Top Java Interview Questions and Answers (2022) - InterviewBit

Do you have what it takes to ace a Java Interview? We are here to help you in consolidating your knowledge and concepts in **Java**. Before we begin, let's understand what Java is all about.

What is Java?

Java is the high-level programming language that was developed by James Gosling in the year 1982. It is based on the principles of object-oriented programming and can be used to develop large-scale applications. **Learn More**.

The following article will cover all the popular Core Java interview questions, String Handling interview questions, java 8 interview questions, java multithreading interview questions, java OOPs interview questions, java exception handling interview questions, collections interview questions, and some frequently asked java coding interview questions.

Go through all the questions to enhance your chances of performing well in the interviews. The questions will revolve around the basic, core & advanced fundamentals of Java.

So, let’s dive deep into the plethora of useful **Java Interview questions and answers for freshers and experienced** candidates in depth.

Java Basic Interview Questions

1. Why is Java a platform independent language?

Java language was developed in such a way that it does not depend on any hardware or software due to the fact that the **compiler** compiles the code and then converts it to platform-independent byte code which can be run on multiple systems.

> The only condition to run that byte code is for the machine to have a runtime environment (JRE) installed in it

2. Why is Java not a pure object oriented language?

Java supports primitive data types - byte, boolean, char, short, int, float, long, and double and hence it is not a pure **object oriented language**.

3. Difference between Heap and Stack Memory in java. And how java utilizes this.

Stack memory is the portion of memory that was assigned to every individual program. And it was fixed. On the other hand, Heap memory is the portion that was not allocated to the java program but it will be available for use by the java program when it is required, mostly during the runtime of the program.

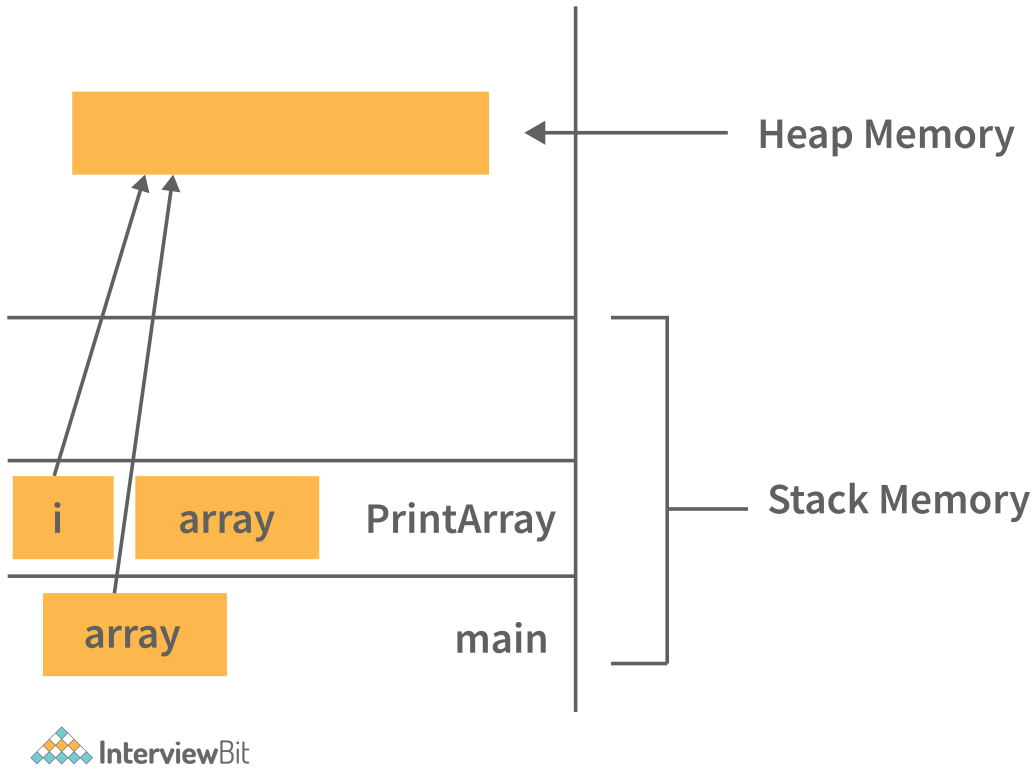
Java Utilizes this memory as -

- When we write a java program then all the variables, methods, etc are stored in the stack memory.
- And when we create any object in the java program then that object was created in the heap memory. And it was referenced from the stack memory.

Example- **Consider the below java program**:

```
class Main {
   public void printArray(int[] array){
       for(int i : array)
           System.out.println(i);
   }
   public static void main(String args[]) {
       int[] array = new int[10];
       printArray(array);
   }
}
```

For this java program. The stack and heap memory occupied by java is -



Main and PrintArray is the method that will be available in the stack area and as well as the variables declared that will also be in the stack area.

And the Object (Integer Array of size 10) we have created, will be available in the Heap area because that space will be allocated to the program during runtime.

4. Can java be said to be the complete object-oriented programming language?

It is not wrong if we claim that java is the complete object-oriented programming language. Because Everything in Java is under the classes. And we can access that by creating the objects.

But also if we say that java is not a completely object-oriented programming language because it has the support of primitive data types like int, float, char, boolean, double, etc.

Now for the question: **Is java a completely object-oriented programming language?** We can say that - Java is not a pure object-oriented programming language, because it has direct access to primitive data types. And these primitive data types don't directly belong to the Integer classes.

5. How is Java different from C++?

- C++ is only a compiled language, whereas Java is compiled as well as an interpreted language.
- Java programs are machine-independent whereas a c++ program can run only in the machine in which it is compiled.
- C++ allows users to use pointers in the program. Whereas java doesn’t allow it. Java internally uses pointers.
- C++ supports the concept of Multiple inheritances whereas Java doesn't support this. And it is due to avoiding the complexity of name ambiguity that causes the diamond problem.

6. Pointers are used in C/ C++. Why does Java not make use of pointers?

Pointers are quite complicated and unsafe to use by beginner programmers. Java focuses on code simplicity, and the usage of pointers can make it challenging. Pointer utilization can also cause potential errors. Moreover, security is also compromised if pointers are used because the users can directly access memory with the help of pointers.

Thus, a certain level of abstraction is furnished by not including pointers in Java. Moreover, the usage of pointers can make the procedure of garbage collection quite slow and erroneous. Java makes use of references as these cannot be manipulated, unlike pointers.

7. What do you understand by an instance variable and a local variable?

Instance variables are those variables that are accessible by all the methods in the class. They are declared outside the methods and inside the class. These variables describe the properties of an object and remain bound to it at any cost.

All the objects of the class will have their copy of the variables for utilization. If any modification is done on these variables, then only that instance will be impacted by it, and all other class instances continue to remain unaffected.

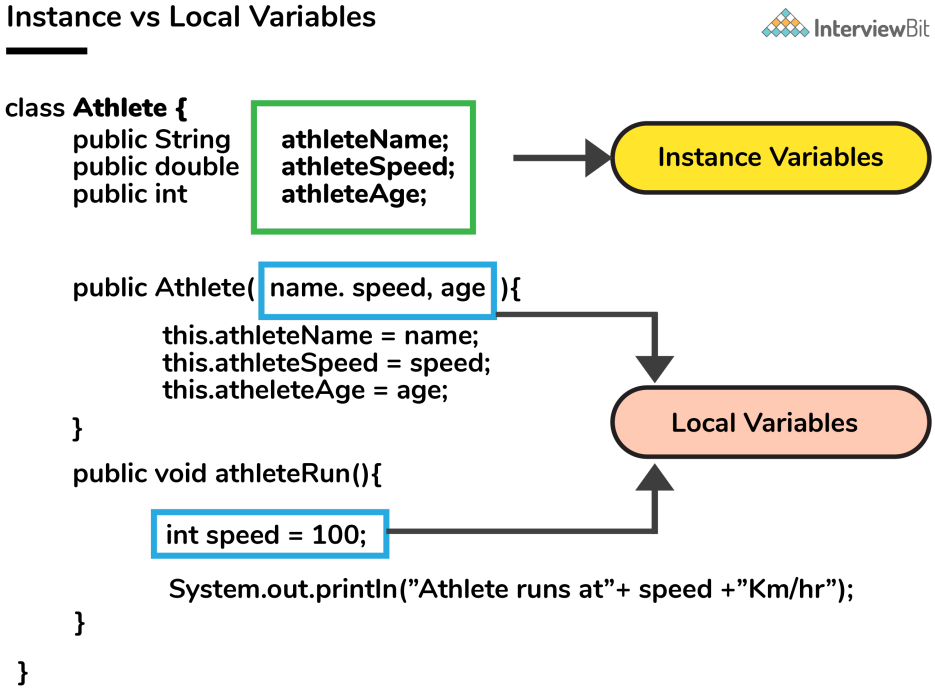
Example:

```
class Athlete {
public String athleteName;
public double athleteSpeed;
public int athleteAge;
}
```

Local variables are those variables present within a block, function, or constructor and can be accessed only inside them. The utilization of the variable is restricted to the block scope. Whenever a local variable is declared inside a method, the other class methods don’t have any knowledge about the local variable.

Example:

```
public void athlete() {
String athleteName;
double athleteSpeed;
int athleteAge;
}
```

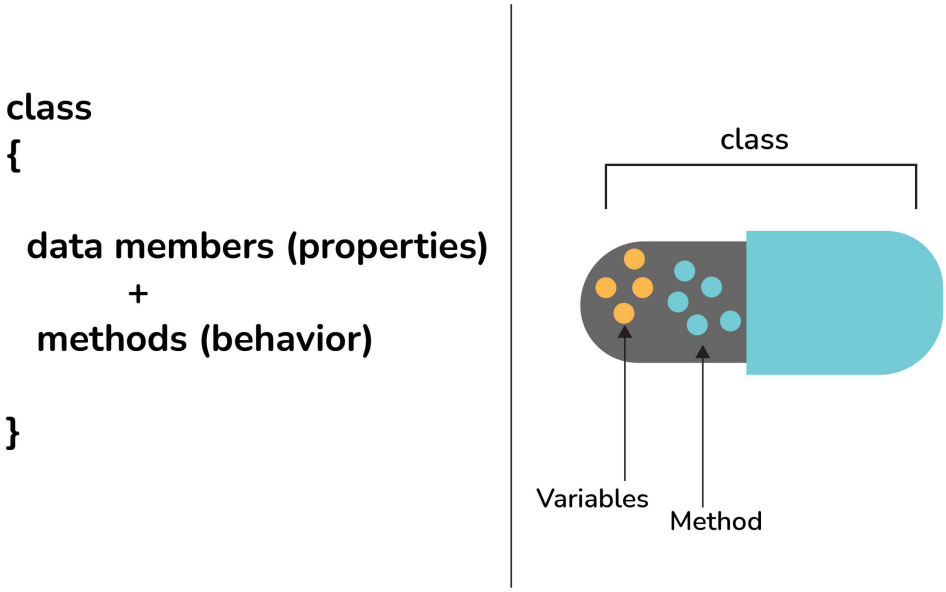


8. What are the default values assigned to variables and instances in java?

- There are no default values assigned to the variables in java. We need to initialize the value before using it. Otherwise, it will throw a compilation error of (**Variable might not be initialized**).
- But for instance, if we create the object, then the default value will be initialized by the default constructor depending on the data type.
- If it is a reference, then it will be assigned to null.
- If it is numeric, then it will assign to 0.
- If it is a boolean, then it will be assigned to false. Etc.

9. What do you mean by data encapsulation?

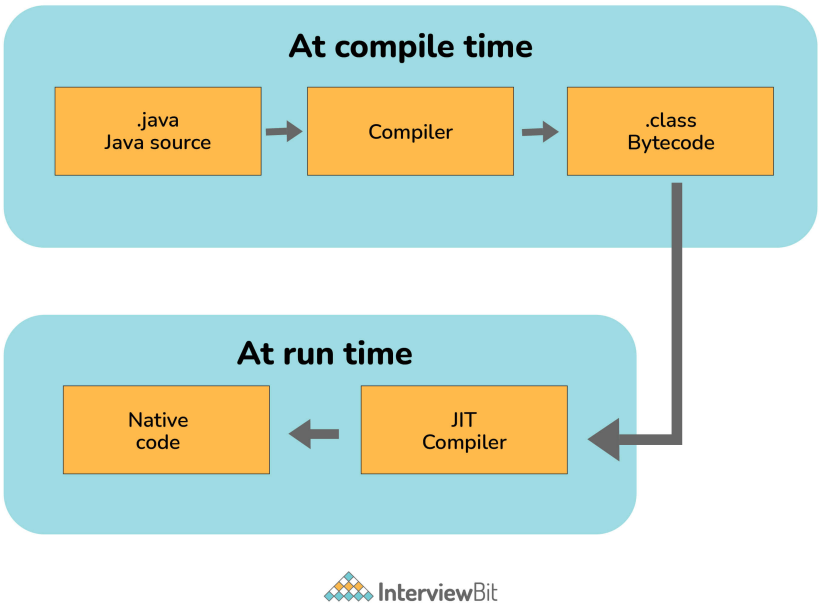
- Data Encapsulation is an Object-Oriented Programming concept of hiding the data attributes and their behaviours in a single unit.
- It helps developers to follow modularity while developing software by ensuring that each object is independent of other objects by having its own methods, attributes, and functionalities.
- It is used for the security of the private properties of an object and hence serves the purpose of data hiding.



InterviewBit

10. Tell us something about JIT compiler.

- JIT stands for Just-In-Time and it is used for improving the performance during run time. It does the task of compiling parts of byte code having similar functionality at the same time thereby reducing the amount of compilation time for the code to run.
- The compiler is nothing but a translator of source code to machine-executable code. But what is special about the JIT compiler? Let us see how it works:
  - First, the Java source code (.java) conversion to byte code (.class) occurs with the help of the javac compiler.
  - Then, the .class files are loaded at run time by JVM and with the help of an interpreter, these are converted to machine understandable code.
  - JIT compiler is a part of JVM. When the JIT compiler is enabled, the JVM analyzes the method calls in the .class files and compiles them to get more efficient and native code. It also ensures that the prioritized method calls are optimized.
  - Once the above step is done, the JVM executes the optimized code directly instead of interpreting the code again. This increases the performance and speed of the execution.



11. Can you tell the difference between equals() method and equality operator (==) in Java?

We are already aware of the **(==) equals** operator. That we have used this to compare the equality of the values. But when we talk about the terms of object-oriented programming, we deal with the values in the form of objects. And this object may contain multiple types of data. So using the **(==) operator** does not work in this case. So we need to go with the .**equals() method.**

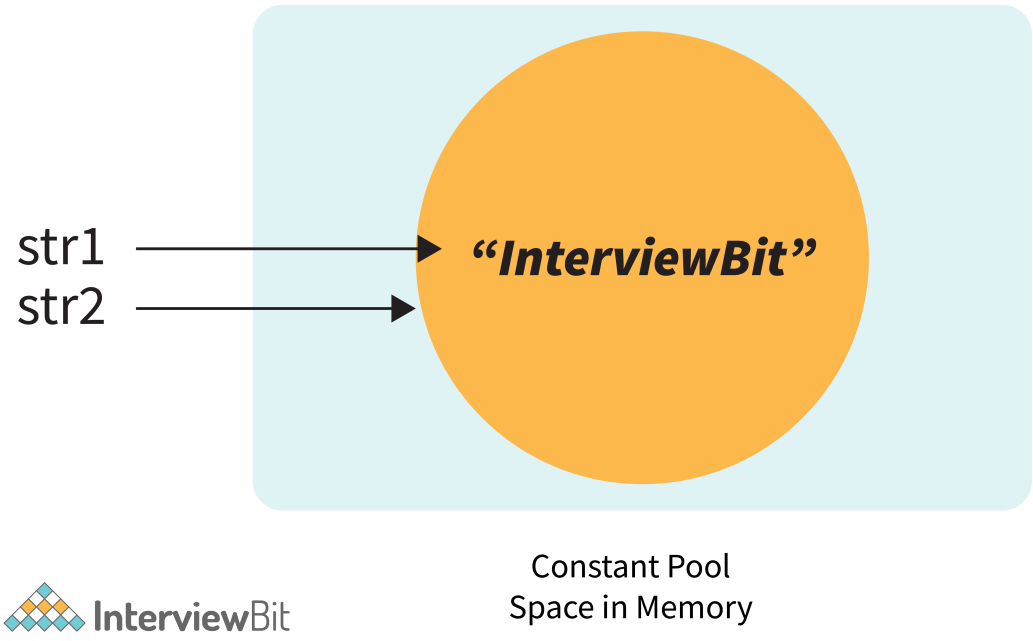
Both **[(==)** and **.equals()]** primary functionalities are to compare the values, but the secondary functionality is different.

So in order to understand this better, let's consider this with the example -

```
String str1 = "InterviewBit";
String str2 = "InterviewBit";

System.out.println(str1 == str2);
```

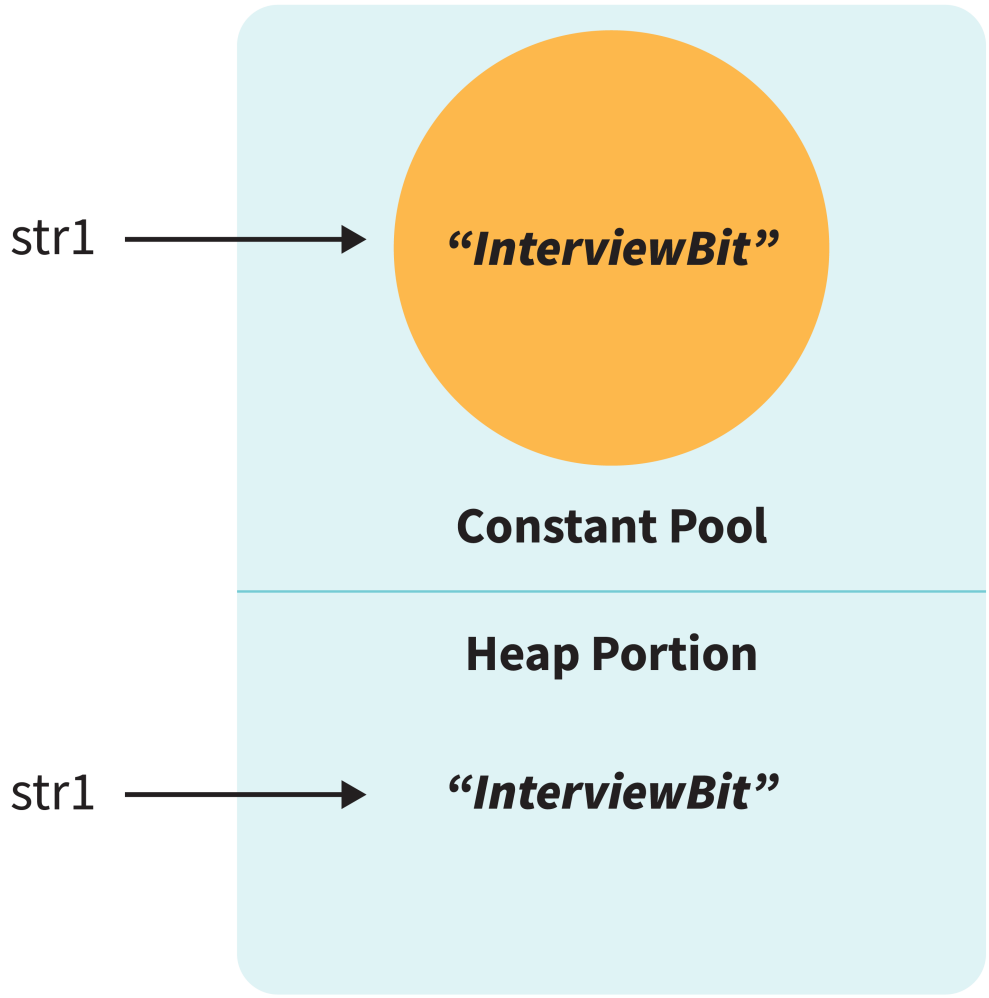
This code will print true. We know that both strings are equals so it will print true. But here **(==) Operators** don't compare each character in this case. It compares the memory location. And because the string uses the constant pool for storing the values in the memory, both **str1** and **str2** are stored at the same memory location. See the detailed Explanation in Question no 73: **Link**.



Now, if we modify the program a little bit with -

```
String str1 = new String("InterviewBit");
String str2 = "InterviewBit";

System.out.println(str1 == str2);
```



Then in this case, it will print false. Because here no longer the constant pool concepts are used. Here, new memory is allocated. So here the memory address is different, therefore (==) Operator returns false. But the twist is that the values are the same in both strings. So how to compare the values? Here the .equals() method is used.

.equals() method compares the values and returns the result accordingly. If we modify the above code with -

```
System.out.println(str1.equals(str2));
```

Then it returns true.

equals()	==
This is a method defined in the Object class.	It is a binary operator in Java.

equals()	==
The .equals() Method is present in the Object class, so we can override our custom .equals() method in the custom class, for objects comparison.	It cannot be modified. They always compare the HashCode.
This method is used for checking the equality of contents between two objects as per the specified business logic.	This operator is used for comparing addresses (or references), i.e checks if both the objects are pointing to the same memory location.

Note:

- In the cases where the equals method is not overridden in a class, then the class uses the default implementation of the equals method that is closest to the parent class.
- Object class is considered as the parent class of all the java classes. The implementation of the equals method in the Object class uses the == operator to compare two objects. This default implementation can be overridden as per the business logic.

12. How is an infinite loop declared in Java?

Infinite loops are those loops that run infinitely without any breaking conditions. Some examples of consciously declaring infinite loop is:

Using For Loop:

```
for (;;)
{
   // Business logic
   // Any break logic
}
```

Using while loop:

```
while(true){
   // Business logic
   // Any break logic
}
```

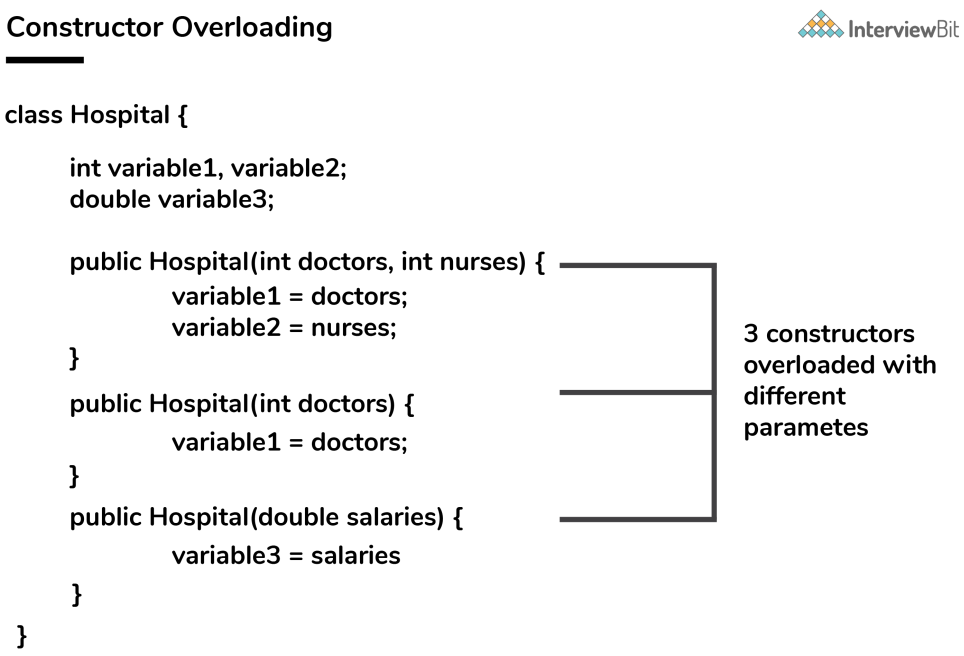
Using do-while loop:

```
do{
   // Business logic
   // Any break logic
}while(true);
```

13. Briefly explain the concept of constructor overloading

Constructor overloading is the process of creating multiple constructors in the class consisting of the same name with a difference in the constructor parameters. Depending upon the number of parameters and their corresponding types, distinguishing of the different types of constructors is done by the compiler.

```
class Hospital {
int variable1, variable2;
double variable3;
public Hospital(int doctors, int nurses) {
 variable1 = doctors;
 variable2 = nurses;
}
public Hospital(int doctors) {
 variable1 = doctors;
}
public Hospital(double salaries) {
 variable3 = salaries
}
}
```



Three constructors are defined here but they differ on the basis of parameter type and their numbers.

14. Define Copy constructor in java.

Copy Constructor is the constructor used when we want to initialize the value to the new object from the old object of the same class.

```
class InterviewBit{
   String department;
   String service;
   InterviewBit(InterviewBit ib){
       this.departments = ib.departments;
       this.services = ib.services;
   }
}
```

Here we are initializing the new object value from the old object value in the constructor. Although, this can also be achieved with the help of object cloning.

15. Can the main method be Overloaded?

Yes, It is possible to overload the main method. We can create as many overloaded main methods we want. However, JVM has a predefined calling method that JVM will only call the main method with the definition of -

```
public static void main(string[] args)
```

Consider the below code snippets:

```
class Main {
    public static void main(String args[]) {
        System.out.println(" Main Method");
    }
    public static void main(int[] args){
        System.out.println("Overloaded Integer array Main Method");
    }
    public static void main(char[] args){
        System.out.println("Overloaded Character array Main Method");
    }
    public static int main(double[] args){
        System.out.println("Overloaded Double array Main Method");
    }
    public static void main(float args){
        System.out.println("Overloaded float Main Method");
    }
}
```

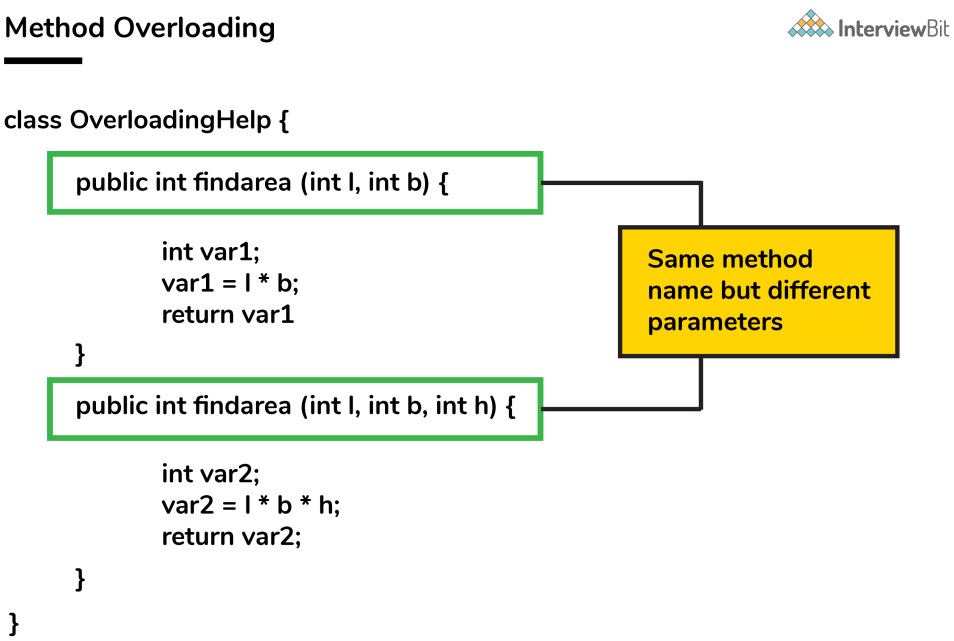
16. Comment on method overloading and overriding by citing relevant examples.

In Java, **method overloading** is made possible by introducing different methods in the same class consisting of the same name. Still, all the functions differ in the number or type of parameters. It

takes place inside a class and enhances program readability.

The only difference in the return type of the method does not promote method overloading. The following example will furnish you with a clear picture of it.

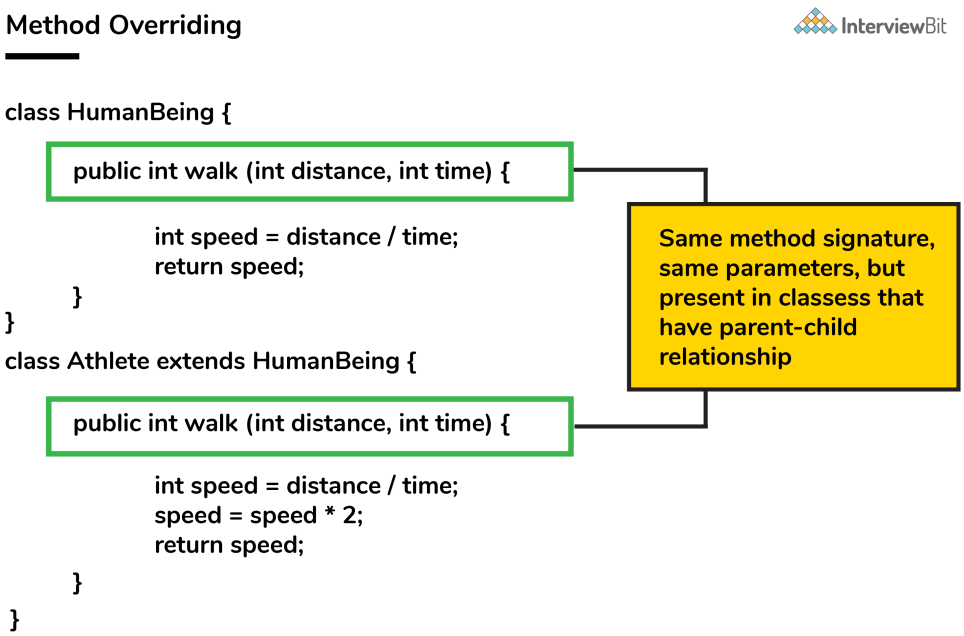
```
class OverloadingHelp {
   public int findarea (int l, int b) {
            int var1;
            var1 = l * b;
            return var1;
   }
   public int findarea (int l, int b, int h) {
            int var2;
            var2 = l * b * h;
            return var2;
   }
}
```



Both the functions have the same name but differ in the number of arguments. The first method calculates the area of the rectangle, whereas the second method calculates the area of a cuboid.

Method overriding is the concept in which two methods having the same method signature are present in two different classes in which an inheritance relationship is present. A particular method implementation (already present in the base class) is possible for the derived class by using method overriding.
Let's give a look at this example:

```
class HumanBeing {
       public int walk (int distance, int time) {
               int speed = distance / time;
               return speed;
       }
}
class Athlete extends HumanBeing {
       public int walk(int distance, int time) {
               int speed = distance / time;
               speed = speed * 2;
               return speed;
       }
}
```



Both class methods have the name walk and the same parameters, distance, and time. If the derived class method is called, then the base class method walk gets overridden by that of the derived class.

17. A single try block and multiple catch blocks can co-exist in a Java Program. Explain.

Yes, multiple catch blocks can exist but specific approaches should come prior to the general approach because only the first catch block satisfying the catch condition is executed. The given code illustrates the same:

```
public class MultipleCatch {
public static void main(String args[]) {
 try {
  int n = 1000, x = 0;
  int arr[] = new int[n];
  for (int i = 0; i <= n; i++) {
   arr[i] = i / x;
  }
```

```
  }
  catch (ArrayIndexOutOfBoundsException exception) {
   System.out.println("1st block = ArrayIndexOutOfBoundsException");
  }
  catch (ArithmeticException exception) {
   System.out.println("2nd block = ArithmeticException");
  }
  catch (Exception exception) {
   System.out.println("3rd block = Exception");
  }
 }
 }
```

Here, the second catch block will be executed because of division by 0 (i / x). In case x was greater than 0 then the first catch block will execute because for loop runs till i = n and array index are till n-1.

18. Explain the use of final keyword in variable, method and class.

In Java, the final keyword is used as defining something as constant /final and represents the non-access modifier.

- **final variable:**
  - When a variable is declared as final in Java, the value can't be modified once it has been assigned.
  - If any value has not been assigned to that variable, then it can be assigned only by the constructor of the class.
- **final method:**
  - A method declared as final cannot be overridden by its children's classes.
  - A constructor cannot be marked as final because whenever a class is inherited, the constructors are not inherited. Hence, marking it final doesn't make sense. Java throws compilation error saying - `modifier final not allowed here`
- **final class:**

  No classes can be inherited from the class declared as final. But that final class can extend other classes for its usage.

19. Do final, finally and finalize keywords have the same function?

All three keywords have their own utility while programming.

Final: If any restriction is required for classes, variables, or methods, the final keyword comes in handy. Inheritance of a final class and overriding of a final method is restricted by the use of the final keyword. The variable value becomes fixed after incorporating the final keyword. Example:

```
final int a=100;
a = 0;  // error
```

The second statement will throw an error.

Finally: It is the block present in a program where all the codes written inside it get executed irrespective of handling of exceptions. Example:

```
try {
int variable = 5;
}
catch (Exception exception) {
System.out.println("Exception occurred");
}
finally {
System.out.println("Execution of finally block");
}
```

Finalize: Prior to the garbage collection of an object, the finalize method is called so that the clean-up activity is implemented. Example:

```
public static void main(String[] args) {
String example = new String("InterviewBit");
example = null;
System.gc(); // Garbage collector called
}
public void finalize() {
// Finalize called
}
```

20. Is it possible that the 'finally' block will not be executed? If yes then list the case.

Yes. It is possible that the 'finally' block will not be executed. The cases are-

- Suppose we use **System.exit()** in the above statement.
- If there are fatal errors like Stack overflow, Memory access error, etc.

21. Identify the output of the java program and state the reason.

```
1. public class InterviewBit
2. {
3.       public static void main(String[] args) {
4.               final int i;
```

```
5.                i = 20;
6.                int j = i+20;
7.                i = j+30;
8.            System.out.println(i + " " + j);
9.        }
10. }
```

The above code will generate a compile-time error at Line 7 saying - **[error: variable i might already have been initialized]**. It is because variable 'i' is the final variable. And final variables are allowed to be initialized only once, and that was already done on line no 5.

22. When can you use super keyword?

- The super keyword is used to access hidden fields and overridden methods or attributes of the parent class.
- Following are the cases when this keyword can be used:
  - Accessing data members of parent class when the member names of the class and its child subclasses are same.
  - To call the default and parameterized constructor of the parent class inside the child class.
  - Accessing the parent class methods when the child classes have overridden them.
- The following example demonstrates all 3 cases when a super keyword is used.

```
public class Parent{
        protected int num = 1;

        Parent(){
            System.out.println("Parent class default constructor.");
        }

        Parent(String x){
            System.out.println("Parent class parameterised constructor.");
        }

        public void foo(){
            System.out.println("Parent class foo!");
        }
    }

    public class Child extends Parent{
        private int num = 2;

        Child(){
            System.out.println("Child class default Constructor");
            super("Call Parent");    // to call parameterised constructor.
            super();    // to call default parent constructor

        }

        void printNum(){
            System.out.println(num);
            System.out.println(super.num); //prints the value of num of parent cla
ss
```

```
        }

        @Override
        public void foo(){
            System.out.println("Parent class foo!");
            super.foo();    //Calls foo method of Parent class inside the Override
 n foo method of Child class.
        }
    }
```

23. Can the static methods be overloaded?

Yes! There can be two or more static methods in a class with the same name but differing input parameters.

24. Why is the main method static in Java?

The main method is always static because static members are those methods that belong to the classes, not to an individual object. So if the main method will not be static then for every object, It is available. And that is not acceptable by JVM. JVM calls the main method based on the class name itself. Not by creating the object.

Because there must be only 1 main method in the java program as the execution starts from the main method. So for this reason the main method is static.

25. Can the static methods be overridden?

- No! Declaration of static methods having the same signature can be done in the subclass but run time polymorphism can not take place in such cases.
- Overriding or dynamic polymorphism occurs during the runtime, but the static methods are loaded and looked up at the compile time statically. Hence, these methods cant be overridden.

26. Difference between static methods, static variables, and static classes in java.

- **Static Methods and Static variables** are those methods and variables that belong to the class of the java program, not to the object of the class. This gets memory where the class is loaded. And these can directly be called with the help of class names.

  For example - We have used mathematical functions in the java program like - max(), min(), sqrt(), pow(), etc. And if we notice that, then we will find that we call it directly with the class name. Like - Math.max(), Math.min(), etc. So that is a static method. And Similarly static variables we have used like (length) for the array to get the length. So that is the static method.
- **Static classes** - A class in the java program cannot be static except if it is the inner class. If it is an inner static class, then it exactly works like other static members of the class.

27. What is the main objective of garbage collection?

The main objective of this process is to free up the memory space occupied by the unnecessary and unreachable objects during the Java program execution by deleting those unreachable objects.

> This ensures that the memory resource is used efficiently, but it provides no guarantee that there would be sufficient memory for the program execution.

28. What is a ClassLoader?

- Java Classloader is the program that belongs to JRE (Java Runtime Environment). The task of ClassLoader is to load the required classes and interfaces to the JVM when required.
- **Example-** To get input from the console, we require the scanner class. And the Scanner class is loaded by the ClassLoader.

29. What part of memory - Stack or Heap - is cleaned in garbage collection process?

Heap.

30. What are shallow copy and deep copy in java?

To copy the object's data, we have several methods like deep copy and shallow copy.

Example -

```
class Rectangle{
int length = 5;
     int breadth = 3;
}
```

Object for this Rectangle class - **Rectangle obj1 = new Rectangle();**

> **Shallow copy** - The shallow copy only creates a new reference and points to the same object. Example - For Shallow copy, we can do this by -

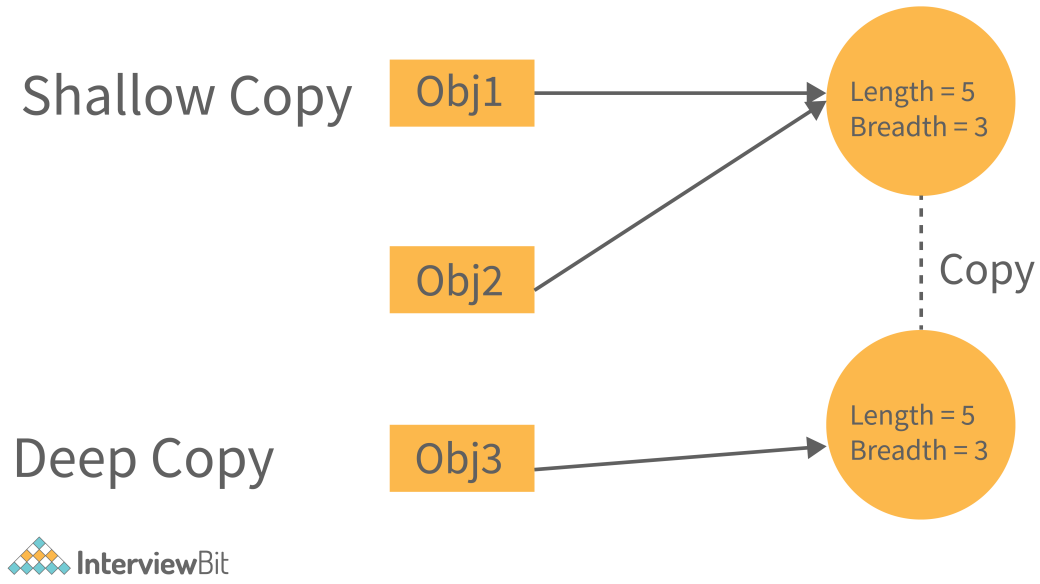
```
Rectangle obj2 = obj1;
```

Now by doing this what will happen is the new reference is created with the name obj2 and that will point to the same memory location.

> **Deep Copy** - In a deep copy, we create a new object and copy the old object value to the new object. Example -

```
Rectangle obj3 = new Rectangle();
Obj3.length = obj1.length;
Obj3.breadth = obj1.breadth;
```

Both these objects will point to the memory location as stated below -



Now, if we change the values in shallow copy then they affect the other reference as well. Let's see with the help of an example -

```
class Rectangle
{
int length = 5;
   int breadth = 3;
}
public class Main
{
public static void main(String[] args) {
 Rectangle obj1 = new Rectangle();
 //Shallow Copy
           Rectangle obj2 = obj1;

           System.out.println(" Before Changing the value of object 1, the object
2 will be - ");
           System.out.println(" Object2 Length = "+obj2.length+", Object2 Breadth
= "+obj2.breadth);

           //Changing the values for object1.
           obj1.length = 10;
           obj1.breadth = 20;

           System.out.println("\n After Changing the value of object 1, the objec
t2 will be - ");
           System.out.println(" Object2 Length = "+obj2.length+", Object2 Breadth
= "+obj2.breadth);
```

```
}
}
```

Output -

```
Before Changing the value of object 1, the object2 will be -
Object2 Length = 5, Object2 Breadth = 3

After Changing the value of object 1, the object2 will be -
Object2 Length = 10, Object2 Breadth = 20
```

We can see that in the above code, if we change the values of object1, then the object2 values also get changed. It is because of the reference.

Now, if we change the code to deep copy, then there will be no effect on object2 if it is of type deep copy. Consider some snippets to be added in the above code.

```
class Rectangle
{
   int length = 5;
   int breadth = 3;
}
public class Main
{
public static void main(String[] args) {
 Rectangle obj1 = new Rectangle();
 //Shallow Copy
           Rectangle obj2 = new Rectangle();
           obj2.length = obj1.length;
           obj2.breadth = obj1.breadth;

           System.out.println(" Before Changing the value of object 1, the object
2 will be - ");
           System.out.println(" Object2 Length = "+obj2.length+", Object2 Breadth
= "+obj2.breadth);

           //Changing the values for object1.
           obj1.length = 10;
           obj1.breadth = 20;

           System.out.println("\n After Changing the value of object 1, the objec
t2 will be - ");
           System.out.println(" Object2 Length = "+obj2.length+", Object2 Breadth
= "+obj2.breadth);

}
}
```

The above snippet will not affect the object2 values. It has its separate values. The output will be

```
Before Changing the value of object 1, the object2 will be -
Object2 Length = 5, Object2 Breadth = 3

After Changing the value of object 1, the object2 will be -
Object2 Length = 5, Object2 Breadth = 3
```

Now we see that we need to write the number of codes for this deep copy. So to reduce this, In java, there is a method called **clone().**

The **clone()** will do this deep copy internally and return a new object. And to do this we need to write only 1 line of code. That is - **Rectangle obj2 = obj1.clone();**

Java Advanced Interview Questions

70. Although inheritance is a popular OOPs concept, it is less advantageous than composition. Explain.

Inheritance lags behind composition in the following scenarios:

- Multiple-inheritance is not possible in Java. Classes can only extend from one superclass. In cases where multiple functionalities are required, for example - to read and write information into the file, the pattern of composition is preferred. The writer, as well as reader functionalities, can be made use of by considering them as the private members.
- Composition assists in attaining high flexibility and prevents breaking of encapsulation.
- Unit testing is possible with composition and not inheritance. When a developer wants to test a class composing a different class, then Mock Object can be created for signifying the composed class to facilitate testing. This technique is not possible with the help of inheritance as the derived class cannot be tested without the help of the superclass in inheritance.
- The loosely coupled nature of composition is preferable over the tightly coupled nature of inheritance.

Let’s take an example:

```
package comparison;
public class Top {
public int start() {
  return 0;
}
}
class Bottom extends Top {
 public int stop() {
  return 0;
```

```
  }
}
```

In the above example, inheritance is followed. Now, some modifications are done to the Top class like this:

```
public class Top {
 public int start() {
  return 0;
 }
 public void stop() {
 }
}
```

If the new implementation of the Top class is followed, a compile-time error is bound to occur in the Bottom class. Incompatible return type is there for the Top.stop() function. Changes have to be made to either the Top or the Bottom class to ensure compatibility. However, the composition technique can be utilized to solve the given problem:

```
class Bottom {
 Top par = new Top();
 public int stop() {
  par.start();
  par.stop();
  return 0;
 }
}
```

71. What is the difference between '>>' and '>>>' operators in java?

These 2 are the bitwise right shift operators. Although both operators look similar. But there is a minimal difference between these two right shift operators.

- **'>>' Bitwise Right Shift Operator**- This operator shifts each bit to its right position. And this maintains the signed bit.
- **'>>>' Bitwise Right Shift Operator with trailing zero**- This operator also shifts each bit to its right. But this doesn't maintain the signed bit. This operator makes the Most significant bit to 0.

Example- Num1 = 8, Num2 = -8.

So the binary form of these numbers are -

Num1 = 00000000 00000000 00000000 00001000
Num2 = 11111111 11111111 11111111 11111000

'>>' Operator : 8 >> 1 (Shift by one bit) :

Num1 = 00000000 00000000 00000000 00000100
Num2 = 11111111 11111111 11111111 11111100

'>>>' Operator : 8 >>> 1 (Shift by one bit) =

Num1 = 00000000 00000000 00000000 00000100
Num2 = 01111111 11111111 11111111 11111100

72. What are Composition and Aggregation? State the difference.

Composition, and Aggregation help to build (Has - A - Relationship) between classes and objects. But both are not the same in the end. **Let's understand with the help of an example.**

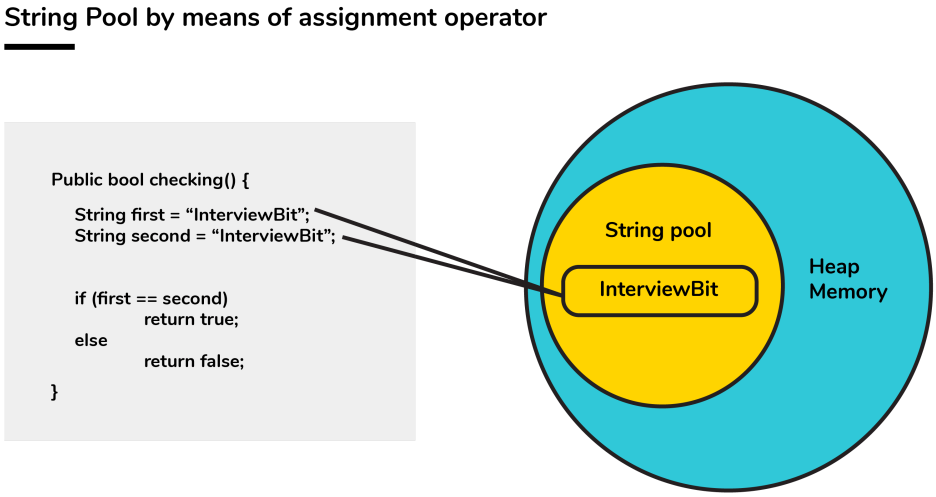
- Consider the University as a class that has some departments in it. So the university will be the container object. And departments in it will contain objects. Now in this case, if the container object destroys then the contained objects will also get destroyed automatically. So here we can say that there is a strong association between the objects. So this Strong Association is called **Composition**.
- Now consider one more example. Suppose we have a class department and there are several professors' objects there in the department. Now if the department class is destroyed then the professor's object will become free to bind with other objects. Because container objects (Department) only hold the references of contained objects (Professor's). So here is the weak association between the objects. And this weak association is called **Aggregation**.

73. How is the creation of a String using new() different from that of a literal?

When a String is formed as a literal with the assistance of an assignment operator, it makes its way into the String constant pool so that String Interning can take place. This same object in the heap will be referenced by a different String if the content is the same for both of them.

```
public bool checking() {
String first = "InterviewBit";
String second = "InterviewBit";
if (first == second)
 return true;
else
 return false;
}
```

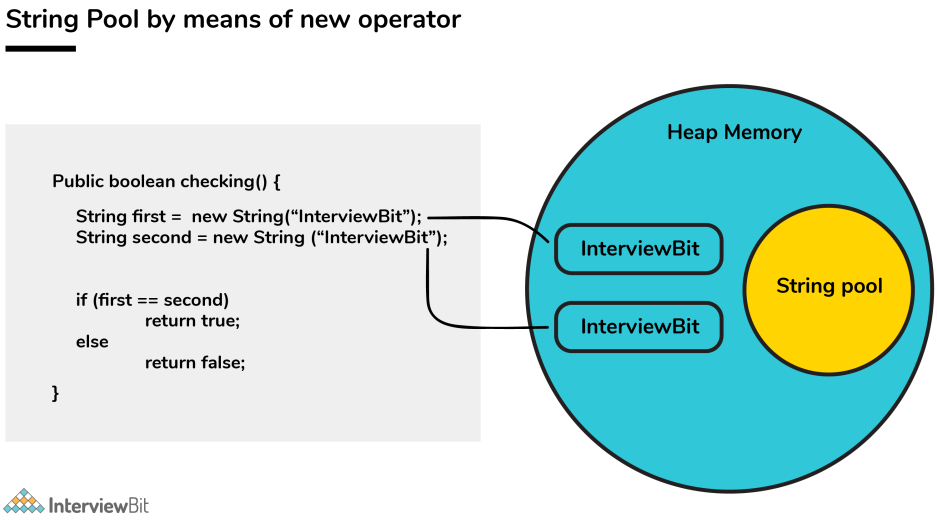
The checking() function will return true as the same content is referenced by both the variables.



Conversely, when a String formation takes place with the help of a new() operator, interning does not take place. The object gets created in the heap memory even if the same content object is present.

```
public bool checking() {
String first = new String("InterviewBit");
String second = new String("InterviewBit");
if (first == second)
 return true;
else
 return false;
}
```

The checking() function will return false as the same content is not referenced by both the variables.



74. How is the 'new' operator different from the 'newInstance()' operator in java?

Both '**new**' and '**newInstance()**' operators are used to creating objects. The difference is- that when we already know the class name for which we have to create the object then we use a new operator. But suppose we don't know the class name for which we need to create the object, Or we get the class name from the command line argument, or the database, or the file. Then in that case we use the '**newInstance()**' operator.

The '**newInstance()**' keyword throws an exception that we need to handle. It is because there are chances that the class definition doesn't exist, and we get the class name from runtime. So it will throw an exception.

75. Is exceeding the memory limit possible in a program despite having a garbage collector?

Yes, it is possible for the program to go out of memory in spite of the presence of a garbage collector. Garbage collection assists in recognizing and eliminating those objects which are not required in the program anymore, in order to free up the resources used by them.

In a program, if an object is unreachable, then the execution of garbage collection takes place with respect to that object. If the amount of memory required for creating a new object is not sufficient, then memory is released for those objects which are no longer in the scope with the help of a garbage collector. The memory limit is exceeded for the program when the memory released is not enough for creating new objects.

Moreover, exhaustion of the heap memory takes place if objects are created in such a manner that they remain in the scope and consume memory. The developer should make sure to dereference the object after its work is accomplished. Although the garbage collector endeavors its level best to reclaim memory as much as possible, memory limits can still be exceeded.

Let’s take a look at the following example:

```
List<String> example = new LinkedList<String>();
while(true){
example.add(new String("Memory Limit Exceeded"));
}
```

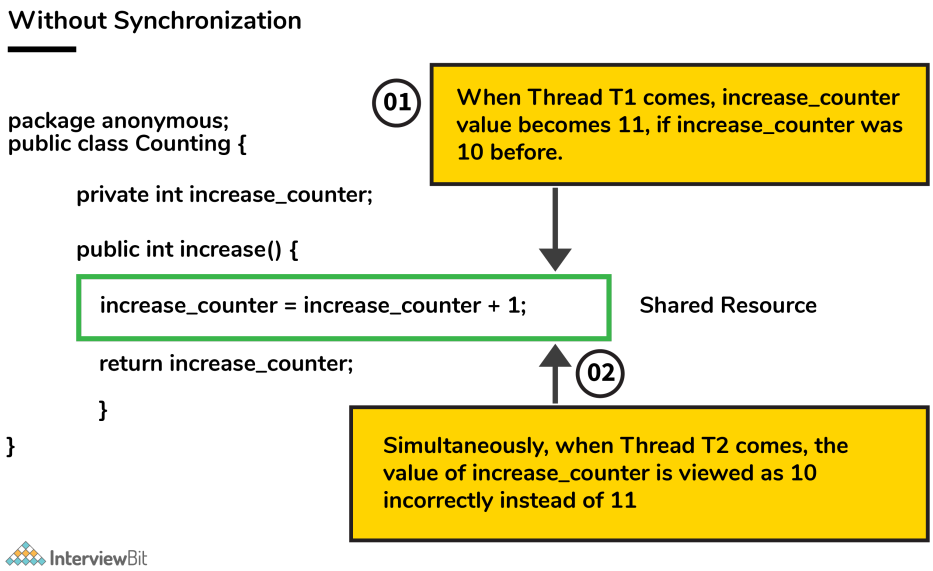
76. Why is synchronization necessary? Explain with the help of a relevant example.

Concurrent execution of different processes is made possible by synchronization. When a particular resource is shared between many threads, situations may arise in which multiple threads require the same shared resource.

Synchronization assists in resolving the issue and the resource is shared by a single thread at a time. Let’s take an example to understand it more clearly. For example, you have a URL and you have to find out the number of requests made to it. Two simultaneous requests can make the count erratic.

No synchronization:

```
package anonymous;
public class Counting {
	private int increase_counter;
	public int increase() {
		increase_counter = increase_counter + 1;
		return increase_counter;
	}
}
```

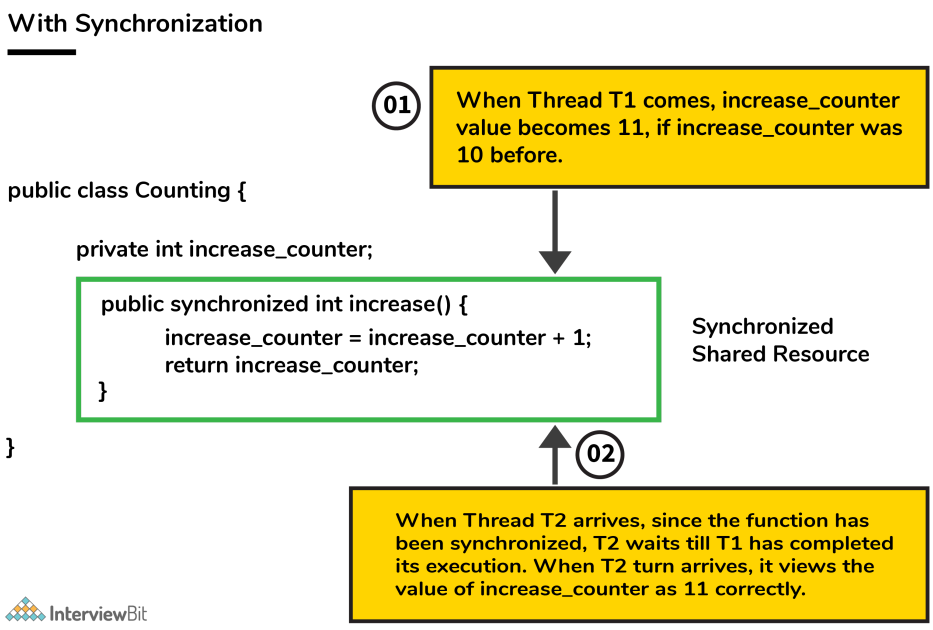


If a thread Thread1 views the count as 10, it will be increased by 1 to 11. Simultaneously, if another thread Thread2 views the count as 10, it will be increased by 1 to 11. Thus, inconsistency in count values takes place because the expected final value is 12 but the actual final value we get will be 11.

Now, the function increase() is made synchronized so that simultaneous accessing cannot take place.

With synchronization:

```
package anonymous;
public class Counting {
	private int increase_counter;
	public synchronized int increase() {
		increase_counter = increase_counter + 1;
		return increase_counter;
	}
}
```



If a thread Thread1 views the count as 10, it will be increased by 1 to 11, then the thread Thread2 will view the count as 11, it will be increased by 1 to 12. Thus, consistency in count values takes place.

77. In the given code below, what is the significance of ... ?

```
public void fooBarMethod(String... variables){
   // method code
}
```

- Ability to provide `...` is a feature called varargs (variable arguments) which was introduced as part of Java 5.
- The function having `...` in the above example indicates that it can receive multiple arguments of the datatype String.
- For example, the fooBarMethod can be called in multiple ways and we can still have one method to process the data as shown below:

```
fooBarMethod("foo", "bar");
fooBarMethod("foo", "bar", "boo");
fooBarMethod(new String[]{"foo", "var", "boo"});
public void myMethod(String... variables){
   for(String variable : variables){
       // business logic
   }
}
```

78. What will be the output of the below java program and define the steps of Execution of the java program with the help of the below code?

```
class InterviewBit{
    int i;
    static int j;
    {
        System.out.println(" Instance Block 1. Value of i = "+i);
    }
    static{
        System.out.println(" Static Block 1. Value of j = "+j);
        method_2();
    }
    {
        i = 5;
    }
    static{
        j = 10;
    }
    InterviewBit(){
        System.out.println(" Welcome to InterviewBit ");
    }
    public static void main(String[] args){
        InterviewBit ib = new InterviewBit();
    }
    public void method_1(){
        System.out.println(" Instance method. ");
    }
    static{
        System.out.println(" Static Block 2. Value of j = "+j);
    }
    {
        System.out.println(" Instance Block 2. Value of i = "+i);
        method_1();
    }
    public static void method_2(){
```

```
            System.out.println(" Static method. ");
        }
    }
```

The Output we get by executing this program will be

Static Block 1. Value of j = 0
Static method.
Static Block 2. Value of j = 10
Instance Block 1. Value of i = 0
Instance Block 2. Value of i = 5
Instance method.
Welcome to InterviewBit

This is a java tricky interview question frequently asked in java interviews for the experienced. The output will be like this because, when the java program is compiled and gets executed, then there are various steps followed for execution. And the steps are -

- Identification of Static Members from top to bottom.
- Execution of Static variable assignment and a Static block from top to bottom.
- Execution of the main method.
- Identification of Instance Members from top to bottom.
- Execution of Instance variable assignment and Instance block from top to bottom.
- Execution of Constructor.

In above steps from 4 to 6, will be executed for every object creation. If we create multiple objects then for every object these steps will be performed.

Now from the above code, the execution will happen like this -

1. In the step of identification of static members. It is found that -

- static int j.
- static block.
- main method.
- static method_2.

During identification, the JVM will assign the default value in the static int j variable. Then it is currently in the state of reading and indirectly writing. Because the original value is not assigned.

2. In the next step, it will execute the static block and assign the value in static variables.

- First static block it will print and because execution from top to bottom and original value in j is not assigned. So it will print the default value of 0.

- After executing static block 1. It will execute the static method_1 because it is called from the static block 1.
- Then it will assign the original value of 5 in the j variable. And executes the remaining static block.

3. Now it will execute the main method. In which it will create an object for the class InterviewBit. And then the execution of instances will happen.

4. Identify the instance variables and blocks from top to bottom.

- int i.
- Instance block 1.
- Instance method_1.

Like a static variable, the instance variable also has been initialized with the default value 0 and will be in the state of reading and writing indirectly.

5. It will execute the instance methods and assign the original value to the instance variable.

- Prints the Instance block 1. And the current value of i is not assigned till now, so it will print 0.
- Assign the original value to i. Then print instance block 2. And after that instance method will be called and printed because it is being called in the instance block.

6. And at the last step, the constructor will be invoked and the lines will be executed in the constructor.

This is how the java program gets executed.

79. Define System.out.println().

System.out.println() is used to print the message on the console. **System** - It is a class present in **java.lang package**. Out is the static variable of type PrintStream class present in the **System class. println()** is the method present in the PrintStream class.

So if we justify the statement, then we can say that if we want to print anything on the console then we need to call the **println()** method that was present in PrintStream class. And we can call this using the output object that is present in the System class.

80. Can you explain the Java thread lifecycle?

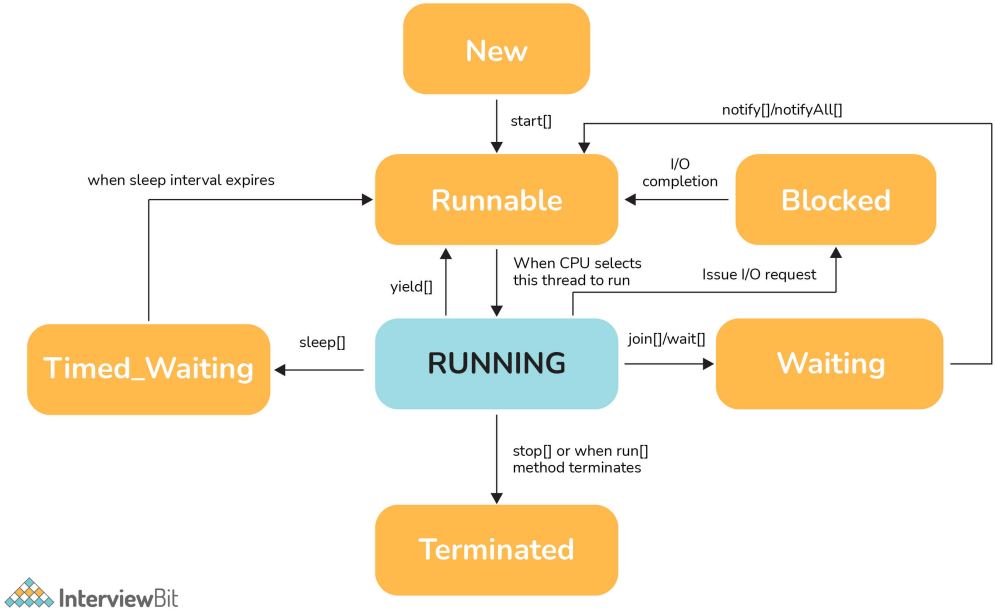
Java thread life cycle is as follows:

- **New** – When the instance of the thread is created and the start() method has not been invoked, the thread is considered to be alive and hence in the NEW state.
- **Runnable** – Once the start() method is invoked, before the run() method is called by JVM, the thread is said to be in RUNNABLE (ready to run) state. This state can also be entered from the

Waiting or Sleeping state of the thread.

- **Running** – When the run() method has been invoked and the thread starts its execution, the thread is said to be in a RUNNING state.
- **Non-Runnable (Blocked/Waiting)** – When the thread is not able to run despite the fact of its aliveness, the thread is said to be in a NON-RUNNABLE state. Ideally, after some time of its aliveness, the thread should go to a runnable state.
  - A thread is said to be in a Blocked state if it wants to enter synchronized code but it is unable to as another thread is operating in that synchronized block on the same object. The first thread has to wait until the other thread exits the synchronized block.
  - A thread is said to be in a Waiting state if it is waiting for the signal to execute from another thread, i.e it waits for work until the signal is received.
- **Terminated** – Once the run() method execution is completed, the thread is said to enter the TERMINATED step and is considered to not be alive.

The following flowchart clearly explains the lifecycle of the thread in Java.



81. What could be the tradeoff between the usage of an unordered array versus the usage of an ordered array?

- The main advantage of having an ordered array is the reduced search time complexity of `O(log n)` whereas the time complexity in an unordered array is `O(n)` .
- The main drawback of the ordered array is its increased insertion time which is O(n) due to the fact that its element has to reordered to maintain the order of array during every insertion whereas the time complexity in the unordered array is only O(1).
- Considering the above 2 key points and depending on what kind of scenario a developer requires, the appropriate data structure can be used for implementation.

82. Is it possible to import the same class or package twice in Java and what happens to it during runtime?

It is possible to import a class or package more than once, however, it is redundant because the JVM internally loads the package or class only once.

83. In case a package has sub packages, will it suffice to import only the main package? e.g. Does importing of com.myMainPackage.* also import com.myMainPackage.mySubPackage.*?

This is a big NO. We need to understand that the importing of the sub-packages of a package needs to be done explicitly. Importing the parent package only results in the import of the classes within it and not the contents of its child/sub-packages.

84. Will the finally block be executed if the code System.exit(0) is written at the end of try block?

NO. The control of the program post `System.exit(0)` is immediately gone and the program gets terminated which is why the finally block never gets executed.

85. What do you understand by marker interfaces in Java?

Marker interfaces, also known as tagging interfaces are those interfaces that have no methods and constants defined in them. They are there for helping the compiler and JVM to get run time-related information regarding the objects.

86. Explain the term "Double Brace Initialisation" in Java?

This is a convenient means of initializing any collections in Java. Consider the below example.

```
import java.util.HashSet;
import java.util.Set;

public class IBDoubleBraceDemo{
   public static void main(String[] args){
        Set<String> stringSets = new HashSet<String>()
        {
            {
                add("set1");
                add("set2");
                add("set3");
            }
        };

        doSomething(stringSets);
    }

   private static void doSomething(Set<String> stringSets){
        System.out.println(stringSets);
```

```
    }
}
```

In the above example, we see that the stringSets were initialized by using double braces.

- The first brace does the task of creating an anonymous inner class that has the capability of accessing the parent class's behavior. In our example, we are creating the subclass of HashSet so that it can use the add() method of HashSet.
- The second braces do the task of initializing the instances.

Care should be taken while initializing through this method as the method involves the creation of anonymous inner classes which can cause problems during the garbage collection or serialization processes and may also result in memory leaks.

87. Why is it said that the length() method of String class doesn't return accurate results?

- The length method returns the number of Unicode units of the String. Let's understand what Unicode units are and what is the confusion below.
- We know that Java uses UTF-16 for String representation. With this Unicode, we need to understand the below two Unicode related terms:
  - Code Point: This represents an integer denoting a character in the code space.
  - Code Unit: This is a bit sequence used for encoding the code points. In order to do this, one or more units might be required for representing a code point.
- Under the UTF-16 scheme, the code points were divided logically into 17 planes and the first plane was called the Basic Multilingual Plane (BMP). The BMP has classic characters - U+0000 to U+FFFF. The rest of the characters- U+10000 to U+10FFFF were termed as the supplementary characters as they were contained in the remaining planes.
  - The code points from the first plane are encoded using **one** 16-bit code unit
  - The code points from the remaining planes are encoded using **two** code units.

Now if a string contained supplementary characters, the length function would count that as 2 units and the result of the length() function would not be as per what is expected.

In other words, if there is 1 supplementary character of 2 units, the length of that SINGLE character is considered to be TWO - Notice the inaccuracy here? As per the java documentation, it is expected, but as per the real logic, it is inaccurate.

88. What is the output of the below code and why?

```
public class InterviewBit{
   public static void main(String[] args)
   {
       System.out.println('b' + 'i' + 't');
```

```
    }
}
```

“bit” would have been the result printed if the letters were used in double-quotes (or the string literals). But the question has the character literals (single quotes) being used which is why concatenation wouldn't occur. The corresponding ASCII values of each character would be added and the result of that sum would be printed.
The ASCII values of ‘b’, ‘i’, ‘t’ are:

- ‘b’ = 98
- ‘i’ = 105
- ‘t’ = 116

```
98 + 105 + 116 = 319
```

Hence 319 would be printed.

89. What are the possible ways of making object eligible for garbage collection (GC) in Java?

First Approach: Set the object references to null once the object creation purpose is served.

```
public class IBGarbageCollect {
  public static void main (String [] args){
        String s1 = "Some String";
            // s1 referencing String object - not yet eligible for GC
        s1 = null; // now s1 is eligible for GC
    }
 }
```

Second Approach: Point the reference variable to another object. Doing this, the object which the reference variable was referencing before becomes eligible for GC.

```
public class IBGarbageCollect {
 public static void main(String [] args){
     String s1 = "To Garbage Collect";
     String s2 = "Another Object";
     System.out.println(s1); // s1 is not yet eligible for GC
     s1 = s2; // Point s1 to other object pointed by s2
     /* Here, the string object having the content  "To Garbage Collect" is not r
eferred by any reference variable. Therefore, it is eligible for GC */
 }
}
```

Third Approach: Island of Isolation Approach: When 2 reference variables pointing to instances of the same class, and these variables refer to only each other and the objects pointed by these 2 variables don't have any other references, then it is said to have formed an “Island of Isolation” and these 2 objects are eligible for GC.

```
public class IBGarbageCollect {
   IBGarbageCollect ib;
   public static void main(String [] str){
        IBGarbageCollect ibgc1 = new IBGarbageCollect();
        IBGarbageCollect ibgc2 = new IBGarbageCollect();
        ibgc1.ib = ibgc2; //ibgc1 points to ibgc2
        ibgc2.ib = ibgc1; //ibgc2 points to ibgc1
        ibgc1 = null;
        ibgc2 = null;
        /*
        * We see that ibgc1 and ibgc2 objects refer
        * to only each other and have no valid
        * references- these 2 objects for island of isolcation - eligible for GC
        */
   }
}
```

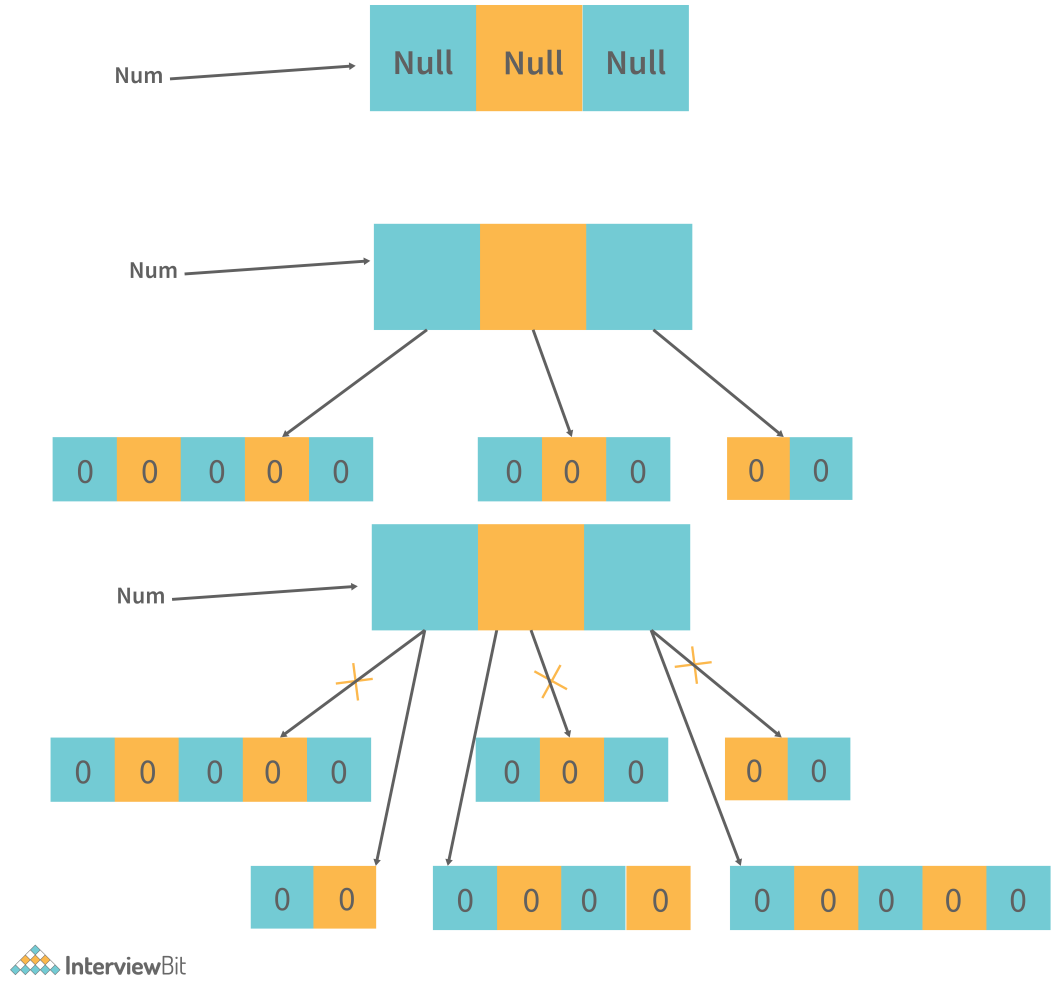
90. In the below Java Program, how many objects are eligible for garbage collection?

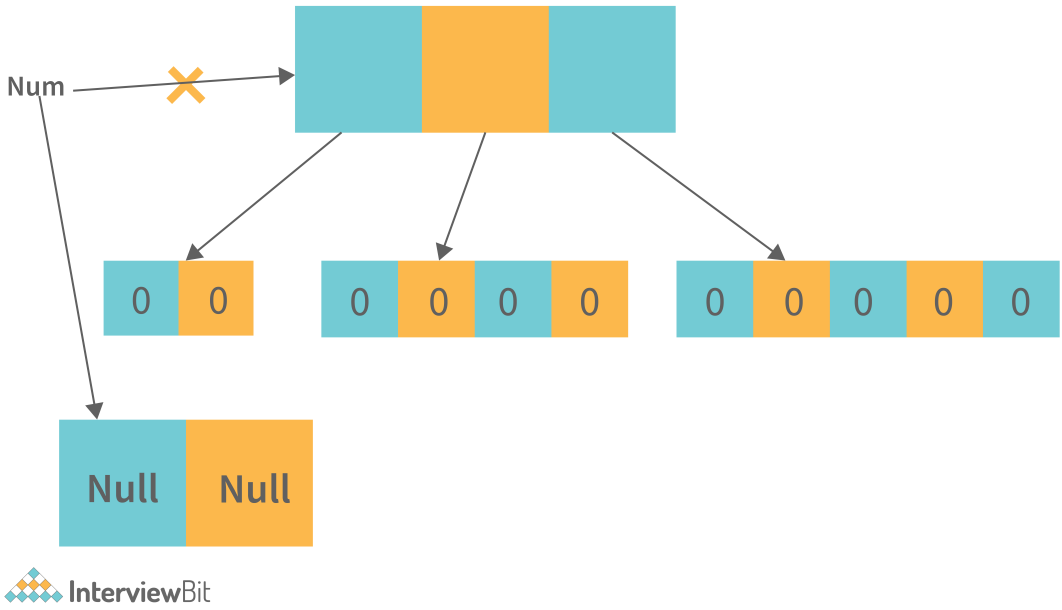
```
class Main{
   public static void main(String[] args){
        int[][] num = new int[3][];
        num[0] = new int[5];
        num[1] = new int[2];
        num[2] = new int[3];

        num[2] = new int[5];
        num[0] = new int[4];
        num[1] = new int[3];

        num = new int[2][];
   }
}
```

In the above program, a total of 7 objects will be eligible for garbage collection. Let’s visually understand what's happening in the code.





In the above figure on line 3, we can see that on each array index we are declaring a new array so the reference will be of that new array on all the 3 indexes. So the old array will be pointed to by none. So these three are eligible for garbage collection. And on line 4, we are creating a new array object on the older reference. So that will point to a new array and older multidimensional objects will become eligible for garbage collection.

91. What is the best way to inject dependency? Also, state the reason.

There is no boundation for using a particular dependency injection. But the recommended approach is -

Setters are mostly recommended for optional dependencies injection, and constructor arguments are recommended for mandatory ones. This is because constructor injection enables the injection of values into immutable fields and enables reading them more easily.

92. How we can set the spring bean scope. And what supported scopes does it have?

A scope can be set by an annotation such as the @Scope annotation or the "scope" attribute in an XML configuration file. Spring Bean supports the following five scopes:

- Singleton
- Prototype
- Request
- Session
- Global-session

93. What are the different categories of Java Design patterns?

Java Design patterns are categorized into the following different types. And those are also further categorized as

Structural patterns:

- Adapter
- Bridge
- Filter
- Composite
- Decorator
- Facade
- Flyweight
- Proxy

Behavioral patterns:

- Interpreter
- Template method/ pattern
- Chain of responsibility
- Command pattern
- Iterator pattern
- Strategy pattern

- Visitor pattern

J2EE patterns:

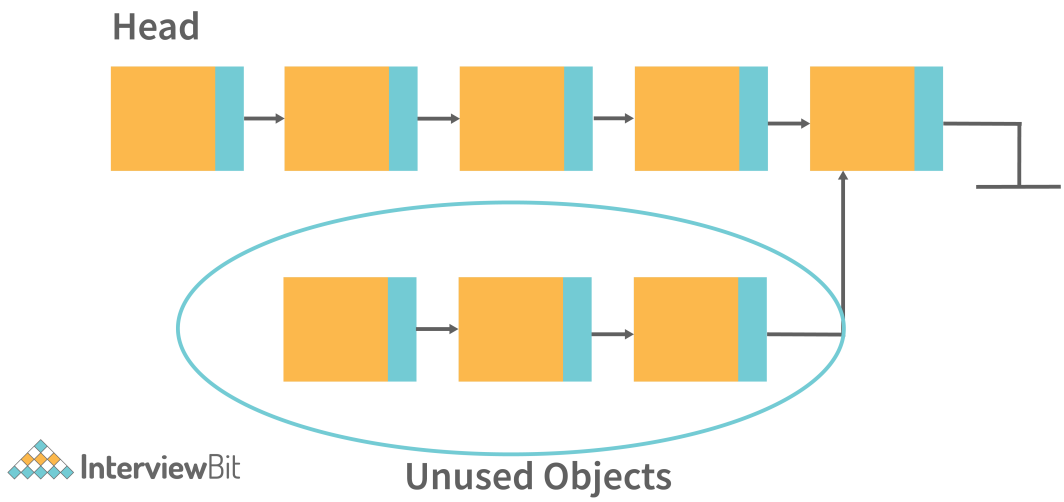
- MVC Pattern
- Data Access Object pattern
- Front controller pattern
- Intercepting filter pattern
- Transfer object pattern

Creational patterns:

- Factory method/Template
- Abstract Factory
- Builder
- Prototype
- Singleton

94. What is a Memory Leak? Discuss some common causes of it.

The Java Garbage Collector (GC) typically removes unused objects when they are no longer required, but when they are still referenced, the unused objects cannot be removed. So this causes the memory leak problem. **Example** - Consider a linked list like the structure below -



In the above image, there are unused objects that are not referenced. But then also Garbage collection will not free it. Because it is referencing some existing referenced object. So this can be the situation of memory leak.

Some common causes of Memory leaks are -

- When there are Unbounded caches.
- Excessive page swapping is done by the operating system.

- Improper written custom data structures.
- Inserting into a collection object without first deleting it.

  etc.

95. Assume a thread has a lock on it, calling the sleep() method on that thread will release the lock?

A thread that has a lock won't be released even after it calls sleep(). Despite the thread sleeping for a specified period of time, the lock will not be released.

Java Programming Interview Questions

96. Check if a given string is palindrome using recursion.

```
/*
* Java program to check if a given inputted string is palindrome or not using rec
ursion.
*/
import java.util.*;
public class InterviewBit {
   public static void main(String args[]) {
        Scanner s = new Scanner(System.in);
        String word = s.nextLine();
        System.out.println("Is "+word+" palindrome? - "+isWordPalindrome(word));
   }


   public static boolean isWordPalindrome(String word){
        String reverseWord = getReverseWord(word);
        //if word equals its reverse, then it is a palindrome
        if(word.equals(reverseWord)){
            return true;
        }
        return false;
   }

   public static String getReverseWord(String word){
        if(word == null || word.isEmpty()){
            return word;
        }

        return word.charAt(word.length()- 1) + getReverseWord(word.substring(0, wo
rd.length() - 1));
   }
}
```

97. Write a Java Program to print Fibonacci Series using Recursion.

```
class InterviewBit {
    public static void printFibonacci(int val_1, int val_2, int num){
        //Base Case
        if(num == 0)
            return;

        //Printing the next Fibonacci number
        System.out.print( val_1 + val_2 + " ");

        //Recursively calling for printing Fibonacci for remaining length
        printFibonacci(val_2, val_1+val_2, --num);
    }
    public static void main(String args[]) {
        System.out.println(" *** Fibonacci Series *** ");

        //Printing the first two values
        System.out.print("0 1 ");

        //Calling Method to print the fibonacci for length 10
        printFibonacci(0, 1, 10);
    }
}
```

In the above code, we are printing the base 2 Fibonacci values 0 and 1. And then based on the length of Fibonacci to be printed, we are using the helper function to print that.

98. Write a Java program to check if the two strings are anagrams.

The main idea is to validate the length of strings and then if found equal, convert the string to char array and then sort the arrays and check if both are equal.

```
import java.util.Arrays;
import java.util.Scanner;
public class InterviewBit {
 public static void main(String[] args) {
   Scanner s = new Scanner(System.in);
   //Input from two strings
   System.out.print("First String: ");
   String string1 = s.nextLine();
   System.out.print("Second String: ");
   String string2 = s.nextLine();
   // check for the length
   if(string1.length() == string2.length()) {
     // convert strings to char array
     char[] characterArray1 = string1.toCharArray();
     char[] characterArray2 = string2.toCharArray();
     // sort the arrays
     Arrays.sort(characterArray1);
     Arrays.sort(characterArray2);
     // check for equality, if found equal then anagram, else not an anagram
     boolean isAnagram = Arrays.equals(characterArray1, characterArray2);
     System.out.println("Anagram: "+ isAnagram);
```

```
  }
}
```

99. Write a Java Program to find the factorial of a given number.

```
public class FindFactorial {
   public static void main(String[] args) {
        int num = 10;
        long factorialResult = 1l;
        for(int i = 1; i <= num; ++i)
        {
            factorialResult *= i;
        }
        System.out.println("Factorial: "+factorialResult);
   }
}
```

100. Given an array of non-duplicating numbers from 1 to n where one number is missing, write an efficient java program to find that missing number.

Idea is to find the sum of n natural numbers using the formula and then finding the sum of numbers in the given array. Subtracting these two sums results in the number that is the actual missing number. This results in O(n) time complexity and O(1) space complexity.

```
public class IBMissingNumberProblem {

   public static void main(String[] args) {

        int[] array={4,3,8,7,5,2,6};
        int missingNumber = findMissingNum(array);
        System.out.println("Missing Number is "+ missingNumber);
   }

   public static int findMissingNum(int[] array) {
        int n=array.length+1;
        int sumOfFirstNNums=n*(n+1)/2;
        int actualSumOfArr=0;
        for (int i = 0; i < array.length; i++) {
            actualSumOfArr+=array[i];
        }
        return sumOfFirstNNums-actualSumOfArr;
   }
}
```

101. Write a Java Program to check if any number is a magic number or not. A number is said to be a magic number if after doing sum of digits in each step and inturn doing sum of digits of that sum, the ultimate result (when there is only one digit left) is 1.

Example, consider the number:

- Step 1: 163 => 1+6+3 = 10
- Step 2: 10 => 1+0 = 1 => Hence 163 is a magic number

```
public class IBMagicNumber{

   public static void main(String[] args) {
       int num = 163;
       int sumOfDigits = 0;
       while (num > 0 || sumOfDigits > 9)
       {
           if (num == 0)
           {
               num = sumOfDigits;
               sumOfDigits = 0;
           }
           sumOfDigits += num % 10;
           num /= 10;
       }

       // If sum is 1, original number is magic number
       if(sumOfDigits == 1) {
           System.out.println("Magic number");
       }else {
           System.out.println("Not magic number");
       }
   }
}
```

102. Write a Java program to create and throw custom exceptions.

```
class InterviewBit {
    public static void main(String args[]) throws CustomException {

        // Throwing the custom exception be passing the message
        throw new CustomException(" This is my custom Exception ");
    }
}
//Creating Custom Exception Class
class CustomException extends Exception{
    //Defining Constructor to throw exception message
    public CustomException(String message){
        super(message);
    }
}
```

We have created the exception class named with CustomException and called the base exception constructor with the error message that we want to print. And to avoid handling exceptions in the main method, we have used the throws keyword in the method declaration.

103. Write a Java program to reverse a string.

```
class InterviewBit{
    public static void main(String[] args){
        //Input String
        String str = "Welcome to InterviewBit";

        //Pointers.
        int i = 0, j = str.length()-1;

        //Result character array to store the reversed string.
        char[] revString = new char[j+1];

        //Looping and reversing the string.
        while(i < j){
            revString[j] = str.charAt(i);
            revString[i] = str.charAt(j);
            i++;
            j--;
        }
        //Printing the reversed String.
        System.out.println("Reversed String = " + String.valueOf(revString));
    }
}
```

In the above code, we are storing the last character from the string to the first and the first value to the last in the output character array. And doing the same thing in the loop for the remaining 2nd to n-1 characters. This is how the string will be reversed.

104. Write a Java program to rotate arrays 90 degree clockwise by taking matrices from user input.

```
mport java.util.Scanner;
public class InterviewBit
{
    public static void main(String[] args) {
          Scanner sc = new Scanner(System.in);
          int no;
        System.out.print("Enter size of Array : ");
        no = sc.nextInt();
        int[][] a = new int[no][no];
        System.out.print("Enter  "+ no*no+" Element Array : ");

        for(int i = 0; i<no; i++){
            for(int j = 0; j<no; j++){
                a[i][j] = sc.nextInt();
            }
        }
        System.out.print("\nArray Before Rotation\n\n");
        for(int i = 0; i<no; i++){
            for(int j = 0; j<no; j++){
                System.out.print(a[i][j] + " ");
            }
```

```
            System.out.println();
        }

        System.out.println("\n");
        //Rotation

        //Transpose
        for(int i = 0; i < no; i++){
            for(int j = i; j < no; j++){
                int temp = a[i][j];
                a[i][j] = a[j][i];
                a[j][i] = temp;
            }
        }

        //Reverse Each row
        for(int i = 0; i < no; i++){
            int l, j;
            for(j = 0, l = no -1; j < l; j++){
                int temp = a[i][j];
                a[i][j] = a[i][l];
                a[i][l] = temp;
                l--;
            }
        }

        System.out.println("Array After Rotation - \n");

        for(int i = 0; i<no; i++){
            for(int j = 0; j<no; j++){
                System.out.print(a[i][j] + " ");
            }
            System.out.println();
        }
    }
}
```

In the above code, for rotating the matrix to 90 degrees we are first transposing the matrix so the row becomes the column. And after that, we are reversing each row in the matrix. So this is how the matrix got rotated.

105. Write a java program to check if any number given as input is the sum of 2 prime numbers.

Example :

Input - 18

Output -

18 = 13 + 5
18 = 11 + 7

```
public class InterviewBit
{
    // Method to Check Prime Number
    private static int check_prime(int num){
        int flag = 0;
        for(int i = 2; i<=num/2; i++){
            if(num%i == 0){
                flag = 1;
                return 1;
            }
        }
        if(flag == 0)
            return 0;
        return 1;
    }
    // Method to get print the prime sum
    private static void find(int num){
        for(int i = 2; i <= num/2; i++){
            if(check_prime(i) == 0){
                if(check_prime(num-i) == 0)
                    System.out.println(num + " = "+ (num-i) + " "+ i);
            }
        }
    }
        public static void main(String[] args) {
                find(18);
        }
}
```

In the above code, for any number **n**, we find all the 2 pairs of numbers that are added together resulting in **n**. And each checking number if it is prime. If it is prime then we are printing that.

106. Write a Java program for solving the Tower of Hanoi Problem.

```
public class InterviewBit
{
    //Recursive Method for Solving the Tower of hanoi.
    private static void TOH(char source, char auxiliary, char destination, int nu
mOfDisk){
        if (numOfDisk > 0){
                TOH(source, destination, auxiliary, numOfDisk-1);
                System.out.println("Move 1 disk from "+source+" to "+destination+
" using "+auxiliary+".");
                TOH(auxiliary, source, destination, numOfDisk-1);
        }
    }
        public static void main(String[] args) {
                TOH('A','B','C', 3);
        }
}
```

In the above code we are first moving the **n-1** disk from Tower **A** to Tower **B**, then moving that **nth** disk from Tower **A** to Tower **C**, and finally, the remaining **n-1** disk from Tower **B** to Tower **C**. And we are doing this recursively for the **n-1** disk.

107. Implement Binary Search in Java using recursion.

```
public class Main
{
    //Recursive method for binary search
    private static boolean binarySearch(int[] arr, int low, int high, int key){

        //Calculating Mid.
        int mid = (low + high)/2;

        //Base Case.
        if(low > high)
            return false;

        //Checking if the key is found in the middle.
        if(arr[mid] == key)
            return true;

        //Searching on the left half if a key exists there.
        if(key < arr[mid])
            return binarySearch(arr, low, mid-1, key);

        //Searching on the other half otherwise.
        return binarySearch(arr, mid+1, high, key);
    }
public static void main(String[] args) {

   int[] arr = {2, 5, 9, 13, 17, 21, 30};
   if(binarySearch(arr, 0, (arr.length-1), 30))
       System.out.println(" Element Found. ");
   else
       System.out.println(" Element not Found.");
}
}
```

In the above code, we are finding the middle element each time and checking if the element is in the middle or not. If it is not, then we check on which side from the middle it exists. And Recursively searching on the particular subarray. So this way we are reducing the search space by 2 every time. So the search time is very low.

Java MCQ

Interpretor is nothing but the JIT compiler.

It acts as medium between JVM and JIT.

It does the conversion of byte code to machine code.

It reads the high level code and executes them.

Association

Aggregation

Composition

Encapsulation

int-float method

float-int method

Compilation Error

Run Time error

0

1

Compilation Error

Run time error

Garbage collection does not happen during thread execution.

Thread pauses while the garbage collection process runs.

Both the process takes place simultaneously and does not interfere its execution.

Nothing happens, the thread proceeds with execution.

false false

true true

true false

false true

It invokes the constructor.

It has the same functionality of new operator.

It creates object if the class does not have constructor defined.

None of the above.