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Java Basics

1. What is Java? Explain its features.

Java is a high-level, object-oriented, platform-independent programming language. It was developed by Sun Microsystems (now owned by Oracle).

Features:

- **Platform Independent**: Compile once, run anywhere (WORA).
- **Object-Oriented**: Everything is treated as an object.
- **Secure**: Runs in a virtual machine sandbox.
- **Robust**: Strong memory management.
- **Multithreaded**: Supports multithreaded programming.
- **High Performance**: Just-In-Time (JIT) compiler improves performance.

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2. Explain the Java program execution process.

1. Write Java code (.java file)
2. Compile using javac → generates .class bytecode
3. Execute using JVM (java command) → runs on any platform

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

java

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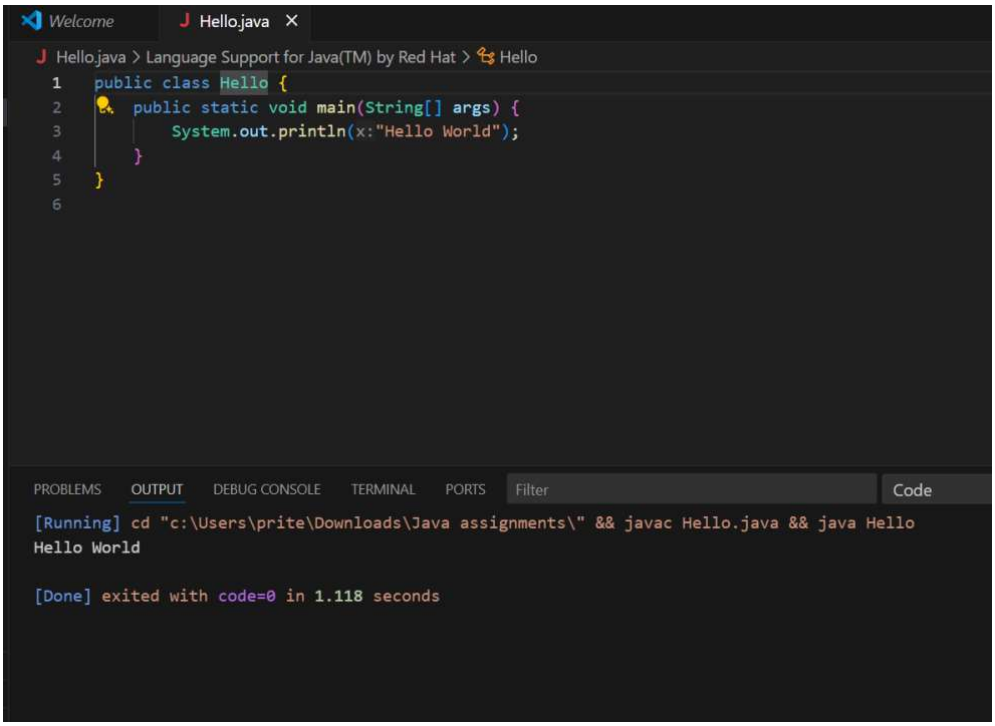
```
public class HelloWorld {
   public static void main(String[] args) {
      System.out.println("Hello World");
   }
}
```



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

Java has two types:

- **Primitive**: int, float, double, char, boolean, byte, short, long
- **Non-primitive**: String, Array, Class, Interface

Example:

java

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int age = 25;

String name = "Sonal";

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5. Difference between JDK, JRE, and JVM

Term	Description
JVM	Runs Java bytecode
JRE	JVM + libraries (for running Java apps)
JDK	JRE + compiler and tools (for developing Java apps)

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

A **variable** is a container for storing data values.

java

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```
int x = 10; // integer variable

String name = "Harsh"; // string variable
```

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7. Different types of operators in Java

- **Arithmetic**: +, -, *, /, %
- **Relational**: ==, !=, >, <, >=, <=
- **Logical**: &&, ||, !
- **Assignment**: =, +=, -=, etc.
- **Unary**: ++, --
- **Bitwise**: &, |, ^

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

java

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```
int x = 10;

if (x > 5) {

   System.out.println("Greater than 5");

} else {

   System.out.println("5 or less");

}


switch (x) {

   case 10: System.out.println("Ten"); break;

   default: System.out.println("Other");

}
```

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9. Java program to find even or odd number

java

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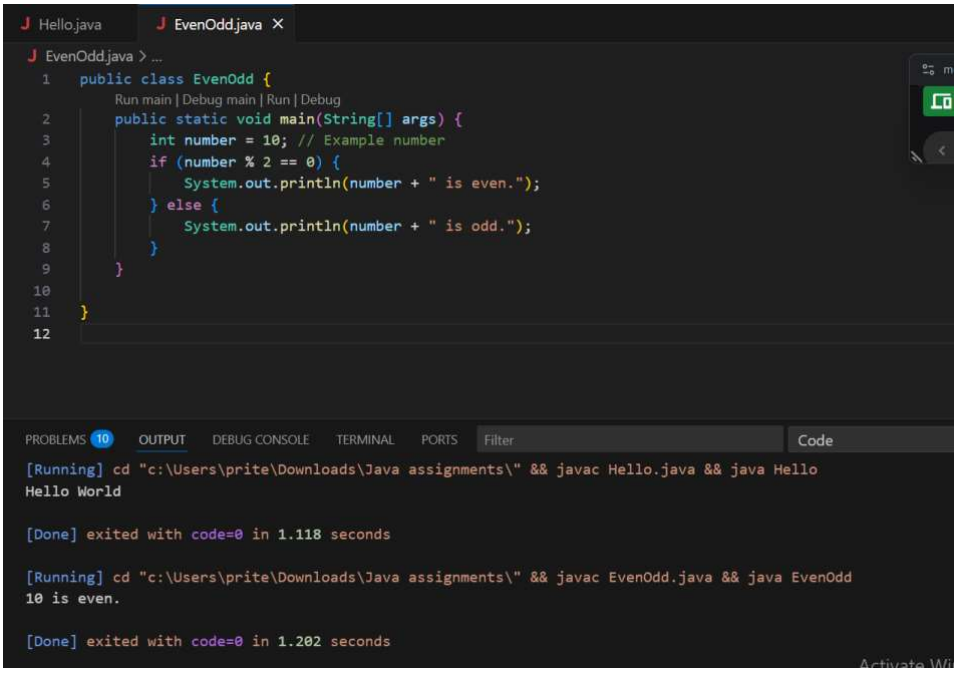
```
import java.util.Scanner;


public class EvenOdd {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      int num = sc.nextInt();


      if (num % 2 == 0)
         System.out.println("Even");
      else
         System.out.println("Odd");
   }
}
```



10. Difference between while and do-while loop

While Loop	Do-While Loop
Condition checked first	Condition checked after execution
May never execute	Executes at least once

Object-Oriented Programming (OOPs)

1. Principles of OOPs in Java

- **Encapsulation**: Data hiding using classes
- **Abstraction**: Hiding implementation details
- **Inheritance**: Code reuse through subclasses
- **Polymorphism**: Many forms of methods/objects

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2. What is a class and object in Java?

java

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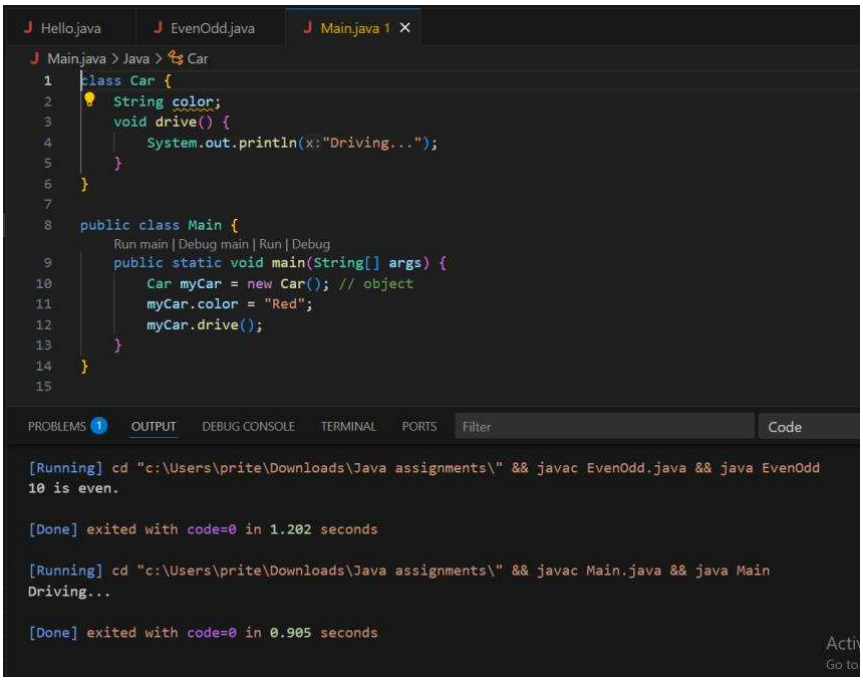
```
class Car {
   String color;
   void drive() {
      System.out.println("Driving...");
   }
}

public class Main {
   public static void main(String[] args) {
      Car myCar = new Car(); // object
      myCar.color = "Red";
      myCar.drive();
```

```
    }
}
```



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3. Program to calculate area of rectangle

java

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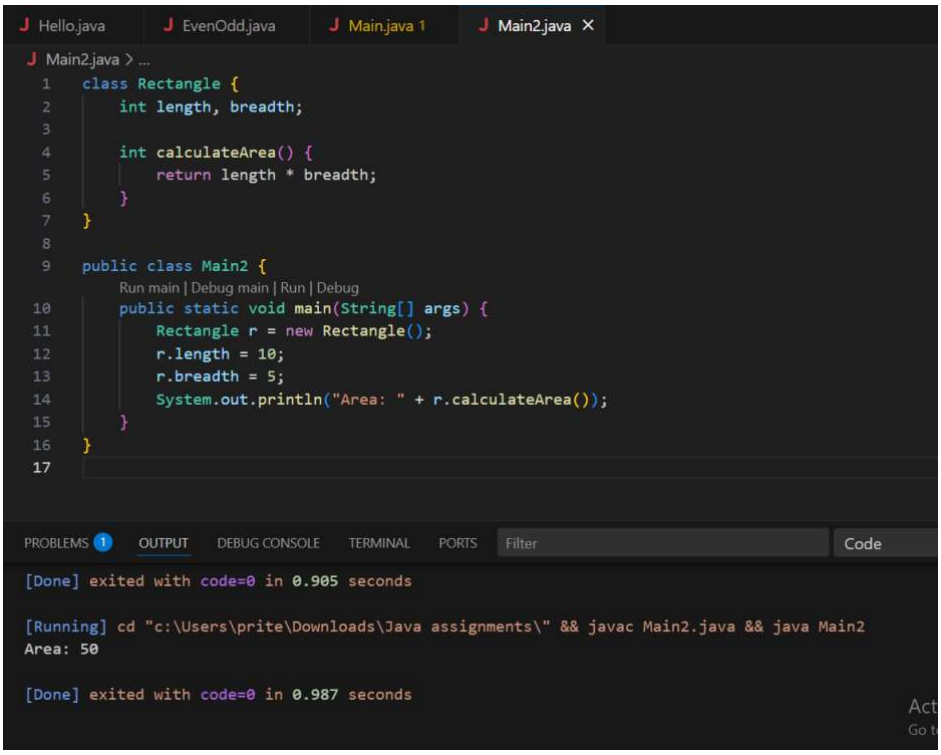
```
class Rectangle {
    int length, breadth;

    int calculateArea() {
        return length * breadth;
    }
}

public class Main {
    public static void main(String[] args) {
        Rectangle r = new Rectangle();
        r.length = 10;
        r.breadth = 5;
```

```
        System.out.println("Area: " + r.calculateArea());
    }
}
```



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4. Inheritance with real-life example

java

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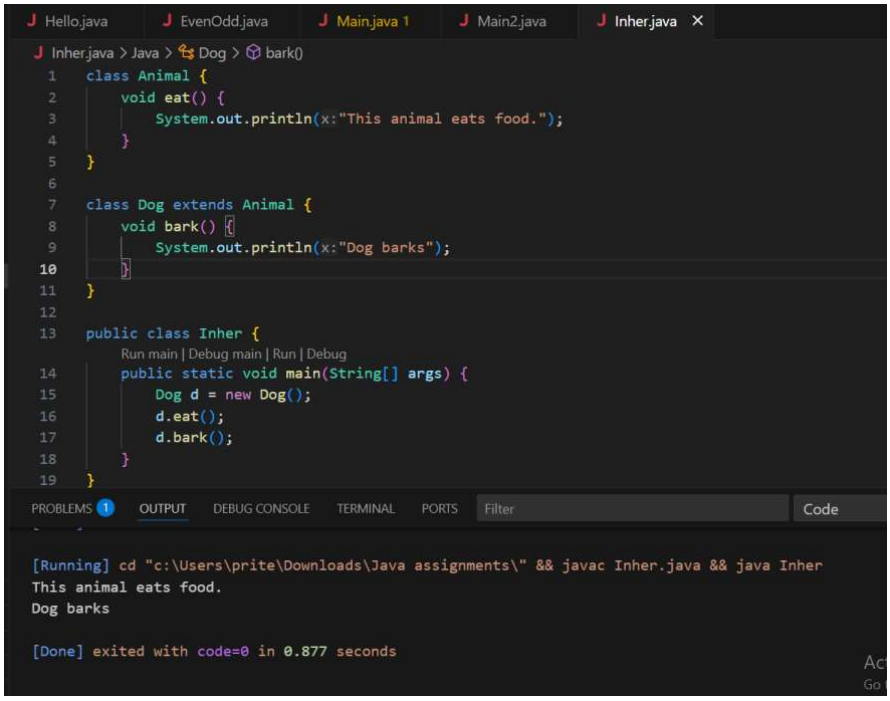
```
class Animal {
    void eat() {
        System.out.println("This animal eats food.");
    }
}


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

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



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5. What is polymorphism?

Runtime (method overriding):

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

class Dog extends Animal {
   @Override
```

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

class Cat extends Animal {
    @Override
    void sound() {
        System.out.println("Cat meows");
    }
}

public class Runtime {
    public static void main(String[] args) {
        Animal a;           // reference of type Animal

        a = new Dog();      // object of Dog
        a.sound();          // Output: Dog barks

        a = new Cat();      // object of Cat
        a.sound();          // Output: Cat meows
```

Runtime.java 1

C: > Java session > Runtime.java > Language Support for Java(TM) by Red Hat > Animal

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

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

class Cat extends Animal {
    @Override
    void sound() {
        System.out.println(x:"Cat meows");
    }
}

public class Runtime {
    Run main | Debug main | Run | Debug
    public static void main(String[] args) {
        Animal a;             // reference of type Animal

        a = new Dog();        // object of Dog
        a.sound();            // Output: Dog barks

        a = new Cat();        // object of Cat
        a.sound();            // Output: Cat meows
```

Runtime.java 1

C: > Java session > Runtime.java > Language Support for Java(TM) by Red Hat > Runtime > main(String[])

```java
class Cat extends Animal {
    void sound() {
    }
}

public class Runtime {
    Run main | Debug main | Run | Debug
    public static void main(String[] args) {
        Animal a;             // reference of type Animal

        a = new Dog();        // object of Dog
        a.sound();            // Output: Dog barks

        a = new Cat();        // object of Cat
        a.sound();            // Output: Cat meows
    }
}
```

PROBLEMS 1 OUTPUT DEBUG CONSOLE TERMINAL PORTS Filter

```
[Running] cd "c:\Java session\" && javac Runtime.java && java Runtime
Dog barks
Cat meows

[Done] exited with code=0 in 1.167 seconds
```

Compile-time (method overloading):

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

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

   int add(int a, int b, int c) {
      return a + b + c;
   }
}

public class Compile {
   public static void main(String[] args) {
      MathUtils mu = new MathUtils();
      System.out.println(mu.add(2, 3));         // 5
      System.out.println(mu.add(2.5, 3.5));      // 6.0
      System.out.println(mu.add(1, 2, 3));       // 6
   }
}
```

Runtime.java 1 | Compile.java 1

C: > Java session > Compile.java > Language Support for Java(TM) by Red Hat > MathUti

```java
class MathUtils {
    // Overloaded add methods
    int add(int a, int b) {
        return a + b;
    }

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

    int add(int a, int b, int c) {
        return a + b + c;
    }
}

public class Compile {
    Run main | Debug main | Run | Debug
    public static void main(String[] args) {
        MathUtils mu = new MathUtils();
        System.out.println(mu.add(a:2, b:3));          // 5
        System.out.println(mu.add(a:2.5, b:3.5));      // 6.0
        System.out.println(mu.add(a:1, b:2, c:3));       // 6
    }
}
```

Runtime.java 1 | Compile.java 1

C: > Java session > Compile.java > Language Support for Java(TM) by Red Hat > MathUtils

```java
class MathUtils {
    // Overloaded add methods
    int add(int a, int b) {
        return a + b;
    }

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

    int add(int a, int b, int c) {
        return a + b + c;
    }
}

public class Compile {
    Run main | Debug main | Run | Debug
    public static void main(String[] args) {
        MathUtils mu = new MathUtils();
        System.out.println(mu.add(a:2, b:3));          // 5
```

PROBLEMS 2 | OUTPUT | DEBUG CONSOLE | TERMINAL | PORTS | Filter

```
[Running] cd "c:\Java session\" && javac Compile.java && java Compile
5
6.0
6

[Done] exited with code=0 in 1.321 seconds
```

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6. Method Overloading vs Overriding

Overloading: Same method name, different parameters (same class)

Overriding: Same method name and parameters in subclass

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7. Program for encapsulation

```
public class person {
   private String name;
   private int age;

   public String getName() {
      return name;
   }

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

   public int getAge() {
      return age;
   }
   public void setAge(int newAge) {
      if (newAge > 0) {
         age = newAge;
      } else {
         System.out.println("Age must be positive.");
      }
   }

   public static void main(String[] args) {
      person p1 = new person();
```

```
        p1.setName("Sonal");
        p1.setAge(18);

        System.out.println("Name: " + p1.getName());
        System.out.println("Age: " + p1.getAge());
    }
}
```

person.java 1

C: > Java session > person.java > Language Support for Java(TM) by Red Hat > person

```java
// Encapsulation Example in Java
public class person {
    // Private data members (data hiding)
    private String name;
    private int age;

    // Public getter for name
    public String getName() {
        return name;
    }

    // Public setter for name
    public void setName(String newName) {
        name = newName;
    }

    // Public getter for age
    public int getAge() {
        return age;
    }

    // Public setter for age with validation
    public void setAge(int newAge) {
        if (newAge > 0) {
            age = newAge;
        } else {
            System.out.println(x:"Age must be positive.");
        }
    }
```

```
person.java 1 ×
C: > Java session > person.java > Java > person
2   public class person {
23      public void setAge(int newAge) {
28          }
29      }
30
31      // Main method to test encapsulation
        Run main | Debug main | Run | Debug
32      public static void main(String[] args) {
33          // Create object of Person
34          person p1 = new person();
35
36          // Set values using setters
37          p1.setName(newName:"Sonal");
38          p1.setAge(newAge:18);
39
40          // Get values using getters
41          System.out.println("Name: " + p1.getName());
42          System.out.println("Age: " + p1.getAge());
43      }
44  }
PROBLEMS 1   OUTPUT   DEBUG CONSOLE   TERMINAL   PORTS   Filter

[Running] cd "c:\Java session\" && javac person.java && java person
Name: Sonal
Age: 18

[Done] exited with code=0 in 1.218 seconds
```

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8. What is abstraction?

Abstraction means hiding details and showing only essential features. Achieved using:

- **Abstract class**
- **Interface**

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9. Abstract class vs Interface

Abstract Class	**Interface**
Can have constructors	Cannot have constructors
Can have both abstract and concrete methods	All methods abstract (Java 7)
Supports inheritance	Supports multiple inheritance

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10. Program using Interface

java

CopyEdit

```
interface Vehicle {
   void start();
}

class Bike implements Vehicle {
   public void start() {
      System.out.println("Bike started");
   }
}

public class Main {
   public static void main(String[] args) {
      Vehicle v = new Bike();
      v.start();
   }
}
```