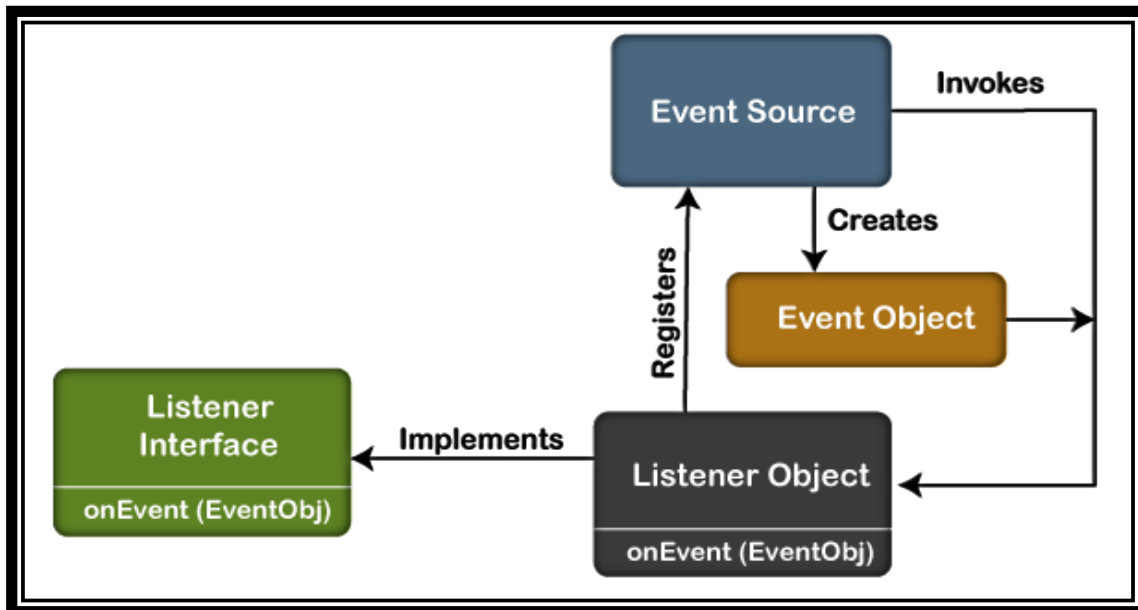


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## Q-3 Write a short note on Event Delegation Model

Ans:



- ❖ It defines a standard and compatible mechanism to generate and process events. In this model, a source generates an event and forwards it to one or more listeners. The listener waits until it receives an event.
- ❖ Once it receives the event, it is processed by the listener and returns it. The UI elements are able to delegate the processing of an event to a separate function.
- ❖ The key advantage of the Delegation Event Model is that the application logic is completely separated from the interface logic.
- ❖ In this model, the listener must be connected with a source to receive the event notifications. Thus, the events will only be received by the listeners who wish to receive them.
- ❖ Basically, an Event Model is based on the following three components:
  - Events
  - Events Sources
  - Events Listeners

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## Events

- ❖ The Events are the objects that define state change in a source.
- ❖ An event can be generated as a reaction of a user while interacting with GUI elements. Some of the event generation activities are moving the mouse pointer, clicking on a button, pressing the keyboard key etc

## Event Sources

- ❖ A source is an object that causes and generates an event. It generates an event when the internal state of the object is changed. The sources are allowed to generate several different types of events.

## Event Listeners

- ❖ An event listener is an object that is invoked when an event triggers.

The listeners require two things; first, it must be registered with a source; however, it can be registered with several resources to receive notification about the events. Second, it must implement the methods to receive and

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## Example:

```
import javax.swing.*;
import java.awt.event.*;

public class ac1 implements ActionListener
{
    JTextField t;
    ac1()
    {
        JFrame f=new JFrame();

        JButton b1=new JButton("Submit");
        b1.setBounds(80,200,80,30);
        t=new JTextField();
        t.setBounds(80,250,80,30);

        f.add(b1);
        f.add(t);
        b1.addActionListener(this);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void actionPerformed(ActionEvent e)
    {
        t.setText("Hello World");
    }
    public static void main(String args[])
    {
        ac1 a=new ac1();
    }
}
```

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MCQ	
1) Which are components of event delegation model?	Event, Event Source, Event Listener
2) Event Listener must be registered with event source? (T/F)?	True

## Q-3 Write a short note on Event packages OR

Write a short note on Awt and swing Event Package

### Ans:

- ❖ The java.awt.event package defines classes and interfaces used for event handling in the AWT and Swing. The members of this package fall into three categories:

### Event Class:

- ❖ The classes with names ending in "Event" represent specific types of events, generated by the AWT or by one of the AWT or Swing components.

### Listeners:

- ❖ The interfaces in this package are all event listeners; their names end with "Listener". These interfaces define the methods that must be implemented by any object that wants to be notified when a particular event occurs.
- ❖ **There is a listener interface for each Event Class.**

### Adapters:

- ❖ Java adapter classes *provide the default implementation of listener interfaces*. If you inherit the adapter class, you will not be forced to provide the implementation of all the methods of listener interfaces. So it *saves code*.

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## Java Event classes and Listener interfaces

Event Classes	Listener Interfaces
ActionEvent	ActionListener
MouseEvent	MouseListener and MouseMotionListener
MouseWheelEvent	MouseWheelListener
KeyEvent	KeyListener
ItemEvent	ItemListener
TextEvent	TextListener
AdjustmentEvent	AdjustmentListener
WindowEvent	WindowListener
ComponentEvent	ComponentListener
ContainerEvent	ContainerListener
FocusEvent	FocusListener

### 3) Action Event:

- ❖ The ActionEvent is generated when button is clicked or the item of a list is double clicked.
- ❖ It is notified against ActionEvent.
- ❖ The ActionListener interface is found in java.awt.event package.
- ❖ It has only one method: actionPerformed().

#### actionPerformed():

- ❖ The actionPerformed() method is invoked automatically whenever you click on the registered component.

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```
import javax.swing.*;
import java.awt.event.*;

public class buttoncli implements ActionListener
{
    JFrame f;
    JButton b;
    JTextField t;

    buttoncli()
    {
        f=new JFrame();
        b=new JButton("Submit");
        b.setBounds(100,150,100,20);
        t=new JTextField();
        t.setBounds(150,100,50,20);
        t.addActionListener(this);
        f.add(b);
        f.add(t);
        f.setSize(400,400);
        f.setVisible(true);
        f.setLayout(null);
    }

    public void actionPerformed(ActionEvent e)
    {
        t.setText("Hello World");
    }

    public static void main(String args[])
    {
        buttoncli c=new buttoncli();
    }
}
```



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```
import javax.swing.*;
import java.awt.event.*;

public class check implements ItemListener
{
    JFrame f;
    JCheckBox c1,c2;
    JLabel l;
    check()
    {
        f=new JFrame();
        l=new JLabel();
        l.setBounds(50,100,50,50);
        c1=new JCheckBox("C#");
        c1.setBounds(100,150,50,50);
        c2=new JCheckBox("Java");
        c2.setBounds(100,250,50,50);
        c1.addItemListener(this);
        c2.addItemListener(this);
        f.add(c1);
        f.add(c2);
        f.add(l);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void itemStateChanged(ItemEvent e)
    {
        if(e.getSource()==c1)
            l.setText("Checkbox 1 checked");
        else
            l.setText("Checkbox 2 checked");
    }

    public static void main(String args[])
    {
        check e=new check();
    }
}
```

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## 5) Focus Event:

- ❖ A low-level event which indicates that a component has gained or lost the input focus
- ❖ The ItemListener interface is found in java.awt.event package.
- ❖ It has only two methods: focusGained() and focusLost()

### **focusGained():**

- ❖ This method is invoked automatically whenever any component gains the focus.

### **focusLost()**

- ❖ This method is invoked automatically when window is closed. The focus is lost when the window is closed.

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```
import javax.swing.*;
import java.awt.event.*;

public class focus1 implements FocusListener
{
    JFrame f;
    JTextField tf;

    focus1()
    {
        f=new JFrame();
        tf=new JTextField();
        tf.setBounds(80,150,80,80);
        tf.addFocusListener(this);
        f.add(tf);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void focusGained(FocusEvent e)
    {
        tf.setText("Focus Gained");
    }
    public void focusLost(FocusEvent e)
    {
        tf.setText("Focus Lost");
    }

    public static void main(String args[])
    {
        focus1 f=new focus1();
    }
}
```

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## 6) Adjustment Event:

- ❖ The adjustment event emitted by Adjustable objects like Scrollbar and Scroll Pane.
- ❖ When the user changes the value of the scrolling component, it receives an instance of Adjustment Event.
- ❖ It has only one method: `adjustmentValueChanged()`

### `adjustmentValueChanged():`

- ❖ This method is invoked automatically to get the value of scrolling
- ❖

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```
import javax.swing.*;
import java.awt.event.*;

public class adjus implements AdjustmentListener
{
    JFrame f;
    JScrollBar s;
    JTextField tf;

    adjus()
    {
        f=new JFrame();
        tf=new JTextField();
        tf.setBounds(80,100,80,80);
        s=new JScrollBar();
        s.setBounds(80,150,80,80);
        s.addAdjustmentListener(this);

        f.add(s);
        f.add(tf);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void adjustmentValueChanged(AdjustmentEvent e)
    {
        Integer i=e.getValue();
        tf.setText(i.toString());
    }

    public static void main(String args[])
    {
        adjus f=new adjus();
    }
}
```

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## 7) Window Event:

- ❖ A low-level event that indicates that a window has changed its status.
- ❖ This low-level event is generated by a Window object when it is opened, closed, activated, deactivated, iconified, or deiconified, or when focus is transferred into or out of the Window.
- ❖ It has only following methods:

### **windowOpened():**

- ❖ This method is executed only the first time a window is made visible.

### **windowClosed():**

- ❖ This method is executed when the window has been closed

### **WindowActivated():**

- ❖ This event is delivered when the Window becomes the active window

### **WindowDeactivated():**

- ❖ This event is delivered when the Window is no longer active window.

### **WindowClosing():**

- ❖ This event is delivered when the user attempts to close the window from the window's system menu

### **WindowIconified():**

- ❖ This event is delivered when the window has been changed from a normal to a minimized state

### **WindowDeiconified():**

- ❖ This event is delivered when the window has been changed from a minimized to a normal state.

### **Example:**

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```
import javax.swing.*;
import java.awt.event.*;
public class w1 implements WindowListener
{
    JFrame f;
    w1(){
        f=new JFrame();
        f.addWindowListener(this);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void windowActivated(WindowEvent e)
    {
        System.out.println("Activated");
    }
    public void windowDeactivated(WindowEvent e)
    {
        System.out.println("Deactivated");
    }
    public void windowClosed(WindowEvent e)
    {
        System.out.println("Closed");
    }
    public void windowOpened(WindowEvent e)
    {
        System.out.println("Opened");
    }
    public void windowIconified(WindowEvent e)
    {
        System.out.println("Iconified");
    }
    public void windowDeiconified(WindowEvent e)
    {
        System.out.println("DeIconified");
    }
    public void windowClosing(WindowEvent e)
    {
        System.out.println("Closing");
    }
}
```

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

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## **Entered():**

- ❖ This method is executed when the mouse cursor enters into specific component.

## **mouseExited():**

- ❖ This method is executed when the cursor leaves the specific component

## **mousePressed():**

- ❖ This event is executed when the mouse is being pressed in the component area

## **mouseReleased():**

- ❖ This event is executed when the mouse is released from the component area.

## **mouseClicked():**

- ❖ This event is delivered when the mouse is clicked in the component area.



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## 9) MouseWheel Event:

- ❖ An event which indicates that the mouse wheel was rotated in a component.
- ❖ A wheel mouse is a mouse which has a wheel in place of the middle button.
- ❖ This wheel can be rotated towards or away from the user.
- ❖ It has only one method: `mouseWheelMoved()`

**mouseWheelMoved():** This method is executed when mouse wheel is rotated or moved in the component.

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```
import javax.swing.*;
import java.awt.event.*;

public class w1 implements MouseWheelListener
{
    JFrame f;
    JTextField t;
    w1(){
        f=new JFrame();
        t=new JTextField();
        t.setBounds(80,150,80,30);
        t.addMouseWheelListener(this);
        f.add(t);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void mouseWheelMoved(MouseWheelEvent e)
    {
        t.setText("Mouse Wheel Moved");
    }

    public static void main(String args[])
    {
        w1 e=new w1();
    }
}
```

- ❖ An event which indicates that an object's text changed.
- ❖ It is generated by an object when its text changes.

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- ❖ The event is passed to every Text Listener object which registered to receive such events using the component's addTextListener method.
- ❖ It has only one method: `textValueChanged()`

**`textValueChanged()`**: This method is executed when object's text changes.

```
import javax.swing.*;
import java.awt.event.*;

public class w1 implements TextListener
{
    JFrame f;
    JTextField t;
    w1(){
        f=new JFrame();
        t=new JTextField();
        t.setBounds(80,150,80,30);
        t.addTextListener(this);
        f.add(t);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void textValueChanged(TextEvent e)
    {
        t.setText("Text Changed");
    }

    public static void main(String args[])
    {
        w1 e=new w1();
    }
}
```

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MCQ	
1) Which event is generated when mouse wheel is rotated?	MouseWheelEvent
2) ActionEvent have .....method.	actionPerformed()
3) Which event is generated to adjust the values of scrollbar	Adjustment Event
4) How many methods focusEvent have?	focusGained(), focusLost()
5) Which event is generated when key is released or pressed?	KeyEvent

## Q-4 Write a short note on Adapter Class

### Ans:

- ❖ Java adapter classes *provide the default implementation of listener interfaces*
- ❖ If you inherit the adapter class, you will not be forced to provide the implementation of all the methods of listener interfaces. So it *saves code*.

### Pros of using Adapter classes:

- It assists the unrelated classes to work combined.
  - It provides ways to use classes in different ways.
  - It increases the transparency of classes.
  - It provides a way to include related patterns in the class.
  - It provides a pluggable kit for developing an application.
  - It increases the reusability of the class.
- ❖ The adapter classes are found in `java.awt.event`, `java.awt.dnd` and `javax.swing.event` packages.

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## Mouse Adapter:

- ❖ An abstract adapter class for receiving keyboard focus events.

```
import javax.swing.*;
import java.awt.event.*;

public class mouse1 extends MouseAdapter
{
    JFrame f;
    JTextArea ta,ta1;
    mouse1()
    {
        f=new JFrame();
        ta=new JTextArea();
        ta1=new JTextArea();
        ta.setBounds(80,150,80,70);
        ta.addMouseListener(this);
        ta1.setBounds(80,250,80,70);
        ta1.addMouseListener(this);
        f.add(ta);
        f.add(ta1);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void mouseClicked(MouseEvent e)
    {
        ta1.setText("CLicked");
    }

    public static void main(String args[])
    {
        mouse1 k=new mouse1();
    }
}
```

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```
import javax.swing.*;
import java.awt.event.*;

public class focus1 extends FocusAdapter
{
    JFrame f;
    JTextField tf;

    focus1()
    {
        f=new JFrame();
        tf=new JTextField();
        tf.setBounds(80,150,80,80);
        tf.addFocusListener(this);
        f.add(tf);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void focusGained(FocusEvent e)
    {
        tf.setText("Focus Gained");
    }

    public static void main(String args[])
    {
        focus1 f=new focus1();
    }
}
```

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```
import javax.swing.*;
import java.awt.event.*;

public class key1 extends KeyAdapter
{
    JFrame f;
    JTextArea ta,ta1;
    key1()
    {
        f=new JFrame();
        ta=new JTextArea();
        ta1=new JTextArea();
        ta.setBounds(80,150,80,70);
        ta.addKeyListener(this);
        ta1.setBounds(80,250,80,70);
        ta1.addKeyListener(this);
        f.add(ta);
        f.add(ta1);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void keyPressed(KeyEvent e)
    {
        ta1.setText("Pressed");
    }
    public static void main(String args[])
    {
        key1 k=new key1();
    }
}
```

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```
import javax.swing.*;
import java.awt.event.*;

public class key1 extends MouseAdapter
{
    JFrame f;
    JTextArea ta,ta1;
    key1()
    {
        f=new JFrame();
        ta=new JTextArea();
        ta1=new JTextArea();
        ta.setBounds(80,150,80,70);
        ta.addKeyListener(this);
        ta1.setBounds(80,250,80,70);
        ta1.addMouseListener(this);
        f.add(ta);
        f.add(ta1);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void mouseDragged(MouseEvent e)
    {
        ta1.setText("Dragged");
    }
    public static void main(String args[])
    {
        key1 k=new key1();
    }
}
```



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## MCQ

1) .....class provide the default implementation of listener interface	Adapter Class
2) If you inherit adapter class, you will not need to include implementation of all the methods? (T/F)	true

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## UNIT-4 PENDING LAYOUT MANAGERS

### 1) Box Layout:

- ❖ The BorderLayout class is used to arrange the components either vertically (along Y-axis) or horizontally (along X-axis).

In BorderLayout class, the components are put either in a single row or a single column

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## Example:

```
import javax.swing.*;
import java.awt.*;
public class box12
{
    box12()
    {
        JFrame f=new JFrame();
        JButton b1=new JButton("Button 1");
        JButton b2=new JButton("Button 2");
        JButton b3=new JButton("Button 3");
        JButton b4=new JButton("Button 4");
        JButton b5=new JButton("Button 5");
        JPanel p=new JPanel();
        BorderLayout bo=new BorderLayout(p,BoxLayout.X_AXIS);
        p.setLayout(bo);
        p.add(b1);
        p.add(b2);
        p.add(b3);
        p.add(b4);
        p.add(b5);
        f.add(p);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public static void main(String args[])
    {
        box12 b=new box12();
    }
}
```

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## 2) Group Layout:

- ❖ **GroupLayout** groups its components and places them in a Container hierarchically. The grouping is done by instances of the Group class.
- ❖ Group is an abstract class, and two concrete classes which implement this Group class are SequentialGroup and ParallelGroup.
- ❖ SequentialGroup positions its child sequentially one after another whereas ParallelGroup aligns its child on top of each other.
- ❖ The GroupLayout class provides methods such as createParallelGroup() and createSequentialGroup() to create groups.
- ❖ GroupLayout treats each axis independently. That is, there is a group representing the horizontal axis, and a group representing the vertical axis. Each component must exist in both a horizontal and vertical group, otherwise an IllegalStateException is thrown during layout or when the minimum, preferred, or maximum size is requested.

**Example:**

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```
import javax.swing.*;
import java.awt.*;
public class group1
{
    JFrame f;
    JButton b1,b2,b3,b4,b5,b6;
    group1()
    {
        f=new JFrame();
        Container c=f.getContentPane();
        GroupLayout g=new GroupLayout(c);
        c.setLayout(g);
        b1=new JButton("Button 1");
        b2=new JButton("Button 2");
        b3=new JButton("Button 3");
        b4=new JButton("Button 4");
        b5=new JButton("Button 5");
        b6=new JButton("Button 6");
        g.setHorizontalGroup(
        g.createSequentialGroup()
            .addComponent(b1)
            .addComponent(b2)
            .addComponent(b3)
            .addComponent(b4)
            .addComponent(b5)
            .addComponent(b6));
        g.setVerticalGroup(
        g.createParallelGroup(GroupLayout.Alignment.TRAILING)
            .addComponent(b1)
            .addComponent(b2)
            .addComponent(b3)
            .addComponent(b4)
            .addComponent(b5)
            .addComponent(b6));
        f.pack();
        f.setVisible(true);
    }
}
```

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### 3) Spring Layout:

- ❖ A **SpringLayout** *arranges the children of its associated container according to a set of constraints.*
- ❖ Constraints are nothing but horizontal and vertical distance between two-component edges.
- ❖ Every constraint is represented by a **SpringLayout.Constraint** object.
- ❖ Each child of a **SpringLayout** container, as well as the container itself, has exactly one set of constraints associated with them.
- ❖ Each edge position is dependent on the position of the other edge. If a constraint is added to create a new edge, than the previous binding is discarded. **SpringLayout** doesn't automatically set the location of the components it manages.

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```
import javax.swing.*;
import java.awt.*;

public class spr
{
    JFrame f;
    JLabel l;
    JButton b;
    JTextField t;

    spr()
    {
        f=new JFrame();
        SpringLayout s=new SpringLayout();
        l=new JLabel("heading");
        t=new JTextField("my textbox",15);
        b=new JButton("Submit");
        f.add(l);
        f.add(t);
        f.add(b);
        f.setLayout(s);
        s.putConstraint(SpringLayout.WEST,l,6,SpringLayout.WEST,f);
        s.putConstraint(SpringLayout.WEST,t,6,SpringLayout.EAST,l);
        s.putConstraint(SpringLayout.SOUTH,b,80,SpringLayout.NORTH,f);
        f.pack();
        f.setVisible(true);
        f.setSize(300,300);
    }
    public static void main(String args[])
    {
        spr s1=new spr();
    }
}
```

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## Programs

### Ch-1

#### 1) Write a program to print hello

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

**Output: Hello**

#### 2) Write a program to demonstrate use of arithmetic operator

```
import java.util.*;
class arithmetic
{
public static void main(String args[])
{
int a,b;
Scanner sc=new Scanner(System.in);
System.out.println("Enter a");
a=sc.nextInt();
System.out.println("Enter b");
b=sc.nextInt();
System.out.println("Addition=" +(a+b));
System.out.println("Sub is" +(a-b));
System.out.println("Mul is" +(a*b));
System.out.println("Div is" +(a/b));
System.out.println("Modulas is" +(a%b));
}
}
```



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## Output:

Enter a 10  
Enter b 5  
Addition=15  
Sub is 5  
Mul is 50  
Div is 2

## 3) Write a program to demonstrate use of relational operator

```
import java.util.*;
class arithmetic
{
public static void main(String args[])
{
int a,b;
Scanner sc=new Scanner(System.in);
System.out.println("Enter a");
a=sc.nextInt();
System.out.println("Enter b");
b=sc.nextInt();
System.out.println("> than" +(a>b));
System.out.println("< than" +(a<b));
System.out.println(">= is" +(a>=b));
System.out.println("<="+(a<=b));
System.out.println("== is" +(a==b));
System.out.println("!= is" +(a!=b));
}
}
```

## Output:

Enter a 10  
Enter b 5  
1

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0  
1  
0  
0  
1

## 4) Write a program to demonstrate use of logical operator

```
import java.util.*;
class arithmetic
{
public static void main(String args[])
{
int a,b,c;
Scanner sc=new Scanner(System.in);
System.out.println("Enter a");
a=sc.nextInt();
System.out.println("Enter b");
b=sc.nextInt();
System.out.println("Enter c");
c=sc.nextInt();
if(a>b && a>c)
    System.out.println("a is max");
else if(b>c && b>a)
    System.out.println("b is max");
else
    System.out.println("c is max");
}
}
```

### Output:

```
Enter a 10
Enter b 5
Enter c 2
a is max
```

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## 5) Write a program to demonstrate use of decision control structure (if)

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    if(a==b)
        System.out.println("Equal");
}
}
```

### Output:

Enter a 10

Enter b 10

Equal

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- 6) Write a program to demonstrate use of decision control structure (if-else)

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    if(a==b)
        System.out.println("Equal");
    else
        System.out,println("Not Equal");
}
}
```

## Output:

Enter a 10  
Enter b 11  
Not Equal

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7) Write a program to demonstrate use of decision control structure  
(Nested if)

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b,c;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    System.out.println("Enter c");
    c=sc.nextInt();

    if(a>b)
    {
        if(a>c)
            System.out.println("a is max");
        else
            System.out,println("c is max");
    }
    else
    {
        if(b>c)
            System.out.println("b is max");
        else
            System.out.println("c is max");
    }
}
}
```

**Output:**

**Enter a 10**

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Enter b 11  
Enter c 50  
c is max

8) Write a program to demonstrate use of decision control structure (else-if ladder)

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b,c;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    System.out.println("Enter c");
    c=sc.nextInt();

    if(a>b && a>c)
        System.out.println("a is max");
    else if(b>c && b>a)
        System.out.println("b is max");
    else
        System.out.println("c is max");
}
}
```

**Output:**

Enter a 10  
Enter b 11  
Enter c 50  
c is max

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## 9) Write a program to demonstrate use of decision control structure (switch case)

```
import java.util.*;
class dc
{
public static void main(String args[])
{
    int a,b,ch;
    Scanner sc=new Scanner(System.in);
    System.out.println("Enter a");
    a=sc.nextInt();
    System.out.println("Enter b");
    b=sc.nextInt();
    System.out.println("Enter 1.add 2.sub 3.mul 4.div");
    ch=sc.nextInt();
    switch(ch)
    {
        case 1: System.out.println(a+b);
                break;

        case 2: System.out.println(a-b);
                break;

        case 3: System.out.println(a*b);
                break;

        case 4: System.out.println(a/b);
                break;
        default: System.out.println("Invalid");
                break;
    }
}
}
```

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10) Write a program to demonstrate use of for loop

```
class loop
{
public static void main(String args[])
{
    int i;
    for(i=1;i<=5;i++)
    {
        System.out.println(i);
    }
}
```

**Output:**

1  
2  
3  
4  
5



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11) Write a program to demonstrate use of while loop

```
class loop
{
public static void main(String args[])
{
    int i=1;
    while(i<=5)
    {
        System.out.println(i);
        i++;
    }
}
```

Output:

1  
2  
3  
4  
5

12) Write a program to demonstrate use of do-while loop

```
class loop
{
public static void main(String args[])
{
    int i=1;
    do
    {
        System.out.println(i);
        i++;
    }while(i<=5);
}
```

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**Output:**

1  
2  
3  
4  
5

13) Write a program to demonstrate use of jumping statements (break)

```
class jm
{
public static void main(String args[])
{
    int i;
    for(i=1;i<=5;i++)
    {
        if(i==3)
        break;
        System.out.println(i);
    }
}
```

**Output:**

1  
2

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- 14) Write a program to demonstrate use of jumping statements  
(continue)

```
class jm
{
public static void main(String args[])
{
    int i;
    for(i=1;i<=5;i++)
    {
        if(i==3)
            continue;
        System.out.println(i);
    }
}
```

Output:

1  
2  
4  
5

- 15) Write a program to demonstrate use of type casting

```
class exp1
{
    public static void main(String args[])
    {
        int x;
        double f=2.5;
        x=(int)f;
        System.out.println(x);
    }
}
```

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```
class expl
{
    public static void main(String args[])
    {
        int i;
        int a[]=new int[5];
        a[0]=10;
        a[1]=11;
        a[2]=12;
        a[3]=13;
        a[4]=14;
        for(i=0;i<a.length;i++)
            System.out.println(a[i]);
    }
}
```

## Output:

10  
11  
12  
13  
14

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17) Write a program to demonstrate use of 1 dimensional array  
(inputting the values from the user)

```
import java.util.*;
class arr
{
    public static void main(String args[])
    {
        int i;
        int a[]=new int[5];
        Scanner sc=new Scanner(System.in);
        for(i=0;i<5;i++)
        {
            System.out.println("Enter array elements");
            a[i]=sc.nextInt();
        }
        for(i=0;i<5;i++)
        {
            System.out.println("Array ele" +a[i]);
        }
    }
}
```

**Output:**

<b>Enter array elements</b>	<b>Array ele</b>
10	10
11	11
12	12
13	13
14	14

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- 18) Write a program to demonstrate use of multi-dimensional array  
(inputting the values from the user)

```
import java.util.*;
class arr
{
    public static void main(String args[])
    {
        int i,j;
        int a[][]=new int[2][3];
        Scanner sc=new Scanner(System.in);
        for(i=0;i<2;i++)
        {
            for(j=0;j<3;j++)
            {
                System.out.println("Enter array elements");
                a[i][j]=sc.nextInt();
            }
        }
        for(i=0;i<2;i++)
        {
            for(j=0;j<3;j++)
            {
                System.out.println("Array ele" +a[i][j]);
            }
        }
    }
}
```

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## Output:

Enter array elements	Array ele
10	10
11	11
12	12
13	13
14	14

## 19) Write a program to print hello using command line arguments

```
class cmd1
{
    public static void main(String args[])
    {
        System.out.println(args[0]);
    }
}
```

## Output:

hello

## 20) Write a program to print value using command line arguments

```
class cmd1
{
    public static void main(String args[])
    {
        int i;
        for(i=0;i<args.length;i++)
        {
            System.out.println(args[i]);
        }
    }
}
```

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**Output:**

10

21) Write a program to demonstrate use of class and object

```
class student
{
    int roll;
    String name;
}
class sample
{
    public static void main(String args[])
    {
        student s=new student();
        s.roll=1;
        s.name="xyz";
        System.out.println(s.roll);
        System.out.println(s.name);
    }
}
```

**Output:**

1

xyz



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22) Write a program to demonstrate use of encapsulation

```
class test
{
    private int age;
    public void get()
    {
        System.out.println(age);
    }
    public void set(int age)
    {
        this.age=age;
    }
}

class enc
{
    public static void main(String args[])
    {
        test t=new test();
        t.set(1);
        t.get();
    }
}
```

**Output:**

1

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23) Write a program to demonstrate use of single level inheritance

```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}

class Dog extends Animal
{
    void bark()
    {
        System.out.println("Barking");
    }
}

class single
{
    public static void main(String args[])
    {
        Dog d=new Dog();
        d.bark();
        d.eat();
    }
}
```

**Output:**  
**Eating**  
**Barking**

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24) Write a program to demonstrate use of multi level inheritance

```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}
class Dog extends Animal
{
    void bark()
    {
        System.out.println("Barking");
    }
}
class BabyDog extends Dog
{
    void sleep()
    {
        System.out.println("Sleeping");
    }
}
class single
{
    public static void main(String args[])
    {
        BabyDog bd=new BabyDog();
        d.bark();
        d.eat();
        d.sleep();
    }
}
```

**Eating**  
**Barking**  
**Sleeping**

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25) Write a program to demonstrate use of hierarchical inheritance

```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}
class Dog extends Animal
{
    void bark()
    {
        System.out.println("Barking");
    }
}
class cat extends Animal
{
    void sleep()
    {
        System.out.println("Sleeping");
    }
}
class single
{
    public static void main(String args[])
    {
        cat c=new cat();
        c.eat();
        c.sleep();
    }
}
```

**Output:**  
**Eating**  
**Barking**  
**Eating**  
**Sleeping**

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26) Write a program to demonstrate use of multiple inheritance

```
class A
{
    void msg()
    {
        System.out.println("Hello");
    }
}
class B
{
    void msg()
    {
        System.out.println("Hi");
    }
}
class C extends A,B
{
    public static void main(String args[])
    {
        C c1=new C();
        c1.msg();//Which msg() method will be called?
    }
}
```

Will generate compile time error

**Output:**  
**Error**

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27) Write a program to demonstrate use of hybrid inheritance

```
class Animal
{
    void eat()
    {
        System.out.println("Eating");
    }
}
class Dog extends Animal //Single level inheritance
{
    void bark()
    {
        System.out.println("Barking");
    }
}
class cat extends Animal //Multilevel inheritance
{
    void sleep()
    {
        System.out.println("Sleeping");
    }
}
class single
{
    public static void main(String args[])
    {
        cat c=new cat();
        c.eat();
        c.sleep();
        Dog d=new Dog();
        d.bark();
        d.eat();
    }
}
```

28) Write a program to demonstrate use of compile time polymorphism

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```
class overload
{
    void add(int a,int b,int c)
    {
        System.out.println(a+b+c);
    }
    void add(int a,int b)
    {
        System.out.println(a+b);
    }
}
class method1
{
    public static void main(String args[])
    {
        overload o1=new overload();
        o1.add(2,3,4);
        o1.add(1,2);
    }
}
```

**Output:**

9  
3

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29) Write a program to demonstrate use of run time polymorphism

```
class A
{
    void run()
    {
        System.out.println("Hello");
    }
}

class B extends A
{
    void run()
    {
        System.out.println("Hi");
    }
}

class sam
{
    public static void main(String args[])
    {
        B b1=new B();
        b1.run();
    }
}
```

**Output: Hi**



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30) Write a program to demonstrate use of default constructor

```
class A
{
    A()
    {
        System.out.println("Default constructor");
    }
}

class inhe
{
    public static void main(String args[])
    {
        A a1=new A();
    }
}
```

**Output: Default constructor**

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31) Write a program to demonstrate use of constructor overloading

```
class Aint roll;
    A(int r)
    {
        roll=r;
    }
    void display()
    {
        System.out.println(roll);
    }
}

class inhe
{
    public static void main(String args[])
    {
        A a1=new A(10);
        a1.display();
    }
}
```

**Output:**

10

32) Write a program to demonstrate use of constructor overloading

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```
class cons
{
    int roll;
    String name;
    cons()
    {
        System.out.println("Hello");
    }
    cons(int r)
    {
        roll=r;
    }
    cons(int r,String n)
    {
        roll=r;
        name=n;
    }
    void display()
    {
        System.out.println(roll);
        System.out.println(name);
    }
}
class consoverload
{
    public static void main(String args[])
    {
        cons c=new cons();
        cons c1=new cons(10);
        cons c2=new cons(10,"xyz");
        c1.display();
        c2.display();
    }
}
```

**Output:**

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Hello  
10  
10, xyz

33) Write a program to demonstrate use of static and non-static data members

```
class test
{
    static int a=20;
    void display()
    {
        a++;
        System.out.println(a);
    }
}
class sample
{
    public static void main(String args[])
    {
        test t1=new test();
        test t2=new test();
        test t3=new test();
        t1.display();
        t2.display();
        t3.display();
    }
}
```

**Output: 21,22,23**

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Non-static

```
class test
{
    int a=20;
    void display()
    {
        a++;
        System.out.println(a);
    }
}
class sample
{
    public static void main(String args[])
    {
        test t1=new test();
        test t2=new test();
        test t3=new test();
        t1.display();
        t2.display();
        t3.display();
    }
}
```

**Output: 21,21,21**

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34) Write a program to demonstrate use of vargs

```
class varg
{
    static void display(int...values)
    {
        System.out.println("hello");

        for(int i:values)
        System.out.println(i);
    }
    public static void main(String args[])
    {
        display();
        display(1,2,3,4);
        display(12,22);
    }
}
```

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## Program Chapter-2

35) Write a program to demonstrate use of private access specifier

```
class A
{
    private int data=40;
    private void msg()
    {
        System.out.println("Hello java");
    }
}
class Simple
{
    public static void main(String args[])
    {
        A obj=new A();
        System.out.println(obj.data);//Compile Time Error
        obj.msg();//Compile Time Error
    }
}
```

**Output:**  
**Error**

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36) Write a program to demonstrate use of default access specifier

**//Save this with A.java (Package 1)**

```
package pack;
class A
{
    void display()
    {
        System.out.println("Hello");
    }
}
```

**//Save this with B.java (Package 2)**

```
package mypack;
import pack.*;
class B
{
    public static void main(String args[])
    {
        A obj=new A();
        obj.display();
    }
}
```

**Output:**  
**Cannot be accessed outside the package**



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37) Write a program to demonstrate use of protected access specifier

**//Save this with A.java (Package 1)**

```
package pack;
public class A
{
    protected void display()
    {
        System.out.println("Hello");
    }
}
```

**//Save this with B.java (Package 2)**

```
package mypack;
import pack.*;
class B extends A
{
    public static void main(String args[])
    {
        B obj=new B();
        obj.display();
    }
}
```

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38) Write a program to demonstrate use of public access specifier

**//Save this with A.java (Package 1)**

```
package pack;  
public class A  
{  
    public void display()  
    {  
        System.out.println("Hello");  
    }  
}
```

**//Save this with B.java (Package 2)**

```
package mypack;  
import pack.*;  
class B  
{  
    public static void main(String args[])  
    {  
        A obj=new A();  
        obj.display();  
    }  
}
```

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39) Write a program to demonstrate use of constructor in single level inheritance

```
class parent
{
    parent()
    {
        System.out.println("Parent class constructor");
    }
}
class child extends parent
{
    child()
    {
        System.out.println("Child class constructor");
    }
}
class child1 extends child
{
    child1()
    {
        System.out.println("Child1 constructor");
    }
}
class sample
{
    public static void main(String args[])
    {
        child1 c=new child1();
    }
}
```

child1 class constructor

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40) Write a program to demonstrate use of interface

```
interface draw
{
void print();
}

class rectangle implements draw
{
    public void print()
    {
        System.out.println("draw rectangle");
    }
}

class circle implements draw
{
    public void print()
    {
        System.out.println("draw circle");
    }
}

class test
{
    public static void main(String args[])
    {
        circle c1=new circle();
        c1.print();
        rectangle r=new rectangle();
        r.print();
    }
}
```

**Output:**  
draw circle  
draw rectangle

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- 41) Write a program to demonstrate use of multiple inheritance in java using interface

```
interface a
{
    void display();
}
interface b
{
    void display1();
}
class mul implements a,b
{
    public void display()
    {
        System.out.println("hello");
    }
    public void display1()
    {
        System.out.println("hi");
    }
}

class multiple
{
    public static void main(String args[])
    {
        sam s=new sam();
        s.display();
        s.display1();
    }
}
```

Hello  
Hi

- 42) Write a program to demonstrate use of object cloning

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```
class stu implements Cloneable
{
    int rollno;
    String name;

    stu(int r,String n)
    {
        this.rollno=r;
        this.name=n;
    }
    public Object clone()throws CloneNotSupportedException
    {
        return super.clone();
    }

    public static void main(String args[])
    {
        try
        {
            stu s1=new stu(1,"xyz");
            stu s2=(stu)s1.clone();

            System.out.println(s2.rollno);
            System.out.println(s2.name);
        }catch(CloneNotSupportedException c)
        {

        }
    }
}
```

**Output:**

1

xyz

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43) Write a program to demonstrate use of non-static nested class

```
class outer
{
    int x=10;
    class inner
    {
        int y=4;
    }
}

class nested
{
    public static void main(String args[])
    {
        outer o=new outer();
        outer.inner i=o.new inner();
        System.out.println(i.y);
        System.out.println(o.x);
    }
}
```

**Output:**

4  
10

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44) Write a program to demonstrate use of static nested class

```
class outer
{
    int x=10;
    static class inner
    {
        int y=4;
    }
}

class nested
{
    public static void main(String args[])
    {
        outer.inner i=new outer.inner();
        System.out.println(i.y);
        System.out.println(i.x);//will generate error
    }
}
```

Output:

4

will generate error



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45) Write a program to demonstrate use of abstract class

```
abstract class bike
{
    abstract void run();
    void display()
    {
        System.out.println("hello");
    }
}

class honda extends bike
{
    public void run()
    {
        System.out.println("hi");
    }
}

class sampe
{
    public static void main(String args[])
    {
        honda h=new honda();
        h.run();
        h.display();
    }
}
```

**Output:**

hello  
hi

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46) Write a program to demonstrate use of final keyword

```
final class bike
{

}

class ja extends bike
{
    void display()
    {
        System.out.println("hi");
    }
    public static void main(String args[])
    {
        bike b=new bike();
        b.display(); //Compile time error
    }
}
```

Output:  
Compile time error

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47) Write a program to demonstrate use of normal import

```
class ke
{
    public static void main(String args[])
    {
        System.out.println(Math.sqrt(25));
        System.out.println(Math.pow(2,2));
    }
}
```

Output:

5  
4

48) Write a program to demonstrate use of static import

```
import static java.lang.Math.*;

class ke
{
    public static void main(String args[])
    {
        System.out.println(sqrt(25));
        System.out.println(pow(2,2));
    }
}
```

Output:

5  
4

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49) Write a program to demonstrate use of Wrapper class (Autoboxing)

```
class wrapper1
{
    public static void main(String args[])
    {
        int a=20;
        Integer j=a; //Converting primitive data type to Integer
        wrapper class
            System.out.println(j);
    }
}
```

**Output:**  
20

50) Write a program to demonstrate use of Wrapper class (Unboxing)

```
class wrapper1
{
    public static void main(String args[])
    {
        int a=20;
        Integer j=a; //Converting primitive data type to Integer wrapper class
            System.out.println(j);
    }
}
```

**Output:**  
20

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51) Write a program to demonstrate use of String class (java.lang)

```
class stringfunctions
{
    public static void main(String args[])
    {
        String s="hello";
        String s1="hello";
        String s3="karishma";
        String s4="rupani";
        String s5="hi";
        String s6="Hi";
        System.out.println("Charat" +s.charAt(1));
        System.out.println("length" +s.length());
        System.out.println("substring" +s.substring(1));
        System.out.println("substring" +s.substring(1,3));
        System.out.println("index" +s.contains("el"));
        System.out.println("Equality" +s.equals(s1));
        System.out.println("Empty" +s.isEmpty());
        System.out.println("Concate"+s3.concat(s4));
        System.out.println("replace"+s.replace('l','k'));
        System.out.println("Uppercase" +s3.toUpperCase());
        System.out.println("Lowercase" +s3.toLowerCase());
        System.out.println("IndexOf" +s.indexOf('o'));
        System.out.println("ignorecase" +s5.equalsIgnoreCase(s6));
    }
}
```

**Output:**

e  
5  
ello

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ell

1

1

0

karishmrupani

hekko

KARISHMA

Karishma

4

1

52) Write a program to demonstrate use of StringBuffer class (java.lang)

```
class stringfunctions
{
    public static void main(String args[])
    {
        StringBuffer s=new StringBuffer("hello");
        System.out.println("Length" +s.length());
        System.out.println("Specified" +s.insert(2,"hi"));
        System.out.println("Replace" +s.replace(1,3,"ee"));
        System.out.println("Deleting" +s.delete(1,3));
        System.out.println("Reversing" +s.reverse());
        System.out.println("Capacity" +s.capacity());
        System.out.println("Charat" +s.charAt(2));
        System.out.println("Substring" +s.substring(1));
    }
}
```

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**53) Write a program to demonstrate use of random class**

```
import java.util.*;
class randomn
{
    public static void main(String args[])
    {
        Random r=new Random();
        System.out.println("Integer val" +r.nextInt());
        System.out.println("Next decimal" +r.nextDouble());
    }
}
```

**54) Write a program to demonstrate use of Date class**

```
import java.util.*;

public class main1
{
    public static void main(String[] args)
    {
        Date d=new Date();
        Date d1=new Date(21-11-2010);
        Date d2=new Date(25-6-2022);
        // Creating date
        System.out.println("Current date: " +d);
        System.out.println("Checking"+d1.before(d));
        System.out.println("after" +d.after(d2));
        System.out.println("Clone object" +d.clone());
        System.out.println("Compare" +d.compareTo(d1));
        System.out.println("Equlas" +d.equals(d1));
        System.out.println("Time" +d.getTime());
        System.out.println("Hashcode" +d.hashCode());
    }
}
```

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55) Write a program to demonstrate use of StringTokenizer class

```
import java.util.*;

public class main1
{
    public static void main(String[] args)
    {
        StringTokenizer st=new StringTokenizer("my name is karishma");
        System.out.println("Total number of Tokens: "+st.countTokens());
        while(st.hasMoreTokens())
        {
            System.out.println(st.nextToken());
        }
    }
}
```

56) Write a program to demonstrate use of Gregorian Calendar class

```
import java.util.*;
class greg
{
    public static void main(String args[])
    {
        Calendar cal=Calendar.getInstance();
        GregorianCalendar c=new GregorianCalendar();
        System.out.println("Calendar date:"+cal.getTime());
        System.out.println("Greg" +c.getTime());
    }
}
```



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57) Write a program to demonstrate use of Collection class

```
import java.util.*;
class greg
{
    public static void main(String args[])
    {
        Vector<Integer>ve=new Vector<Integer>(5);
        ve.add(10);
        ve.add(20);
        ve.add(30);
        ve.addElement(40);
        System.out.println("Elements of vector" +ve);
        System.out.println("Clone" +ve.clone());
        System.out.println("Capacity" +ve.capacity());
        System.out.println("Size" +ve.size());
        System.out.println("Firstelement" +ve.firstElement());
        System.out.println("Firstelement" +ve.lastElement());
        System.out.println("Index" +ve.indexOf(20));
        System.out.println("Contains" +ve.contains(10));
        ve.remove(0);
        System.out.println("Elements after removal" +ve);
    }
}
```

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58) Write a program to demonstrate use of Hashtable class

```
import java.util.*;
class hash1
{
    public static void main(String args[])
    {
        Hashtable<Integer,String> h=new Hashtable<Integer,String>();
        h.put(1,"abc");
        h.put(2,"xyz");
        System.out.println("Mapping" +h);
        h.put(2,"ddd");
        System.out.println("Mapping" +h);
        h.remove(2);
        System.out.println("Mapping" +h);
        System.out.println("Check key:" +h.containsKey(1));
        System.out.println("Check value: "+h.containsValue("abc"));
    }
}
```

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59) Write a program to demonstrate use of linked list class

```
import java.util.*;
class linked
{
    public static void main(String args[])
    {
        LinkedList<String>s=new LinkedList<String>();
        s.add("A");
        s.add("B");
        s.add("C");
        s.addLast("D");
        s.addFirst("E");
        System.out.println(s);
        s.remove("C");
        s.removeFirst();
        s.removeLast();
        System.out.println(s);
    }
}
```

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60) Write a program to demonstrate use of Stack class

```
import java.util.*;
class stack
{
    public static void main(String args[])
    {
        Stack<Integer> s=new Stack<Integer>();
        s.push(10);
        s.push(11);
        s.push(12);
        s.push(13);
        s.push(14);
        System.out.println(s);
        s.pop();
        System.out.println(s);
        System.out.println("Stack empty :"+s.empty());
        System.out.println("Search :"+s.search(11));
        System.out.println("Peek: "+s.peek());
    }
}
```

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61) Write a program to demonstrate use of Queue class

```
import java.util.*;
class que
{
    public static void main(String args[])
    {
        PriorityQueue<String> p=new PriorityQueue<String>();
        p.add("abc");
        p.add("xyz");
        p.add("aaa");

        System.out.println("Queue ele: "+p);
        p.remove();
        System.out.println("After removal: "+p);
        System.out.println("Poll: "+p.poll());
        System.out.println("After poll:" +p);
        System.out.println("Peek: "+p.peek());
    }
}
```

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## Program Chapter-3

62) Write a program to demonstrate use of exception handling

```
class exc
{
    public static void main(String args[])
    {
        try
        {
            int a=5/0;
        }catch(ArithmeticException e)
        {
            System.out.println(e);
        }
        finally
        {
            System.out.println("hi");
        }
    }
}
```

Output:  
hi

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63) Write a program to demonstrate use of user defined exception

```
class userdefinedexception
{
    public static void main(String args[])
    {
        try
        {
            throw new myexception(400);
        }
        catch(myexception e)
        {
            System.out.println(e);
        }
    }
}

class myexception extends Exception
{
    int n1;
    myexception(int n2)
    {
        n1=n2;
    }
    public String toString()
    {
        return ("Status: " +n1);
    }
}
```

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**Output:**  
400

64) Write a program to demonstrate use of Thread Class

```
class m extends Thread
{
    public void run()
    {
        System.out.println("Running");
    }
    public static void main(String args[])
    {
        m m1=new m();
        m1.start();
    }
}
```

**Output:**  
Running



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65) Write a program to demonstrate use of Thread Class using Runnable interface

```
class m extends implements Runnable
{
    public void run()
    {
        System.out.println("Running");
    }
    public static void main(String args[])
    {
        m m1=new m();
        Thread t1=new Thread(m1);
        t1.start();
    }
}
```

**Output:**  
**Running**

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66) Write a program to demonstrate use of Thread Class properties

```
class th
{
    public static void main(String args[])
    {
        Thread t1=new Thread("First Thread");
        System.out.println("Thread Priority: "+t1.getPriority());
        t1.setPriority(6);
        t1.start();
        t1.setName("My Thread");
        System.out.println("Thread Name: "+t1.getName());
        System.out.println("Thread Priority: "+t1.getPriority());
        System.out.println("Daemon Thread: "+t1.isDaemon());
    }
}
```

**Output:**

**Thread Name: My Thread**

**Thread Priority: 6**

**Daemon Thread: 0**

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67) Write a program to demonstrate use of Thread Synchronization

```
class mythread2 extends Thread
{
    table t;
    mythread2(table t)
    {
        this.t=t;
    }
    public void run()
    {
        t.printtable(5);
    }
}

class synch
{
    public static void main(String args[])
    {
        table o=new table();
        mythread1 t1=new mythread1(o);
        mythread2 t2=new mythread2(o);
        t1.start();
        t2.start();
    }
}
```

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68) Write a program to demonstrate use of File Class

```
import java.io.*;
class filedemo
{
    public static void main(String args[])
    {
        File f=new File("d:\\th123.java");
        if(f.isFile())
            System.out.println("\n File Exists");
        else
            System.out.println("\n File does not exists");
    }
}
```

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69) Write a program to demonstrate use of new file creation

```
import java.io.*;
import java.io.IOException;
class crf
{
    public static void main(String args[])
    {
        try
        {
            File f=new File("D:\\hel.txt");
            if(f.createNewFile())
            System.out.println("Created");
            else
            System.out.println("Not Created");
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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70) Write a program to demonstrate use of file information

```
import java.io.*;
import java.io.IOException;

class crf
{
    public static void main(String args[])
    {
        File f=new File("D:\\hel.txt");
        if(f.exists())
        {
            System.out.println("Name of file: "+f.getName());
            System.out.println("Path of file:
"+f.getAbsolutePath());
            System.out.println("Path of file: "+f.length());
        }
        else
        {
            System.out.println("Does not exists");
        }
    }
}
```

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71) Write a program to demonstrate writing into file

```
import java.io.*;
import java.io.IOException;

class crf
{
    public static void main(String args[])
    {
        try
        {
            FileWriter w=new FileWriter("d:\\hel.txt");
            w.write("Hello");
            w.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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72) Write a program to demonstrate reading from file

```
import java.io.*;
import java.io.FileNotFoundException;
import java.util.*;

class crf
{
    public static void main(String args[])
    {
        try
        {
            File f=new File("D:\\hel.txt");
            Scanner s=new Scanner(f);
            while(s.hasNextLine())
            {
                String fd=s.nextLine();
                System.out.println(fd);
            }
            s.close();
        }
        catch(FileNotFoundException e)
        {
            System.out.println(e);
        }
    }
}
```



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73) Write a program to demonstrate deleting from file

```
import java.io.*;

class del
{
    public static void main(String args[])
    {
        File f=new File("D:\\hel.txt");
        if(f.delete())
            System.out.println("Deleted");
        else
            System.out.println("Not Deleted");
    }
}
```

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74) Write a program to demonstrate use of random access file

```
import java.io.*;
class Random1
{
    public static void main(String args[])
    {
        try
        {
            RandomAccessFile f=new
RandomAccessFile("test1.txt","rw");
            f.writeChar('k');
            f.writeInt(10);
            f.writeDouble(10.2);
            f.seek(0);

            System.out.println(f.readChar());
            System.out.println(f.readInt());
            System.out.println(f.readDouble());
            f.seek(2);
            System.out.println(f.readInt());
            f.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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75) Write a program to demonstrate use of Character Stream Class  
(FileReader Class)

```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileReader f=new FileReader("D:\\myf.txt");
            int i;
            while((i=f.read())!=-1)
                System.out.println((char)i);
            f.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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76) Write a program to demonstrate use of Character Stream Class  
(FileWriter Class)

```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileWriter f=new FileWriter("D:\\myf6.txt");
            f.write("Hello");
            f.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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77) Write a program to demonstrate use of Buffered Writer Class

```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileWriter f=new FileWriter("D:\\myf7.txt");
            BufferedWriter b=new BufferedWriter(f);
            f.write("Hello");
            f.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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78) Write a program to demonstrate use of Buffered Reader Class

```
import java.io.*;
import java.io.IOException;

class ch1
{
    public static void main(String args[])
    {
        try
        {
            FileReader f=new FileReader("D:\\myf7.txt");
            BufferedReader b=new BufferedReader(f);
            int i;
            while(i=f.read())!=-1)
            {
                System.out.println((char)i);
            }
            b.close();
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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79) Write a program to demonstrate use of FileOutputStream and File InputStream Class

```
import java.io.*;

class inp
{
    public static void main(String args[])
    {
        try
        {
            FileOutputStream f=new FileOutputStream("D:\\myf9.txt");
            f.write(10);
            FileInputStream f1=new FileInputStream("D:\\myf9.txt");
            int i;
            while((i=f1.read())!=-1)
            {
                System.out.println(i);
            }
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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80) Write a program to demonstrate use of DataOutputStream and DataInputStream Class

```
import java.io.*;
class da
{
    public static void main(String args[])throws IOException
    {
        FileOutputStream f=new FileOutputStream("D:\\myf10.txt");
        DataOutputStream f1=new DataOutputStream(f);
        f1.write(10);
        FileInputStream f2=new FileInputStream("D:\\myf10.txt");
        DataInputStream f3=new DataInputStream(f2);
        int i;
        while((i=f3.read())!=-1)
        {
            System.out.println(i);
        }

        f1.close();
        f3.close();
    }
}
```



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81) Write a program to copy the data of one file into another file

```
import java.io.*;
class cop
{
    public static void main(String args[])throws IOException
    {
        FileInputStream f=new FileInputStream("D:\\myf1.txt");
        FileOutputStream f1=new
FileOutputStroam("D:\\copy.txt");
        int i;
        while((i=f.read())!=-1)
        {
            f1.write((char)i);
        }
        f.close();
        f1.close();
    }
}
```

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82) Write a program to demonstrate use of StringTokenizer class

```
import java.io.*;

class stto
{
    public static void main(String args[])throws IOException
    {
        FileReader r=new FileReader("D:\\myf1.txt");
        StringTokenizer st=new StringTokenizer(r);
        double sum=0;
        int n=0;
        while(st.nextToken()!=st.TT_EOF)
        {
            if(st.ttype==StreamTokenizer.TT_NUMBER)
                sum=sum+st.nval;
            else if(st.ttype==StreamTokenizer.TT_WORD)
                n++;
        }
        System.out.println("Sum:" +sum);
        System.out.println("Total Words: "+n);
    }
}
```

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84) Write a program to demonstrate use of `PipedInputStream` and `PipedOutputStream`

```
import java.io.*;

class pipe
{
    public static void main(String args[])
    {
        PipedOutputStream out=new PipedOutputStream();
        PipedInputStream in=new PipedInputStream();
        try
        {
            in.connect(out);
            out.write(23);
            out.write(24);
            for(int i=0;i<2;i++)

                System.out.println(in.read());
        }
        catch(IOException e)
        {
            System.out.println(e);
        }
    }
}
```

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85) Write a program to demonstrate use of Bridge Class  
(InputStreamReader class)

```
import java.io.*;
class br
{
    public static void main(String args[])throws IOException
    {
        FileInputStream f=new
FileInputStream("D:\\myf3.txt");
        InputStreamReader r=new InputStreamReader(f);
        int i;
        while((i=r.read())!=-1)
        {
            System.out.println((char)i);
        }
        r.close();
    }
}
```

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- 86) Write a program to demonstrate use of Bridge Class  
(OutputStreamWriter class)

```
import java.io.*;
class br
{
    public static void main(String args[])throws
IOException
    {
        FileOutputStream f=new
FileOutputStream("D:\\myf100.txt");
        OutputStreamWriter w=new
OutputStreamWriter(f);
        w.write("hello world");
        w.close();
    }
}
```

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87) Write a program to demonstrate use of Bridge Class  
(ObjectInputStream and ObjectOutputStream class)

```
import java.io.*;
class br
{
    public static void main(String args[])throws IOException
    {
        int i=10;
        FileOutputStream f=new
FileOutputStream('d:\\myfile101.txt');
        ObjectOutputStream o=new ObjectOutputStream(f);
        o.writeInt(i);

        FileInputStream f1=new FileInputStream('d:\\myfile101.txt');
        ObjectInputStream o1=new ObjectInputStream(f1);
        System.out.println("Integer:" +o1.readInt());
;
        f.close();
        f1.close();
    }
}
```

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## Ch-5

Write a program which demonstrate life cycle of thread

```
import java.applet.*;
import java.awt.*;
/*<applet code="ap" width=200 height=200>
</applet>*/
public class ap extends Applet {
String msg="";
public void init()
{
msg+="init()called";
}
public void start()
{
msg+="start() called";
}
public void paint(Graphics g)
{
g.drawString(msg,30,30);
}
public void stop()
{
msg+="stop() called";
}
public void destroy()
{
msg+="destroy called";
}
```

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88) Write a program that demonstrate use of parameterized applet

```
import java.applet.*;
import java.awt.*;
/*<applet code="par" width=200 height=100>
<param name="Stuname" value="xyz">
<param name="roll" value="12">
</applet>*/

public class par extends Applet
{
    String name1;
    String roll;
    Font f1;
    public void init()
    {
        f1=new Font("Arial",Font.BOLD,32);
        name1=getParameter("Stuname");
        roll=getParameter("roll");
    }
    public void paint(Graphics g)
    {
        g.setFont(f1);
        g.drawString("Name:"+ name1,50,20);
        g.drawString("Roll:" +roll,250,20);
    }
}
```



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89) Write a program that demonstrate use of flow layout

```
import java.applet.*;
import java.awt.*;
/*<applet code="flow1" width=200 height=200>
</applet>*/

public class flow1 extends Applet
{
    Label b1,b2,b3;
    public void init()
    {
        setLayout(new FlowLayout());
        b1=new Label("OK");
        b2=new Label("Open");
        b3=new Label("Close");
        add(b1);
        add(b2);
        add(b3);
    }
}
```

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90) Write a program that demonstrate use of Border layout

```
import java.applet.*;
import java.awt.*;
/*<applet code="flow1" width=200 height=200>
</applet>*/

public class flow1 extends Applet
{
    Button b1,b2,b3,b4,b5;
    public void init()
    {
        setLayout(new BorderLayout());
        b1=new Button("NORTH");
        b2=new Button("SOUTH");
        b3=new Button("EAST");
        b4=new Button("WEST");
        b5=new Button("CENTER");
        add(b1,BorderLayout.NORTH);
        add(b2,BorderLayout.SOUTH);
        add(b3,BorderLayout.EAST);
        add(b4,BorderLayout.WEST);
        add(b5,BorderLayout.CENTER);
    }
}
```

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91) Write a program that demonstrate use of Card layout

```
import java.applet.*;
import java.awt.*;
import java.awt.event.*;

/*<applet code="card" width=200 height=200>
</applet>*/

public class card extends Applet
{
    Button b1,b2,b3;
    Font f;

    public void init()
    {
        f=new Font("Arial", Font.BOLD,32);
        setLayout(new CardLayout);
        b1=new Button("OK");
        b2=new Button("Cancel");
        b3=new Button("Close");
        b1.setFont(f);
        b2.setFont(f);
        b3.setFont(f);
        add(b1);
        add(b2);
        add(b3);
    }
}
```

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92) Write a program that demonstrate use of Grid layout

```
import java.applet.*;
import java.awt.*;

/*<applet code="gri" width=200 height=200>
</applet>*/

public class gri extends Applet
{
    Button b1,b2,b3,b4,b5;
    Font f;
    public void init()
    {
        setLayout(new GridLayout(3,3));
        f=new Font("Arial",Font.BOLD,32);
        b1=new Button("1");
        b2=new Button("2");
        b3=new Button("3");
        b4=new Button("4");
        b5=new Button("5");
        b1.setFont(f);
        b2.setFont(f);
        b3.setFont(f);
        b4.setFont(f);
        b5.setFont(f);
        add(b1);
        add(b2);
        add(b3);
        add(b4);
        add(b5);
    }
}
```

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93) Write a program that demonstrate use of Grid Bag layout

```
import java.applet.*;
import java.awt.*;

/*<applet code="gri" width=200 height=200>
</applet>*/

public class gri extends Applet
{
    Button b1,b2;
    public void init()
    {
        setLayout(new GridBagLayout());
        Button b1=new Button("Ok");
        Button b2=new Button("Cancel");
        Button b3=new Button("Close");
        Button b4=new Button("Hi");
        GridBagConstraints gc=new GridBagConstraints();
        gc.fill=GridBagConstraints.HORIZONTAL;
        gc.gridx=0;
        gc.gridy=0;
        this.add(b1,gc);
        gc.gridx=0;
        gc.gridy=1;
        this.add(b2,gc);
        gc.gridx=1;
        gc.gridy=0;
        this.add(b3,gc);
        gc.gridx=2;
        gc.gridy=2;
        gc.gridwidth=2;
        this.add(b4,gc);
    }
}
```

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94) Write a program which demonstrate use of Mouse Motion Adapter

```
import javax.swing.*;
import java.awt.event.*;

public class key1 extends MouseAdapter
{
    JFrame f;
    JTextArea ta,ta1;
    key1()
    {
        f=new JFrame();
        ta=new JTextArea();
        ta1=new JTextArea();
        ta.setBounds(80,150,80,70);
        ta.addKeyListener(this);
        ta1.setBounds(80,250,80,70);
        ta1.addMouseListener(this);
        f.add(ta);
        f.add(ta1);
        f.setLayout(null);
        f.setSize(300,300);
        f.setVisible(true);
    }
    public void mouseDragged(MouseEvent e)
    {
        ta1.setText("Dragged");
    }
    public static void main(String args[])
    {
        key1 k=new key1();
    }
}
```