Lesson:

Oops Fundamentals

PW SKILLS

List of Concepts Involved:

- Object Creation
- Instance variable v local variable
- Methods with Memory Map(JVM area)
- Method Overloading

Topic 1: Object Creation

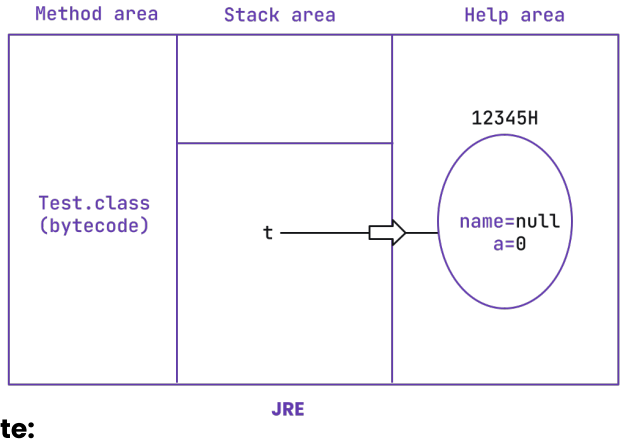
1. We can use the "new" operator to create an object.
2. There is no "delete" operator in java because destruction of useless objects is the responsibility of the garbage collector.

```
class Test
{
	String name;
	int a;
	public static void main(String[] args) {
		Test t = new Test();

	}
}
```

Behind the scenes of Object Creation

1. new operator is a keyword which is used to create the Object.
2. When we say new operator , JVM would allocate memory on the heap area.
3. JVM will load the supplied class name data into the method area.
4. JVM will initialise the memory of instance variables.
5. JVM will set the default value for instance variables based on the data type.Once the memory is set then the address of the object will be stored inside the reference variable.



Note:

new is an operator to create an object , if we know the class name at the beginning then we can create an object by using new operator.

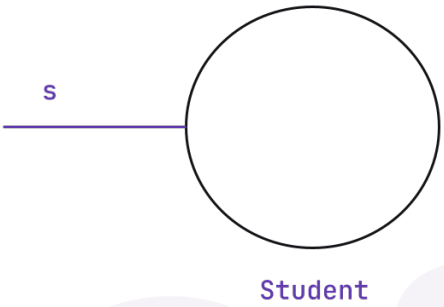
Types of Variables

Division 1 :
Based on the type of value represented by a variable all variables are divided into 2 types. They are:
1. Primitive variables
2. Reference variables

Primitive variables:
Primitive variables can be used to represent primitive values.
Example: int x=10;

Reference variables: Reference variables can be used to refer objects.
Example: Student s=new Student();

Diagram:



Division 2 :
Based on the behavior and position of declaration all variables are divided into the following 3 types.
1. Instance variables
2. Static variables
3. Local variables

Instance variables:
- If the value of a variable is varied from object to object such types of variables are called instance variables.
- For every object a separate copy of instance variables will be created.
- Instance variables will be created at the time of object creation and destroyed at the time of object destruction hence the scope of instance variables is exactly the same as scope of objects.
- Instance variables will be stored on the heap as the part of the object.
- Instance variables should be declared within the class directly but outside of any method or block or constructor.
- Instance variables can be accessed directly from the Instance area. But cannot be accessed directly from a static area.
- But by using object reference we can access instance variables from static area

Example

```
class Test
{
	int i =10;
	public static void main(String[] args) {
		System.out.println(i);//CE: non static variable can't be referenced

		Test t = new Test();
		System.out.println(t.i);//valid
		t.m1();
	}
	public void m1()
	{
		System.out.println(i);//valid
	}
}
```

Local variables:

- Sometimes to meet temporary requirements of the programmer we can declare variables inside a method or block or constructors such type of variables are called local variables or automatic variables or temporary variables or stack variables.
- Local variables will be stored inside the stack.
- The local variables will be created as part of the block execution in which it is declared and destroyed once that block execution completes. Hence the scope of the local variables is exactly the same as the scope of the block in which we declared.

Example

```
class Test
{
	public static void main(String[] args) {
		int i =0;
		for (int j =0;j⩽3 ;j++ )
		{
			i = i+j;
		}
		System.out.println(j);//CE
	}
}
```

- The local variables will be stored on the stack.
- For the local variables JVM won't provide any default values, we should perform initialization explicitly before using that variable.

Example

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

Example

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

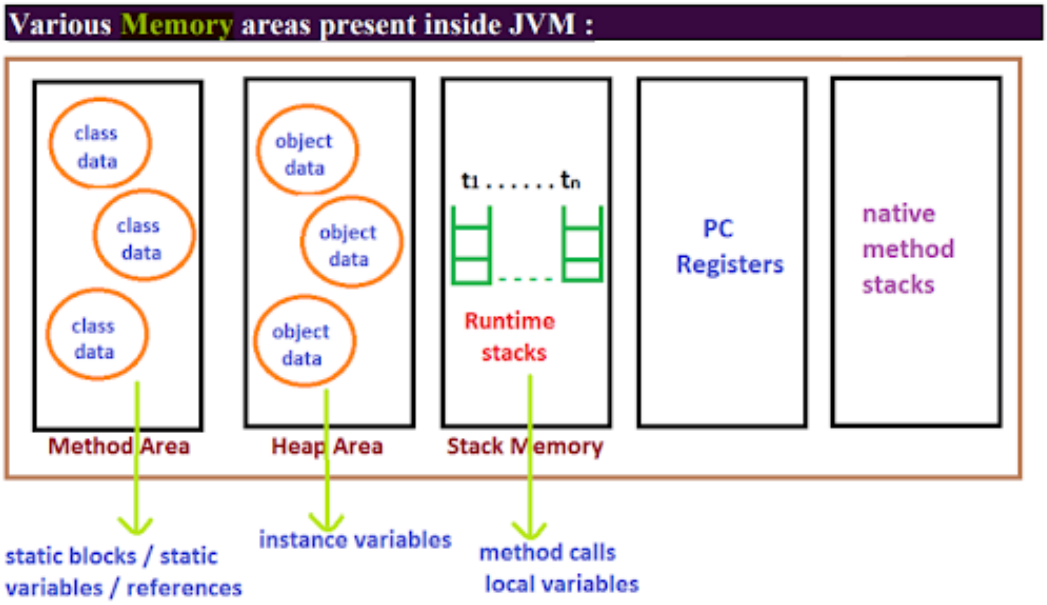
Example

```
class Test
{
	public static void main(String[] args) {
		int x;
		if(args.length>0)
		{
			x=10;
		}
		System.out.println(x);//CE
	}
}
```

Example

```
class Test
{
	public static void main(String[] args) {
		int x;
		if(args.length>0)
		{
			x=10;
		}else{
			x = 20;
		}
		System.out.println(x);
	}
}
```

- It is never recommended to perform initialization for the local variables inside logical blocks because there is no guarantee of executing that block always at runtime.
- It is highly recommended to perform initialization for the local variables at the time of declaration at least with default values.
- The only applicable modifier for local variables is final. If we are using any other modifier we will get a compile time error.



- Class level binary data including static variables will be stored in method area
- Objects and corresponding instance variables will be stored in the Heap area.
- For every method the JVM will create a Runtime stack, all method calls performed by that Thread and corresponding local variables will be stored in that stack. Every entry in stack is called Stack Frame or Action Record.
- The instruction which has to execute next will be stored in the corresponding PC Registers.
- Native method invocations will be stored in native method stacks.

MethodOverloading

- Two methods are said to be overloaded if and only if both have the same name but different argument types.
- In the 'C' language we can't take 2 methods with the same name and different types. If there is a change in argument type compulsory we should go for a new method name.

Example :

abs() for int datatype
labs() for long datatype
fabs() for float datatype

- Lack of overloading in "C" increases complexity of the programming.
- But in java we can take multiple methods with the same name and different argument types.

  abs(int) for int datatype
  abs(long) for long datatype
  abs(float) for float datatype
- Having the same name and different argument types is called method overloading. All these methods are considered as overloaded methods.
- Having overloading concept in java reduces complexity of the programming

Example

```
class Test {
	public void m1(){
		System.out.println("zero arg method");
	}
	public void m1(int i){
		System.out.println("int arg method");
	}
	public void m1(double d){
		System.out.println("double arg method");
	}
	public static void main(String[] args) {
		Test t = new Test();
		t.m1();
		t.m1(10);
		t.m1(10.5);
	}
}
```

Output
zero arg method
int arg method
double arg method

Note:
Conclusion :
In overloading, the compiler is responsible to perform method resolution(decision) based on the reference type(but not based on run time object). Hence overloading is also considered as compile time polymorphism(or) static polymorphism (or)early binding.

Case 1: Automatic promotion in overloading.

- In overloading if the compiler is unable to find the method with exact match we won't get any compile time error immediately.
- First the compiler promotes the argument to the next level and checks whether the matched method is available or not if it is available then that method will be considered if it is not available then the compiler promotes the argument once again to the next level.
- This process will be continued until all possible promotions still if the matched method is not available then we will get a compile time error. This process is called automatic promotion in overloading.

The following are various possible automatic promotions in overloading.

Example

```
class Test {
	public void m1(int i){
		System.out.println("int arg method");
	}
	public void m1(float d){
		System.out.println("float arg method");
	}
	public static void main(String[] args) {
		Test t = new Test();
		t.m1('a');//int arg method
		t.m1(10l);//float arg method
		t.m1(10.5);//CE
	}
}
```

Example

CASE-2

```
class Test {
	public void m1(String s){
		System.out.println("String arg method");
	}
	public void m1(Object d){
		System.out.println("Object arg method");
	}
	public static void main(String[] args) {
		Test t = new Test();
		t.m1("sachin");//String arg method
		t.m1(new Object());//Object arg method
		t.m1(null);//String arg method
	}
}
```

Note :

While resolving overloaded methods, exact matches will always get high priority.

While resolving overloaded methods, the child class will get more priority than the parent class.

Example

CASE-3

```
class Test {
	public void m1(String s){
		System.out.println("String arg method");
	}
	public void m1(StringBuffer d){
		System.out.println("StringBuffer arg method");
	}
	public static void main(String[] args) {
		Test t = new Test();
		t.m1("sachin");//String arg method
		t.m1(new StringBuffer("dhoni"));//StringBuffer arg method
		t.m1(null);//CE
	}
}
```

Example

CASE-4

```
class Test {
	public void m1(int i,float f){
		System.out.println("int, float arg method");
	}
	public void m1(float f, int i){
		System.out.println("float,int arg method");
	}
	public static void main(String[] args) {
		 Test t = new Test();
		 t.m1(10,10.5f);//int,float arg method
		 t.m1(10.5f,10);//float,int arg method
		 t.m1(10,10);//CE
		 t.m1(10.5f,10.5f);//CE

	}
}
```