



University of Kelaniya – Sri Lanka
Centre for Distance & Continuing Education
Bachelor of Science (General) External
First year second semester examination - 2023 (April 2026)
Faculty of Science

Computer Science
COSC 17543 (R) – Object Oriented Programming

No. of Questions: **Four (04)**

No. of Pages: **Four (04)**

Time: **Two & half (2 1/2) Hours.**

Answer **ALL** questions.

1.

- (a) What is the difference between a class and an object? Provide an example in Java.
- (b) “Java is a platform-independent programming language.” Explain this statement with appropriate reasoning.
- (c) Briefly explain the following Java components:
 - (i) Java virtual machine (JVM)
 - (ii) Java Development Kit (JDK)
 - (iii) Bytecode
- (d) Write Java code segments to perform each of the following.
 - (i) Write a code segment to count and print the number of positive and negative numbers in the array.

```
int[] values = {4, -3, 7, -1, 3, -9, 2};
```
 - (ii) Write a Java method to count the number of words in a given sentence.

Ex:

Input	– " Java is simple and powerful"
Output	– 5

(e) Give the output when the following code segment is executed.

```
public static void main(String[] args) {
    for (int i = 1; i <= 4; i++) {
        for (int j = 4; j >= i; j--) {
            System.out.print(j + " ");
        }
        System.out.println();
    }
}
```

2.

- (a) Differentiate between instance variables, static variables, and local variables, using a Java example.
- (b) "Strings in Java are immutable." Explain this statement with examples.
- (c) StringBuilder and StringBuffer classes are used to create mutable Strings. But StringBuilder is faster than StringBuffer. Why?
- (d) Explain the difference between one-dimensional and multi-dimensional arrays providing an example for each.
- (e) Consider the following code.

```
1. class Rectangle {
2.     private double width;
3.     private double height;
4.
5.     Rectangle(double w, double h) {
6.         width = w;
7.         height = h;
8.     }
9.
10.    void getArea() {
11.        return width * height;
12.    }
13.
14.    public static void main(String[] args) {
15.        Rectangle r = new Rectangle(5.0);
16.        System.out.println("Area: " + r.getArea());
17.    }
18. }
```

- (i) Identify the compilation error(s) and specify the line number(s) with the problem(s). Provide a reason for each error.
- (ii) Write the corrected line(s) of the code.

3.

- (a) What is the difference between a default constructor and a parameterized constructor in Java? Give an example of each.
- (b) List two (02) purposes or benefits of using packages in large-scale Java applications.
- (c) Briefly explain three different types of access modifiers in Java.
- (d) Indicate whether there will be an error or not in the following cases. If there is an error, give the reason as well.
 - (i) A class defines a constructor with protected access. We are trying to create an object of that class from a subclass located in a different package.
 - (ii) Class B is public and it is located in package one. We are trying to create new objects of type B inside class C which is located in package two?
 - (iii) We declare two public classes (A and B) in a single .java file.
- (e) Consider the following details about the Point class and Line class to complete the code.
 - (i) Write a class called Point which has two private fields to store x and y coordinates of a point. This class should include the following:
 - public Point(int a, int b)** : Constructs a new point that contains the given coordinates.
 - public String toString()** : Returns a String representation of a point such as (10, 3).
 - (ii) Write another class called Line that represents a line segment between two points. Line objects should have the following methods:
 - public Line(Point p1, Point p2)** : Constructs a new Line that contains the given two points.
 - public Point getP1()** : Returns this Line's first endpoint.
 - public Point getP2()** : Returns this Line's second endpoint.
 - public String toString()** : Returns a String representation of this Line, such as [(22, 3), (4, 7)]
 - public double getSlope()** : Returns the slope of this Line. The slope of a line between points (x1, y1) and (x2, y2) is equal to $(y2 - y1) / (x2 - x1)$.

- (iii) Write a client class named LineClient. It should create an object of class Line and initialize it to points (22, 3) and (4, 7). Print the line object. Print out the slope of the line.

4.

- (a) Briefly explain the four main principles in Object Oriented Programming.
- (b) Define method overloading and method overriding.
- (c) What is the role of polymorphism in object-oriented systems?
- (d) What is the key benefit of inheritance?
- (e) A hospital has a Staff Management System. Different types of staff are managed, including Nurses, Doctors, Surgeons, and Consultants. Some staff are permanent, and others are contract-based. All staff have staff IDs and departments, and they can be assigned to wards or outpatient clinics.
 - (i) Identify the Objects in this system.
 - (ii) Draw a Class Inheritance Hierarchy Diagram to reflect the above relations.
 - (iii) Identify the Attributes and Methods for the following classes: Staff, PermanentStaff, Doctor, and Surgeon.
 - (iv) Write the Java syntax to demonstrate inheritance by making Doctor a subclass of PermanentStaff and override the calculateAnnualBonus() method in the Doctor class.

***** End of Question Paper *****