



Question 1 (25 marks)

a) What do each of the following print? (5 marks)

1. `System.out.println(22 + "rs");`
 - **Output:** "22rs"
 - Reason: `22` is an integer, and `"rs"` is a string. The `+` operator concatenates them, converting `22` to a string.
2. `System.out.println(22 + 3 + "rs");`
 - **Output:** "25rs"
 - Reason: `22 + 3` is evaluated first because of left-to-right associativity, resulting in `25`. Then, `25` is concatenated with `"rs"`.
3. `System.out.println((22+3) + "rs");`
 - **Output:** "25rs"
 - Reason: Parentheses cause `22 + 3` to be evaluated first, giving `25`. Then, `25` is concatenated with `"rs"`.
4. `System.out.println("rs" + (22+3));`
 - **Output:** "rs25"
 - Reason: The expression in parentheses (`22 + 3`) is evaluated first, yielding `25`. Then, `"rs"` is concatenated with `25`.
5. `System.out.println("rs" + 22 + 3);`
 - **Output:** "rs223"
 - Reason: Since `"rs"` is a string, everything after it is concatenated as strings. First, `"rs" + 22` becomes `"rs22"`, and then `"rs22" + 3` becomes `"rs223"`.

b) Missing code for summing two numbers input from the keyboard. (15 marks)

```
import java.util.Scanner;

public class Test {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);

        System.out.print("Enter first number: ");
        int num1 = input.nextInt();

        System.out.print("Enter second number: ");
        int num2 = input.nextInt();

        int sum = num1 + num2;
        System.out.println("The sum is: " + sum);
    }
}
```

c) Syntax for a function in Java. (5 marks)

```
public returnType functionName(parameterType parameterName) {
    // function body
    return value; // optional, based on returnType
}
```

Example:

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

Question 2 (25 marks)

a) Differentiate between a class and an object using an example. (6 marks)

- **Class:** A class is a blueprint or template for creating objects. It defines properties (attributes) and methods (functions).
 - Example:

```
class Car { int speed; void accelerate() { speed += 10; } }
```
- **Object:** An object is an instance of a class, created using the `new` keyword.
 - Example:

```
Car myCar = new Car();
```

b) Three steps when creating an object from a class. (6 marks)

1. **Declaration:** Declare the class type (e.g., `Car myCar;`).
2. **Instantiation:** Create an instance using the `new` keyword (e.g.,

```
myCar = new Car();
```

).
3. **Initialization:** Initialize the object, setting its initial state (e.g., `myCar.speed = 0;`).

c) Using inheritance to represent object-oriented sentences. (9 marks)

```
public class Animal {  
}  
  
public class Mammal extends Animal {  
}  
  
public class Reptile extends Animal {  
}  
  
public class Dog extends Mammal {  
}
```

Explanation:

- Animal is the superclass.
- Mammal and Reptile inherit from Animal.
- Dog inherits from Mammal, showing the hierarchy.

d) Code to call an interface in class `Animal` . (4 marks)

```
interface Behaviour {  
    void eat();  
}  
  
public class Animal implements Behaviour {  
    public void eat() {  
        System.out.println("Animal is eating.");  
    }  
}
```

Question 3 (25 marks)

a) Define an exception and how it is handled. (6 marks)

- **Exception:** An exception is an event that occurs during the execution of a program and disrupts the normal flow of instructions.
- **Handling:** Exceptions are handled using `try-catch` blocks. Code that might throw an exception is placed in the `try` block, and the `catch` block handles the exception.

b) What type of exception has occurred in the given code? (3 marks)

- **Exceptions:**
 - i. `ArrayIndexOutOfBoundsException`
 - ii. `ArithmeticException`

c) Output of the given code. (8 marks)

The code results in two outputs:

1. The `ArithmeticException` occurs when dividing by zero (`num1/num2` where `num2 = 0`).
 - Output: `Can't divide by zero`
2. The `for` loop causes an `ArrayIndexOutOfBoundsException` at index `i = 3` .

- Output: Array is out of bounds

d) Handle the exception using `throws` . (8 marks)

```
public class Main {  
    public static void main(String[] args) throws ArithmeticException, ArrayIndexOutOfBoundsException {  
        int array[] = {20, 20, 40};  
        int num1 = 15, num2 = 0;  
        int result = 10;  
  
        result = num1 / num2;  
        System.out.println("The result is " + result);  
  
        for (int i = 5; i >= 0; i--) {  
            System.out.println("The value of array is " + array[i]);  
        }  
    }  
}
```

Question 4 (25 marks)

a) Define an array. (1 mark)

- An array is a collection of elements of the same data type, stored at contiguous memory locations.

b) i) Size of the array. (2 marks)

- Size: 10

ii) Values at index 2. (2 marks)

- Value at index 2: 3

iii) Write the missing code for the for loop to display sum. (10 marks)

```
for (int i = 0; i < my_array.length; i++) {  
    sum += my_array[i];  
    System.out.println("The sum is " + sum);  
}
```

iv) Loop to display array elements with index. (10 marks)

```
for (int i = 0; i < my_array.length; i++) {  
    System.out.println("Element at index " + i + ": " + my_array[i]);  
}
```