

Introduction to Java Programming

Final Examination

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SECTION 1: MULTIPLE CHOICE (20 points)

Circle the correct answer for each question

1. Which of the following is NOT a valid Java identifier? a) `_count` b) `$total` c) `3rdPlace` d) `firstName`

Student Answer: c

2. What is the default value of an uninitialized boolean instance variable? a) `true` b) `false` c) `null` d) `0`

Student Answer: a

3. Which statement correctly creates and initializes a one-dimensional array? a) `int numbers = new int[5];` b) `int[] numbers = {1, 2, 3, 4, 5};` c) `int numbers[] = new int[];` d) `array int[5] = new numbers();`

Student Answer: b

4. Which of the following is NOT a feature of Java? a) Platform independence b) Multiple inheritance of classes c) Automatic garbage collection d) Object-oriented programming

Student Answer: b

5. What is the output of the following code?

```
java
```



```
String str = "Java";  
str.concat(" Programming");  
System.out.println(str);
```

- a) Java Programming
- b) Java
- c) Programming
- d) JavaProgramming

Student Answer: a

SECTION 2: TRUE/FALSE (10 points)

Write T for True or F for False

1. Java is a purely object-oriented programming language. **T**
2. The JVM (Java Virtual Machine) allows Java programs to be platform-independent. **T**
3. A class can implement multiple interfaces in Java. **T**
4. Static methods can directly access instance variables of a class. **F**
5. The == operator is used to compare the content of two String objects. **T**

SECTION 3: FILL IN THE BLANKS (10 points)

Fill in the blank with the appropriate term

1. The _____ keyword is used to create a subclass that inherits from a superclass.

Student Answer: extends

2. A variable declared inside a method is called a _____ variable.

Student Answer: local

3. The _____ operator is used to create instances of classes.

Student Answer: new

4. In Java, a(n) _____ is a block of code that runs when an exception occurs.

Student Answer: catch

5. The _____ method is automatically called when an object is no longer needed.

Student Answer: finalize

SECTION 4: CODE ANALYSIS (20 points)

Determine the output of the following code or identify errors

1. What is the output of the following code?

java



```
public class Test {  
    public static void main(String[] args) {  
        int x = 5;  
        System.out.println(x++ + ++x);  
    }  
}
```

Student Answer: 12

2. What is the output of the following code?

java



```
public class StringTest {
    public static void main(String[] args) {
        String s1 = "Java";
        String s2 = "Java";
        String s3 = new String("Java");

        System.out.println(s1 == s2);
        System.out.println(s1 == s3);
        System.out.println(s1.equals(s3));
    }
}
```

Student Answer:

true

false

true

3. Identify the error(s) in the following code:

java



```
public class ErrorExample {
    public static void main(String[] args) {
        int[] arr = {1, 2, 3, 4, 5};
        for(int i = 0; i <= arr.length; i++) {
            System.out.println(arr[i]);
        }
    }
}
```

Student Answer: The loop condition should be `i < arr.length` instead of `i <= arr.length`. The current code will cause an `ArrayIndexOutOfBoundsException` when `i` equals `arr.length` (5).

4. What is the output of the following code?

java



```
public class LoopTest {
    public static void main(String[] args) {
        int sum = 0;
        for(int i = 0; i < 5; i++) {
            if(i % 2 == 0) continue;
            sum += i;
        }
        System.out.println(sum);
    }
}
```

Student Answer: 4

SECTION 5: SHORT ANSWER QUESTIONS (20 points)

Provide a brief explanation for each of the following concepts

1. Explain the difference between method overloading and method overriding.

Student Answer: Method overloading is when you have multiple methods with the same name but different parameters in the same class. Method overriding happens when a subclass provides a specific implementation for a method that is already defined in the parent class. Overloading is resolved at compile time while overriding is resolved at runtime.

2. Describe the concept of encapsulation in Java.

Student Answer: Encapsulation is the bundling of data and methods that operate on that data within a single unit (class). It involves hiding the internal state of an object and requiring all interaction to be performed through an object's methods. We achieve this by making variables private and providing public getter and setter methods.

3. What is the difference between an abstract class and an interface in Java?

Student Answer: An interface can only have abstract methods and cannot have implementation, while abstract classes can have both abstract methods and implemented methods. Also, a class can implement multiple interfaces but can only extend one abstract class.

4. Explain the concept of garbage collection in Java.

Student Answer: Garbage collection is when Java automatically reclaims memory by clearing objects that are no longer being used. When no references to an object exist, the memory used by that object can be reclaimed. This helps prevent memory leaks and makes Java memory management easier than in languages like C++.

SECTION 6: PROGRAMMING QUESTIONS (20 points)

Write Java code to solve the following problems

1. Write a method that calculates the factorial of a given non-negative integer.

Student Answer:

java



```
public static int factorial(int n) {  
    if (n == 0 || n == 1) {  
        return 1;  
    } else {  
        return n * factorial(n - 1);  
    }  
}
```

2. Write a Java program to check if a string is a palindrome (reads the same forward and backward), ignoring case and non-alphanumeric characters.

Student Answer:

java



```
public static boolean isPalindrome(String str) {
    String cleaned = str.replaceAll("[^a-zA-Z0-9]", "").toLowerCase();
    int left = 0;
    int right = cleaned.length() - 1;

    while (left < right) {
        if (cleaned.charAt(left) != cleaned.charAt(right)) {
            return false;
        }
        left++;
        right--;
    }

    return true;
}
```

3. Write a Java method to find the second largest number in an integer array.

Student Answer:

java



```
public static int findSecondLargest(int[] arr) {
    if (arr.length < 2) {
        throw new IllegalArgumentException("Array must contain at least two elements")
    }

    int largest = Integer.MIN_VALUE;
    int secondLargest = Integer.MIN_VALUE;

    for (int i = 0; i < arr.length; i++) {
        if (arr[i] > largest) {
            secondLargest = largest;
            largest = arr[i];
        } else if (arr[i] > secondLargest && arr[i] != largest) {
            secondLargest = arr[i];
        }
    }

    return secondLargest;
}
```

4. Create a class 'Rectangle' with width and height as attributes and methods to calculate area and perimeter. Then, implement a class 'Box' that extends Rectangle and has an additional attribute depth. Add a method to calculate the volume of the box.

Student Answer:



```
public class Rectangle {
    protected double width;
    protected double height;

    public Rectangle(double width, double height) {
        this.width = width;
        this.height = height;
    }

    public double calculateArea() {
        return width * height;
    }

    public double calculatePerimeter() {
        return 2 * (width + height);
    }
}

public class Box extends Rectangle {
    private double depth;

    public Box(double width, double height, double depth) {
        super(width, height);
        this.depth = depth;
    }

    public double calculateVolume() {
        return width * height * depth;
    }
}
```