Java Basics & OOPs Assignment Questions

1. Java Basics

1. What is Java? Explain its features.

Java is a popular programming language used to create software like apps, games, websites, and even smart devices.

Features:

- **Simple:**Java is easy to learn if you know basic programming. It has a clean and understandable syntax.
- **Object**-Oriented:Java treats everything as an object (like real-world items), making the code organized and reusable.
- **Secure**:Java has built-in features to protect data and avoid viruses or hacking.
- **Multithreaded:**Java can perform many tasks at the same time, like downloading while playing music
- **Dynamic:**Java handles errors well and avoids crashes by checking code during both compile-time and run-time.
- **Distributed:**Java supports networking easily – helpful in building apps that run on the internet or over networks.
- **High Performance:**Java is faster than many other languages because of its efficient code and Just-In-Time compiler.
- **Robust:**Java handles errors well and avoids crashes by checking code during both compile-time and run-time.

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2. Explain the Java program execution process.

- Install JDK (Java Development Kit)
- Write the Java Program (.java file)
- Compile the Program using java
- Run the Program using java
- View the Output on the screen

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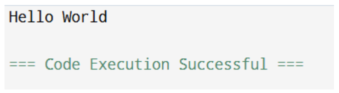
3. Write a simple Java program to display 'Hello World'.

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



```
Hello World

=== Code Execution Successful ===
```

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4. What are data types in Java? List and explain them.

- Primitive Data Types

1. Byte

The byte data type is an 8-bit signed integer. It is used when you want to save memory in large arrays, especially in place of integers. It can store values from -128 to 127. It is mostly used in situations where memory savings are critical.

2. short

The short data type is a 16-bit signed integer. It can hold values from -32,768 to 32,767. It is larger than a byte but smaller than an int, and is used to save memory in applications where an int is not needed.

3. int

The int data type is a 32-bit signed integer and is the most commonly used data type for numeric values. It can store a wide range of values from -2,147,483,648 to 2,147,483,647. It is the default data type for integer values unless memory optimization is needed.

4. long

The long data type is a 64-bit signed integer. It is used when a larger range of values than int is required. It is ideal for big numbers like population counts, distance measurements, etc. When assigning a long value, an "L" is usually added to the end of the number.

5. float

The `float` data type is a 32-bit floating-point number used to store decimal values. It is less precise than a `double` but consumes less memory. When using float, you should add an "f" or "F" at the end of the value.

6. double

The double data type is a 64-bit floating-point number. It is used when high precision is needed for decimal values, like in scientific calculations. It is the default data type for decimal numbers in Java.

7. char

The char data type is a 16-bit Unicode character. It is used to store a single character and must be enclosed in single quotes, like 'A' or '9'. It can also store symbols and letters from different languages.

8. boolean

The boolean data type represents one bit of information and can only hold two values: true or false. It is commonly used for decision-making or conditional logic (e.g., if a condition is true or not).

- Non-Primitive (Reference) Data Types

1. **String**

A String is not a primitive type, but it is widely used to store sequences of characters or text. Strings in Java are objects and come with many built-in methods to manipulate text.

2. Array

An Array is used to store multiple values of the same type in a single variable. For example, you can store a list of numbers or names. Arrays have a fixed size once they are created.

3. Class
A Class is a user-defined data type in Java. It is a blueprint for creating objects and can contain fields (variables) and methods (functions). Classes are a core part of Java's object-oriented programming.

4. Interface
An Interface in Java is a reference type, similar to a class, that contains only abstract methods (method declarations without body). It is used to achieve abstraction and multiple inheritance in Java.

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5. What is the difference between JDK, JRE, and JVM?

Component	Stands for	What It Does	Includes
JVM	Java Virtual Machine	Runs Java bytecode	Part of JRE
JRE	Java Runtime Environment	Runs Java programs	JVM + Libraries
JDK	Java Development Kit	Develops and runs Java programs	JRE + Compiler + Tools

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6.What are variables in Java? Explain with examples.

A **variable** in Java is a **name** that stores a **value** which can change during program execution. Think of it like a **box** where you keep data such as numbers, text, or characters.

Before using a variable, you must **declare its type** (like `int`, `String`, etc.) so the program knows what kind of data it will hold.

Syntax of Variable Declaration:

dataType variableName = value;

Integer Variable

int age = 20;

Here, int is the data type, age is the variable name, and 20 is the value stored.

- **String Variable**

String name = "Sanjana";

Here, String is used to store text.

- **Float Variable**

float price = 99.50f;

Here, f is added at the end because it's a float.

- **Boolean Variable**

boolean isJavaFun = true;

This stores a true/false value.

7.What are the different types of operators in Java?

- Arithmetic Operators

Operator	**Meaning**	**Example**
+	Addition	a + b
-	Subtraction	a - b
*	Multiplication	a * b
/	Division	a / b
%	Modulus (remainder)	a % b

- Relational (Comparison) Operators

Operator	**Meaning**	**Example**
==	Equal to	a == b
!=	Not equal to	a != b
>	Greater than	a > b
<	Less than	a < b

Operator	Meaning	Example
>=	Greater or equal	a >= b
<=	Less or equal	a <= b

- Logical Operators

Operator	Meaning	Example
&&	Logical AND	(a > 5 && b < 10)
!	Logical NOT	!(a > 5)

- Assignment Operators

Operator	Meaning	Example
=	Assign	x = 5
+=	Add and assign	x += 5 → x = x + 5
-=	Subtract and assign	x -= 2

Operator	Meaning	Example
*=	Multiply and assign	x *= 3
/=	Divide and assign	x /= 2
%=	Modulus and assign	x %= 2

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8. Explain control statements in Java (if, if-else, switch).

- if Statement

The if statement runs a block of code **only if the condition is true**.

Syntax:

```
if (condition) {

   // code to execute if condition is true

}
```

Example:

```
int age = 18;

if (age >= 18) {

   System.out.println("You are eligible to vote.");
}
```

- <u>if-else Statement</u>

The if-else statement runs **one block if the condition is true**, otherwise it runs the **else block**.

<u>Syntax:</u>

```
if (condition) {
    // code if condition is true
} else {
    // code if condition is false
}
```

Example:

```
int age = 16;
if (age >= 18) {
    System.out.println("You can vote.");
} else {
    System.out.println("You are too young to vote.");
}
```

- <u>Switch Statement</u>

The switch statement is used to **select one of many options** based on the value of a variable.

Syntax:

```
switch (value) {

   case option1:

       // code

       break;

   case option2:

       // code

       break;

   default:

       // code if no match

}
```

Example:

```
int day = 2;
switch (day) {
   case 1:
       System.out.println("Sunday");
       break;
```

```
    case 2:
        System.out.println("Monday");
        break;
    default:
        System.out.println("Other Day");
}
```

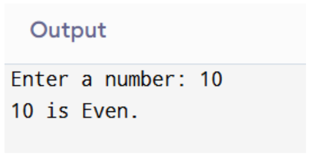
9.Write a Java program to find whether a number is even or odd.

```
import java.util.Scanner;
public class EvenOddCheck {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);

        System.out.print("Enter a number: ");
        int number = input.nextInt();  // taking number from user

        if (number % 2 == 0) {
            System.out.println(number + " is Even.");
        } else {
            System.out.println(number + " is Odd.");
        }

        input.close();
    }
}
```


Output

```
Enter a number: 10
10 is Even.
```

10.What is the difference between while and do-while loop?

Feature	**while Loop**	**do-while Loop**
Condition Check	Checked before the loop runs	Checked after the loop runs
Minimum Executions	May not run at all if condition is false	Runs at least once, even if condition is false
Use Case	When you want to check the condition **first**	When you want to run the code **at least once**
Syntax	while (condition) { ... }	do { ... } while (condition);
Example Code	java\nint i = 5;\nwhile (i < 5) {\n System.out.println("While: " + i);\n i++;\n}	java\nint i = 5;\ndo {\n System.out.println("Do-While: " + i);\n i++;\n} while (i < 5);
Output	*(No output — because the condition is false at the beginning)*	Do-While: 5 (Executes once even though condition is false)

Object-Oriented Programming (OOPs)

1. What are the main principles of OOPs in Java? Explain each.

- **Encapsulation**

Definition:
Encapsulation means hiding the internal details of a class and only exposing necessary parts through methods.

Key Idea:
Keep variables private, and provide public getter and setter methods to access and update them.

Example:

```
java
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public class Student {
  private String name;  // hidden

  public void setName(String n) {
    name = n;
  }

  public String getName() {
    return name;
  }
}
```

- **Inheritance**

Definition:
Inheritance means one class (child) can reuse the properties and behaviors of another class (parent).
Key Idea:

Helps in code reusability.

Example:

CopyEdit

```
class Animal {
    void sound() {
        System.out.println("Animal makes sound");
    }
}

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

- **Polymorphism**

Definition:

Polymorphism means **one task can be done in multiple ways**.

Types:

- **Compile-time (Method Overloading)**
- **Run-time (Method Overriding)**

Example:

```
// Overloading (same method name, different parameters)
class Math {
    int add(int a, int b) {
        return a + b;
    }
    double add(double a, double b) {
        return a + b;
    }
}
```

- **Abstraction**

Definition:
Abstraction means **hiding unnecessary details** and showing only the **important parts** to the user.
Key Idea:
Achieved using **abstract classes** and **interfaces**.
Example:

```
abstract class Shape {
    abstract void draw();
}

class Circle extends Shape {
    void draw() {
        System.out.println("Drawing Circle");
    }
}
```

2.What is a class and an object in Java? Give examples.

What is a Class in Java?

A **class** is like a **blueprint** or **template**. It defines the **properties (variables)** and **behaviors (methods)** of objects, but it doesn’t do anything by itself until you create an object from it.

Example:

```
public class Car {

    String color = "Red";        // property

    void drive() {               // method

        System.out.println("Car is driving");

    }

}
```

What is an Object in Java?

An **object** is a **real-world instance** of a class. It is created using the new keyword and allows you to access the variables and methods of the class.

Example:

```
public class Main {

    public static void main(String[] args) {
        Car myCar = new Car();   // Creating an object of class Car

        System.out.println(myCar.color); // Accessing property

        myCar.drive();           // Calling method

    }

}
```

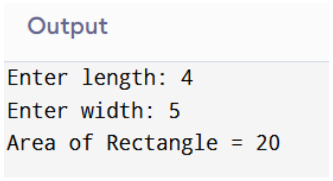
3.Write a program using class and object to calculate area of a rectangle.

```
import java.util.Scanner;
class Rectangle {
    int length;
    int width;
 int calculateArea() {
        return length * width;
    }
}
public class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
Rectangle rect = new Rectangle();  // Creating object

        System.out.print("Enter length: ");
        rect.length = sc.nextInt();       // User input
        System.out.print("Enter width: ");
        rect.width = sc.nextInt();        // User input

        int area = rect.calculateArea();   // Calling method
        System.out.println("Area of Rectangle = " + area);

        sc.close();
    }
  }
```



```
Enter length: 4
Enter width: 5
Area of Rectangle = 20
```

4.Explain inheritance with real-life example and Java code.

Inheritance means one class (child/subclass) can use the properties and methods of another class (parent/superclass). It helps in code reusability.

<u>Real-life Example:</u>

- Think of a general class: Vehicle

All vehicles have speed and can move**.**

Then we have a specific class: Car

- A car is a type of vehicle, so it should inherit everything a vehicle has, and add its own features like music system.

Java Code Example:

```
// Parent class (Super class)

class Vehicle {

  void move() {

    System.out.println("Vehicle is moving");

  }

}


// Child class (Sub class) that inherits from Vehicle

class Car extends Vehicle {

  void musicSystem() {

    System.out.println("Car has a music system");

  }

}


// Main class to test

public class Main {
    public static void main(String[] args) {
        Car myCar = new Car();   // Create object of child class


        myCar.move();            // Inherited method from Vehicle
        myCar.musicSystem();     // Method of Car class
    }
}
```

5.What is polymorphism? Explain with compile-time and runtime examples.

Polymorphism means "many forms".

In Java, polymorphism allows one method or object to behave differently based on how it's used.

Compile-time Polymorphism (Method Overloading)

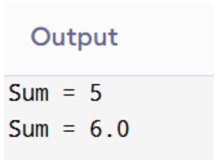
Example:

```
class Calculator {
    int add(int a, int b) {
        return a + b;
    }

    double add(double a, double b) {
        return a + b;
    }
}

public class Main {
    public static void main(String[] args) {
        Calculator calc = new Calculator();

        System.out.println("Sum = " + calc.add(2, 3));         // int version
        System.out.println("Sum = " + calc.add(2.5, 3.5));    // double version
    }
      }
```



Output

```
Sum = 5
Sum = 6.0
```

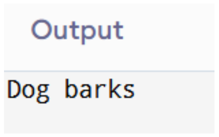
- Run-time Polymorphism (Method Overriding)
  When a subclass provides a specific implementation of a method already defined in the parent class, and the method to run is decided at runtime.
  Example:

```
class Animal {
    void sound() {
        System.out.println("Animal makes sound");
    }
}

class Dog extends Animal {
    void sound() {
        System.out.println("Dog barks");
```

```
  }
}

public class Main {
  public static void main(String[] args) {
    Animal a = new Dog();   // Parent class reference, child class object
    a.sound();             // Calls Dog's version at runtime
  }
    }
```



```
Output

Dog barks
```

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5. What is method overloading and method overriding? Show with examples.

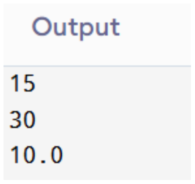
- <u>Method Overloading</u>

Definition:

When multiple methods in the same class have the same name but different parameters (number, type, or order), it is called method overloading.

Example:

```
class Calculator {
  // Method 1: Adds two integers
  int add(int a, int b) {
    return a + b;
     }


     // Method 2: Adds three integers
  int add(int a, int b, int c) {
        return a + b + c;
    }

    // Method 3: Adds two doubles
    double add(double a, double b) {
        return a + b;
    }
}

public class Main {
    public static void main(String[] args) {
        Calculator calc = new Calculator();

        System.out.println(calc.add(5, 10));          // 15
        System.out.println(calc.add(5, 10, 15));      // 30
        System.out.println(calc.add(5.5, 4.5));       // 10.0
    }
}
```



```
Output
15
30
10.0
```

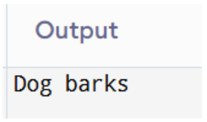
- Method Overriding

<u>Definition:</u>

When a subclass provides a specific implementation of a method that is already defined in the parent class, it is called method overriding.

Example:

```
class Animal {
   void sound() {
      System.out.println("Animal makes a sound");
   }
}

class Dog extends Animal {
   void sound() {
      System.out.println("Dog barks");
   }
}

public class Main {
   public static void main(String[] args) {
      Animal a = new Dog(); // Polymorphism
      a.sound();          // Output: Dog barks
   }
}
```


Output

```
Dog barks
```

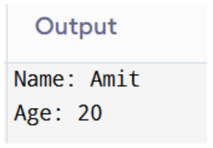
----

6. What is encapsulation? Write a program demonstrating encapsulation.

Encapsulation is the concept of hiding data (variables) inside a class and allowing access to it only through methods ,

Java Program Demonstrating Encapsulation

```
class Student {
    // Step 1: private data
    private String name;
    private int age;
    // Step 2: public setter method to set data
    public void setName(String n) {
        name = n;
    }

    public void setAge(int a) {
        age = a;
    }

    // Step 3: public getter method to get data
    public String getName() {
        return name;
    }

    public int getAge() {
        return age;
    }
}

public class Main {
    public static void main(String[] args) {
        Student s = new Student();

        s.setName("Amit");     // setting values
        s.setAge(20);
        System.out.println("Name: " + s.getName());  // getting values
        System.out.println("Age: " + s.getAge());
    }
        }
```


Output

```
Name: Amit
Age: 20
```

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8. What is abstraction in Java? How is it achieved?

Abstraction is the process of hiding internal details and showing only the essential features to the user.
Abstraction in Java is achieved in two ways:

Method	Description
Abstract Class	A class that has abstract methods (without body) and normal methods
Interface	A contract with method definitions only (no implementation)

<u>Using Abstract Class – Example:</u>

```
abstract class Animal {
    abstract void sound();  // abstract method

    void sleep() {
        System.out.println("Sleeping...");
```

```
  }
}

class Dog extends Animal {
    void sound() {
        System.out.println("Dog barks");
    }
      }
```

Using Interface – Example:

```
interface Vehicle {
    void start();  // abstract method
}

class Car implements Vehicle {
    public void start() {
        System.out.println("Car starts with key");
    }
      }
```

----

9. Explain the difference between abstract class and interface.

Feature	**Abstract Class**	**Interface**
Keyword	abstract class	interface
Method Types	Can have abstract and concrete methods	Only abstract methods (till Java 7)
Variables	Can have variables with any access modifier	All variables are public static final
Multiple Inheritance	Not supported (only one abstract class)	Supported (a class can implement many)
Constructors	Can have constructors	Cannot have constructors
Inheritance Type	Class extends abstract class	Class implements interface
Use Case	When some **code is shared** across classes	When only **structure (methods)** is needed

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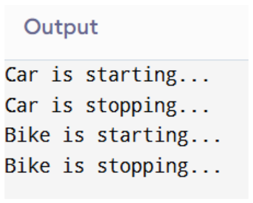
10. Create a Java program to demonstrate the use of interface.

create an interface Vehicle, and two classes Car and Bike that implement this interface.

```
// Interface declaration
interface Vehicle {
   void start();  // abstract method
   void stop();   // abstract method
}
```

```
// Class Car implements Vehicle
class Car implements Vehicle {
    public void start() {
        System.out.println("Car is starting...");
    }

    public void stop() {
        System.out.println("Car is stopping...");
    }
}

// Class Bike implements Vehicle
class Bike implements Vehicle {
    public void start() {
        System.out.println("Bike is starting...");
    }

    public void stop() {
        System.out.println("Bike is stopping...");
    }
}

// Main class to test
public class Main {
    public static void main(String[] args) {
        Vehicle myCar = new Car();
        Vehicle myBike = new Bike();
        myCar.start();   // Output: Car is starting...
        myCar.stop();    // Output: Car is stopping...

        myBike.start();  // Output: Bike is starting...
        myBike.stop();   // Output: Bike is stopping...
    }
}
```



```
Car is starting...
Car is stopping...
Bike is starting...
Bike is stopping...
```