Class:-

In java class is a blue print or template or logical entity of an object.

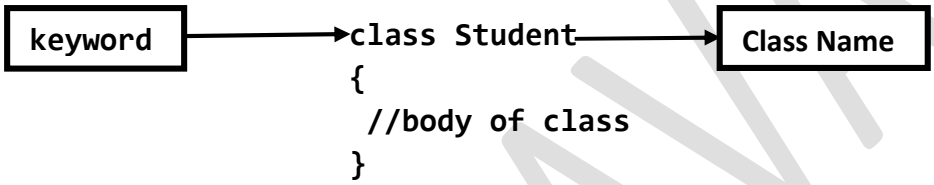
Based on blue print of a class we developed an object.

Class is foundation of any java program.

In java program we write any things inside the class.

Defined class by using class keyword

Example:-



java class can contains:-

a) Object
b) Variable
c) Method
d) Constructors
e) Blocks(instance block and static block)
f) Interface and Nested class

Object:-

Object is physical entity which means it is physically exists, they have memory.

Object is created based on class properties.

Every object contains three characteristics:-

State:-In java programming state represents by instance variable

Behaviour:- In java programming behaviour represent by method.

Identity:-In java for every object JVM will create unique id known as hashcode.

JVM use this unique id for identification purpose of a particular object.

Example:-

```
class Test//class Name
{
int x=10;//state(instance variable)
public static void main(String[]args)//Behaviour(method)
{
Test t=new Test();//object creation
System.out.println(t.x);
}
}
```

Result:-10

Syntax of Object creation by using new keyword:-

```
Class_Name reference_variable=new Class_Name();
```

Example:-

```
Test t=new Test();
Test.......class-name
t.........reference variable
=.........assignment Operator
new........keyword used for object creation
Test().....constructor call
;.........statement terminate
```

Java Variable:-

variable means which hold some memory.

variable is used to store the constant (Literal) values, these values we used in our project requirements.

Variables are also known as fields or properties of a class

All variables must be some types its can be primitive types, array types, class types, interface types etc.

Variable Declaration:- We declare a Variable with three components in this orders.

1. Zero or more Modifier(optional)
2. Variable types(compulsory)
3. Variable names(compulsory)

Example:-

```
public final int id=101;
```

public final :-Modifier(optional)
int:- data type(compulsory)
id:-variable name(compulsory)
101:-literal or constant value(optional)
;:- statement termination

Types of Variable:-Variable divided into two parts.

Division-1

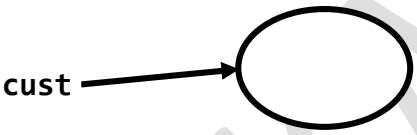
Based on types of value represented by a variable, all variables are divided into two types.

A. Primitive variable.
B. Reference variable

Primitive variable:-This type variable we have used to represent primitive data value.
Example:- int x=101;

Reference variable:-This type of variable we have used to represent Object.
Example:-

```
Customer cust=new Customer();
```



cust is reference variable which is pointing to the Customer class object.

Division-2

Based on position of declaration and behaviour, all variables are divided into three parts.

1. instance variable
2. static variable
3. local variable

Instance Variable:-

If the value of a variable is varied from object to object such types of variables we declared as instance variable.

For every object a separate copy of instance variable will be created

We declared instance variable directly inside the class but outside of the any method or constructor or block.

For the instance variables memory allocated during object creation and memory released when object destroyed. Hence scope of instance variable is exactly same as scope of Object.

It will be stored in heap memory area.

We can access instance variable directly in instance area but can't be access in static area directly but by using object reference we can access in Static area.

There are two types of area in java Language:-

A. Instance Area
B. Static Area

Instance Area:-The area which without static keyword such types of area known as instance area.

```
void m1()//instance method
{
//logic here //instance Area
}
```

Static Area:-The area which with static keyword such types of area known as static area.

```
static void m1()//static method
{
//logic here//static Area
}
```

Example:-

```
class Test
{
//instance variable
int a=20;
int b=30;
//static method
public static void main(String[]args)
{
```

```
//static area
Test t=new Test();
System.out.println("static area value of a="+t.a);
System.out.println("static area value of a="+t.b);
t.m1();
}
//instance method
void m1()
{
//instance area
System.out.println("instance area value of a="+a);
System.out.println("instance area value of a="+b);
}
}
```

Result:-

```
static area value of a=20
static area value of a=30
instance area value of a=20
instance area value of a=30
```

It is also known as object level variable attributes

Static variable:-

If value of the variable is not varied from object to object such types of variables declared as static variable.

For every object a single copy of static variable will be created at class level and shared by every object of the class.

Static variable will be declared inside the class but outside of the method or block or constructor with static modifier.

Static variables memory allocated during .class file loading and memory released at .class file unloading time. So, scope of static variable is exactly same as .class file.

Static variable are stored in method area(non-heap memory).

We can access static variable either by object reference or by class name but recommended to use to class name. within in the same class it is not required to class name and we can access directly by name.

Exercise:-

```
class Test
{
//static variable
static int x=10;
//static method
public static void main(String[]args)
{
//static Area
Test t=new Test();
System.out.println(t.x);
System.out.println(Test.x);
System.out.println(x);
/*all are valid but Test.x is highly recommended to call static
variable because its reflect the properties of static variable.*/
}
}
```

Result:-

```
10
10
10
```

We can access static variable from both instance and static area directly by using its name or with class name.

Exercise:-

```
class Test
{
//static variable
static int x=10;
static int y=20;
//static method
public static void main(String[]args)
{
//static area
System.out.println(x);
System.out.println(y);
Test t=new Test();
t.m1();
}
//instance method
```

```
void m1()
{
//instance area
System.out.println(x);
System.out.println(y);
}
}
```

Result:-

```
10
20
10
20
```

It is known as class level variable because we can access static variable by it name or with class name, we have not required object reference.

Local variable:-

Sometime temporary or locally requirement of the variable. such types of variables we declared as local variable.

We declared local variable inside a method or block or constructor.

Local variable means the variable which access with in block where we declared it, if we try to access that variable from outside of the block then we will get compile time error.

Example:-

```
class Test
{
public static void main(String[]args)
{
int a=10;//local variable
int b=20; //local variable
System.out.println(a);
System.out.println(b);
}
}
```

Result:-

```
10
20
```

In the above example a and b is local variable so a and b we can't access from outside of main method otherwise we will get compile time error.

Local variable will be created while executing the block in which we declare it, once block execution is completes, local variable will be destroyed automatically hence the scope of local variable is the same as block in which we declare it.

Example:-

```
class Test
{
void m1()
{
int x=10;
System.out.println(x);
}
void m2()
{
System.out.println(x);
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
t.m2();
}
}
```

Result:-

```
Test.java:10: error: cannot find symbol
System.out.println(x);
symbol:   variable x
location: class Test
```

Local variable will be stored in stack area. hence it is also known as temporary or stack or automatically variables

For local variable JVM won't provide default value, so we should compulsory to performed initialization explicitly, before using that variable, if we are not used that variable not need to initialize explicitly.

Exercise:-case-1

```
class Test
{
public static void main(String[]args)
{
//Local area of main method
int x;//local variable
System.out.println("Hello");
}
}
```

Result:-Hello

Exercise:-case-2

```
class Test
{
public static void main(String[]args)
{
//Local area of main method
int x;
System.out.println(x);
}
}
```

Result:-

```
Test.java:6: error: variable x might not have been initialized
System.out.println(x);.
```

Note:-Only applicable modifier for local variable is final if we are trying any other then we will get compile Time Error. if we not declared any then it is treated as default but this rule is applicable only for instance and static variable not for local variable.

Example:-

```
class Test
{
public static void main(String[]args)
{
Final int x=10;
private inty=20;
}
}
```

Result:-

```
error: illegal start of expression
private int y=20;
```

METHOD

Method:-

Inside a java class we can't write any business logic directly. Inside a class we declare a method and inside that method we write business logic of programming requirement.

If we write any business logic directly inside the class then we will get compile time error.

Example:-

```
class Test
{
int x=10;
int y=20;
System.out.println(x+y);//business logic
}
```

To Solve this problem, we write all business logic inside the method

```
class Test
{
int x=10;
int y=20;
public static void main(String[]args)//static method
{
Test t=new Test();
System.out.println(t.x+t.y);//business logic
}
}
```

Every method contain three parts

1)method declaration.
2)method implementation(business logic).
3)method calling.

Example:-

```
class Test
{
public void m1()//method declaration
{
System.out.println("m1()method");//method implementation(business
logic)
}
```

```
public static void main(String[]args)
{
Test t=new Test();
t.m1();//method calling
}
}
```

Method Syntax:-

[Modifier-List] Return-Type Method-Name(parameter List)throws Exception

Modifier-List---> Represent access permission------->[optional]

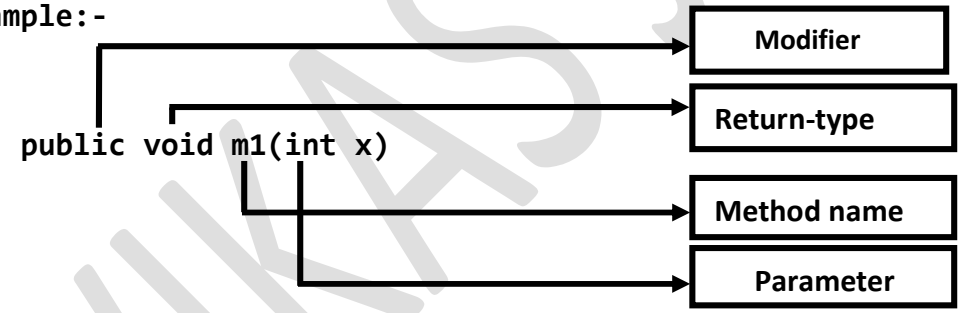
Return-Type--->functionality return value----------->[mandatory]

Method-Name--->functionality name()----------------->[mandatory]

Parameter-List--->input to functionality------------>[optional]

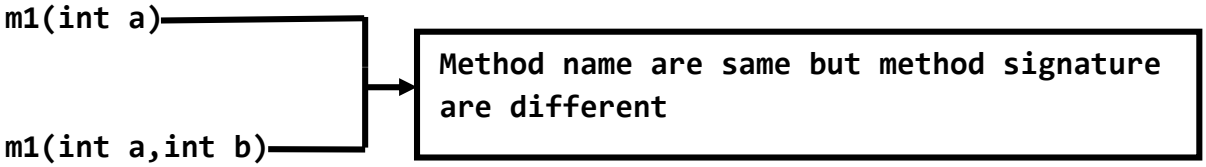
Throws Exception-->represent Exception Handling----->[optional]

Example:-



Method signature:-In java method name and parameter-list considered as method signature, inside a class two method with same signature not contain.

Method signature:- method name(parameter-list).



There are two types of method in java

1)Instance Method

2)Static method

Inside a method when we access at least one instance member directly then corresponding method must be declare as instance otherwise corresponding method we declared as static.

Instance Method:-

The method which declared without static keyword such type of method known as instance method.

Instance Method will be invoked at the time of object creation, If we can access Instance method inside the instance area by using name of the method directly and inside static area by using object reference.

it is also known as non-static method.

```
void m1()//instance method/non-static method
{
 //method Body  //instance area//non static area
}
```

Example:-Access instance method inside the instance area.

```
class Test
{
public void m1()//instance method
{
//instance area
System.out.println("m1()instance method");
}
public void m2()//instance method
{
//instance area
m1();
}
}
```

Example:-Access instance method inside the static area.

```
class Test
{
public void m1()//instance method
{
//instance area
System.out.println("m1()instance method");
}
public void m2()//instance method
{
//instance area
m1();
}
public static void main(String[]args)//static method
{
//static area.
Test t=new Test();
t.m2();
}
}
```

Result:-m1()instance method

Static method:-

The method which declared with static keyword such types of method considered as static method.

Static method will be invoked at the time of .class file load.

we can access static method inside the instance area or static area by using method name directly but this rule is applicable only for within the class but outside of the class we access by using class name.

```
static  void m1()//static method
{
//method Body //static area
}
```

Example:-Access static variable within the class.

```
class Test
{
public static void m1()//static method
{
//static area
System.out.println("m1()static method");
}
public void m2()//instance method
{
//instance area
m1();
}
public static void main(String[]args)//static method
{
Test t=new Test();
t.m2();
m1();
}
}
```

Result:-

```
m1()static method
m1()static method
```

Example:-Access static variable outside of the class.

```
class Test1
{
static void m1()
{
System.out.println("m1() static method of Test1 class");
}
}
class Test2
{
public static void main(String[]args)
{
//m1();//12 line
Test1.m1();
}
}
```

Result:-

```
m1() static method of Test1 class
```

Note:-if we are not commenting line 12 then we will get compile time error saying

```
Test.java:12: error: cannot find symbol
m1();
symbol:   method m1()
location: class Test2
```

Case1:-

Instance and static methods without parameter and at the time of method calling we can't pass any argument.

Example:-

```
class Test
{
public void m1()
{
System.out.println("m1()instance method");
}
public static void m2()
{
System.out.println("m2() static method");
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
Test.m2();
}
}
```

Result:-

```
m1()instance method
m2() static method
```

case2:-

Instance method and static method with parameter

At the time of method calling, we should compulsorily pass the argument then corresponding method will be execute.

While passing parameters, number of argument and order of arguments important.

```
void m1(int a).....t.m1(52);.....valid
void m2(int i,char ch,float f).....t.m2(12,'a',12.32);.....invalid
void m3(int i,char ch,float f).....t.m3(10,'v',12.32f);.....valid
void m4(int i char ch,float f).....t.m4(10,'v');.....invalid
```

Example:-

```
class Test
{
public void m1(int a,char ch)
{
System.out.println("m1 instance method");
System.out.println(a);
System.out.println(ch);
}
public static void m2(double d,boolean b)
{
System.out.println("m2 static method");
System.out.println(d);
System.out.println(b);
}
public static void main(String[]args)
{
Test t=new Test();
t.m1(10,'v');
Test.m2(15.31,true);
}
}
```

Result:-

```
m1 instance method
10
v
m2 static method
15.31
true
```

Case3:-

While calling method we can pass variable as argument also.

Example:-

```
class Test
{
void m1(int a,boolean b,char ch)
{
System.out.println(a);
```

```
System.out.println(b);
System.out.println(ch);
}
public static void main(String[]args)
{
int a=10;
boolean b=true;
char ch='v';
Test t=new Test();
t.m1(a,b,ch);
}
}
```

Result:-

```
10
true
v
```

Case4:-we can provide Object as parameter in the method.

Example:-

```
class Dog
{}
class Cat
{}
class Rat
{}
class Test
{
public void m1(Dog d,Cat c)
{
System.out.println("m1()instance method");
}
static void m2(int a,Rat r)
{
System.out.println("m2() static method");
}
public static void main(String[]args)
{
Dog d=new Dog();
Cat c=new Cat();
Rat r=new Rat();
Test t=new Test();
new Test().m1(new Dog(),new Cat());
t.m1(d,c);
```

```
t.m2(10,r);
Test.m2(10,new Rat());
}
}
```

Result:-

```
m1()instance method
m1()instance method
m2() static method
m2() static method
```

Case5:-Inside a class we can't declare two methods with same signature otherwise we will get compile time error.

Example:-

```
class Test
{
void m1(int a)
{
System.out.println("m1 instance method");
}
static void m1(int b)
{
System.out.println("m1 static method");
}
public static void main(String[]args)
{
Test t=new Test();
t.m1(10);
}
}
```

Result:-

```
Test.java:7: error: method m1(int) is already defined in class Test
static void m1(int b)
```

Case6:-Nesting of method is not possible in java means inside a method we can't declare another method other wise we will get compile time error.

Example:-

```
class Test
{
public void m1()
{
```

```
void m2()
{
System.out.println("m2()inner method");
}
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

Result:-

```
Test.java:5: error: illegal start of expression void m2()
Test.java:5: error: ';'
Expected void m2()
```

Case7:-

Type-casting at method argument level

Example:-

```
class Test
{
public void m1(int x)
{
System.out.println("int value="+x);
}
public void m1(byte b)
{
System.out.println("byte value="+b);
}
public void m1(short s)
{
System.out.println("short value="+s);
}
public void m1(char ch)
{
System.out.println("char value="+ch);
}
public void m1(long l)
{
System.out.println("long value="+l);
}
public void m1(float f)
```

```
{
System.out.println("float value="+f);
}
public void m1(double d)
{
System.out.println("double value="+d);
}
public static void main(String[]args)
{
Test t=new Test();
t.m1(10);
t.m1((byte)20);
t.m1((short)30);
t.m1(40l);
t.m1('V');
t.m1(50.50f);
t.m1(60.60);
}
}
```

Result:-

```
int value=10
byte value=20
short value=30
long value=40
char value=V
float value=50.5
double value=60.6
```

Case8:-

A method can call any number of method but once method execution is completed the control returns to the caller method.

Example:-

```
class Test
{
public void m1()
{
m2();
System.out.println("m1()mehtod");
m2();
}
public void m2()
```

```
{
m3(100);
System.out.println("m2()method");
m3(100);
}
public void m3(int x)
{
System.out.println("m3()method");
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

Result:-

```
m3()method
m2()method
m3()method
m1()mehtod
m3()method
m2()method
m3()method
```

Method Vs Return type

In java method must return type otherwise we will get compile time error, void represent nothing return.

Example:-

```
class Test
{
public m1()
{
System.out.println("m1()method not contain return type");
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

Result:-

Test.java:3: error: invalid method declaration; return type required
public m1()

Method return type can be any type like
-primitive types
-Array types
-class types
-Interface types
-Enum types

If we declare a method with return type, other than void then method body must return return-type value with return keyword otherwise, we will get compile time error.

Case1:- A method declare with float return type.
Example:-

```
class Test
{
float m1()
{
System.out.println("vikas");
return 11;
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

Result:-vikas

Case2:-A method declare with return type other then void and method body not contain any return statement then we will get compile time error.
Example:-

```
class Test
{
float m1()
{
System.out.println("vikas");
}
public static void main(String[]args)
```

```
{
Test t=new Test();
t.m1();
}
}
```

Result:- Test.java:6: error: missing return statement

Case1:- Inside a method body we can declare only one return statement and that statement should be last statement otherwise we will get compile time error.

Example:-

```
class Test
{
public int m1()
{
return 10;
System.out.println("m1()method");
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

Result:-

```
Test.java:6: error: unreachable statement
System.out.println("m1()method");
```

Every method is able to return the value and holding that return value is optional, but it is highly recommended to hold the return value to check the status of the method.

Example:-

```
class Test
{
public boolean m1(int x,char ch)
{
System.out.println("m2() method");
System.out.println(x+".."+ch);
return true;
}
public static void main(String[]args)
{
```

```
Test t=new Test();
boolean b=t.m1(10,'v');
System.out.println("m1()method return values="+b);
}
}
```

Result:-

```
m2() method
10..v
m1()method return values=true
```

Print the return type values of the method by two ways.

1) Hold the return value and try to print that value

2) Directly print, call method by using System.out.println().

Example:-

```
class Test
{
int m1()
{
System.out.println("m1()method");
return 7;
}
void m2()
{
System.out.println("m2()method");
}
public static void main(String[]args)
{
Test t=new Test();
int x=t.m1();
System.out.println("return value of m1()method is="+x);
System.out.println("return value of m1()method is="+t.m1());
t.m2();
//System.out.println(t.m2());//line:-19
}
}
```

Result:-

```
m1()method
return value of m1()method is=7
m1()method
return value of m1()method is=7
m2()method
```

Note:-If we remove comment form line 19 then we will get compile time error Saying:-
Test.java:19: error: 'void' type not allowed here
System.out.println(t.m2());

A java class is able to return user defined class as a return type.

Example:-

```
class X
{}
class Emp
{}
class Test
{
public X m1()
{
System.out.println("m1()method");
X x=new X();
return x;
}
public Emp m2()
{
System.out.println("m2()method");
Emp e=new Emp();
return e;
}
public static String m3()
{
System.out.println("m3()method");
return "vikas";
}
public static void main(String[]args)
{
Test t=new Test();
X x1=t.m1();
System.out.println(x1);
Emp e=t.m2();
System.out.println(e);
String s=Test.m3();
System.out.println(s);
}
}
```

Result:-

```
m1()method
X@15db9742
m2()method
Emp@6d06d69c
m3()method
vikas
```

Template Method:-

In general, after complete the task we required to call all methods, so at the time of method calling we should remember two things.

1. **Number of method and name of method.**
2. **Order of method(which one is first and which one is later).**

Overcome this problem we used Template Method, Template Method is normal method inside this we perform calling all method and based on our requirement we calling only Template Method instead all method one by one.

Example:-

```
//Template method
class Test
{
void customer()
{
System.out.println("customer");
}
void  product()
{
System.out.println("product");
}
void selection()
{
System.out.println("selection");
}
void billing()
{
System.out.println("billing");
}
void deliveryManager()
{
customer();
```

```
product();
selection();
billing();
}
public static void main(String[]args)
{
Test t=new Test();
t.deliveryManager();
}
}
Result:-
customer
product
selection
billing
```

Method recursion:- A method calling itself during execution is called recursion.

```
Example:-
class Test
{
public void m1()
{
System.out.println("m1() method");
m1();
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

Constructors:-

Whenever we are creating an object some piece of the code will be executed automatically to perform initialization state of an object this piece of the code is known as constructor.

Example:-

```
class Test
{
Test()//constructor name and class name both are same.
{
```

```
System.out.println("constructor invoked");
}
public static void main(String[]args)
{
Test t=new Test();
}
}
```

Result:- *constructor invoked*

There are two types of constructor:-

1. *Default Constructor.*
2. **User Defined Constructor**

Default constructor:-

- *If our class doesn't contain any constructor then java compiler provides default constructor.*
- *Inside the class default constructor is invisible mode.*
- *It is always no parameter constructor.*

This application not contains any constructor.

```
class Test
{
void m1()
{
System.out.println("m1()method");
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

After Compilation

After compilation java compiler provide default constructor.

```
class Test
{
void m1()
{
System.out.println("m1()method");
}
Test()//default constuctor
{
}
public static void main(String[]args)
{
Test t=new Test();
t.m1();
}
}
```

User Defined Constructor: -

The constructor which is defined by user (programmer) is called user defined constructor.

User Defined Constructor

1. **Non-parameterized Constructor**
2. **Parameterized Constructor**

Non-Parameterized Constructor:-

The user defined constructor which are not contain any parameter such types of constructor are called Non-parameterized constructor.

Example:-

```
class Test
{
int x;
int y;
Test()
{
x=10;
y=20;
}
public void m1()
{
System.out.println(x+".."+y);
}
public static void main(String[]args)
{
Test t1=new Test();
Test t2=new Test();
t1.m1();
t2.m1();
}
}
```

Result:-

```
10..20
10..20
```

Parameterized Constructor:-

The user defined constructor which are contain at least one parameter such types of constructors are called parameterized constructor.

In case Default constructor and non-parameterized constructor for every object we get same or default value of all instance variable but in case non-parameterized constructor, for every object we get values of instance variable, based on parameter.

Example:-

```
class Test
{
Test(int a)
{
System.out.println("1-arg parameterized constructor");
}
Test(int a,int b)
{
```

```
System.out.println("2-arg parameterized constructor");
}
public static void main(String[]args)
{
Test t1=new Test(10);
Test t2=new Test(10,20);
}
}
```

Result:-

```
1-arg parameterized constructor
2-arg parameterized constructor
```

Copy Constructor:- By using constructor if we want to copy the value of one object to another object called copy constructor.

Example:-

```
class Test
{
int x;
int y;
Test(int x,int y)
{
this.x=x;
this.y=y;
}
Test(Test t)
{
this.x=t.x;
this.y=t.y;
}
void show()
{
System.out.println(x+".."+y);
}
public static void main(String[]args)
{
Test t2=new Test(10,20);
Test t3=new Test(t2);
t2.show();
t3.show();
}
}
```

Result:-

```
10..20
10..20
```

Constructor overloading:-Inside a class if we are declaring multiple constructor with different parameter such types of constructor are called overloaded constructor and in java constructor overloading is possible.

Example:-

```
class Test
{
Test()
{
System.out.println("No-arg constructor");
}
Test(int a)
{
System.out.println("int arg constructor");
}
Test(double d)
{
System.out.println("double arg constructor");
}
public static void main(String[]args)
{
Test t1=new Test();
Test t2=new Test(10);
Test t3=new Test(12.22);
Test t4=new Test(10l);
}
}
```

Result:-

```
No-arg constructor
int arg constructor
double arg constructor
double arg constructor
```

Note:-In java constructor overloading concept is applicable, but constructor overriding concept is not applicable.

Example:-

```
class Parent
{
Parent()
{
System.out.println("Hello parent");
}
}
class Child extends Parent
{
Child(int a)
```

```
{
super();
System.out.println("Hello Child");
}
public static void main(String[]args)
{
//Child c1=new Child();
Child c2=new Child(10);
}
}
```

Result:-

```
Hello parent
Hello Child
```

Note:-Every java class including abstract class can contain constructor but interface can't contain constructor.

Case Study:-

Case1:-

Inside a class if we declare at least one constructor it may be parameterized or non-parameterized then java compile won't create default constructor.

Example:-

```
class Test
{
Test(int a)
{
System.out.println("1-arg user defined constructor");
}
Test(int a,int b)
{
System.out.println("2-arg user defined constructor");
}
public static void main(String[]args)
{
Test t1=new Test();
Test t2=new Test(10);
Test t3=new Test(10,20);
}
}
```

Result: -In the above application we will get compile time error because java compiler is unable to create default constructor, java compiler is created default constructor if and only if there is no any user defined constructor is available.

Compile Time Error is:-
Test.java:13: error: no suitable constructor found for Test(no arguments)
Test t1=new Test();

Case2:-Assign the value of instance variable inside constructor and method [Constructor vs method] then method assigns instance variable we be invoked because method will be executed last then constructor.

Example:-

```
class Test
{
int x;
int y;
Test(int x,int y)
{
this.x=x;
this.y=y;
}
void m1(int x,int y)
{
this.x=x;
this.y=y;
}
void info()
{
System.out.println(x+".."+y);
}
public static void main(String[]args)
{
Test t=new Test(10,20);
t.m1(100,200);
t.info();
}
}
```

Result:- 100..200

Case3:-
Inside a constructor if we are using super() or this() statement then this statement should be the first statement otherwise we will get compile time error.

Example:-

```
class Test
{
Test()
{
System.out.println("Hello");
super();
```

```
}
}
```
Result:- error: call to super must be first statement in constructor
super();

Case4:-Inside the constructor we can use either super() or this() statement but not both statement simultaneously otherwise we will get compile time error.

Example:-
```
class Test
{
Test()
{
super();
this();
}
}
```
Result:-
error: call to this must be first statement in constructor
this();

Case5:-We can use super() and this() statement only inside the constructor no any other place otherwise we will get compile time error.

Example:-
```
class Test
{
public static void main(String[]args)
{
super();
System.out.println("Hello");
}
}
```
Result:-
error: call to super must be first statement in construct or
super();

Case6:-
A constructor can call another constructor by using this() .

```
class Test
{
Test()
{
this(10);
System.out.println("0-arg Constructor");
}
```

```
Test(int x)
{
this(10,20);
System.out.println("1-arg Constructor");
}
Test(int x,int y)
{
System.out.println("2-arg Constructor");
}
public static void main(String[]args)
{
Test t=new Test();
}
}
```

Result:-

```
2-arg Constructor
1-arg Constructor
0-arg Constructor
```

Note:-In this application when object is created 0-parameter constructor is call automatically and 0-parameter constructor call 1-parameter constructor and 1-parameter constructor call 2-parameter constructor by using this().

Case7:-

Recursion constructor:- constructor call each other is known as construction recursion, In our program there may be chance recursion constructor call which create compile time error.

Example:-

```
class Test
{
Test()
{
this(20);
System.out.println("0-arg constructor");
}
Test(int a)
{
this();
System.out.println("1-arg constructor");
}
public static void main(String[]args)
{
Test t=new Test();
}
}
```

Result:-

```
java:8: error: recursive constructor invocation Test(int a)
```

Case7:-

Note:-If parent class method contains any argument constructor then in child class we should provide special care with respect to constructor.

Note:-Whenever we writing any argument constructor inside parent class, we should also write no-arg constructor.

Example:-

```
//Valid
class Parent
{
}
class Child
extends Parent
{
}
```

```
//Valid
class Parent
{
Parent()
{            }
}
class Child extends
Parent
{
}
```

```
//Not Valid
class Parent
{
Parent()
{            }
}
class Child extend
Parent
{
}
```

What is the difference between super(),this() and super, this keyword?

super(),this()	Super, this keyword
1. These are constructors calls	1. These are keywords
2. We can use these to invoke super class & current constructors directly	2. We can use refers parent class and current class instance members.
3. We should use only inside constructors as first line, if we are using outside of constructor we will get compile time error.	3. We can use anywhere (i.e., instance area) except static area , other wise we will get compile time error .

Case8:-

If Parent class constructor throw any checked exception then child class constructor should be throws same types of exception or it Parent types otherwise we will get compile time error.

Example:-

```
import java.io.*;
class Parent
{
Parent() throws IOException
```

```
{
}
}
class Child extends Parent
{
Child()
{
}
}
```

Result:- unreported exception IOException; must be caught or declared to be thrown

Example:-To solve above problem.

```
import java.io.*;
class Parent
{
Parent() throws IOException
{
}
}
class Child extends Parent
{
Child()throws IOException
{
}
}
```

We can't create object for abstract class but abstract class can contain constructor what is the need ?
Abstract class constructor will be executed for every child class object creation to perform initialization of child class object only.

Which of the following statement is true?

1. Whenever we are creating child class object then automatically parent class object will be created.(false).

2. Whenever we are creating child class object then parent class constructor will be executed.(true)

Example:-

```
abstract class Parent
{
Parent()
{
System.out.println(this.hashCode());
//11394033//here this means child class object
}
```

```
}
class Child extends Parent
{
Child()
{
System.out.println(this.hashCode());//11394033
}
}
class Test
{
public static void main(String[] args)
{
Child c=new Child();
System.out.println(c.hashCode());//11394033
}
}
```