University of Kelaniya – Sri Lanka
Centre for Distance & Continuing Education
Bachelor of Science (General) External
First Year Second Semester Examination – 2023
2025 June
Faculty of Science

Computer Science
COSC 17543 – Object Oriented Programming

No. of Questions: **Four (04)** No. of Pages: **Four (04)** Time: **Two and half (02 ½) hrs.**

Answer **ALL** questions.

1.

(a) List three (03) principles of Object-Oriented Programming (OOP) and briefly explain each.

(b) How does Object-Oriented Programming (OOP) differ from procedural programming?

(c) What is the difference between a class and an object? Provide an example in Java.

(d) Briefly explain the following:

(i) Java Virtual Machine (JVM)

(ii) Java Development Kit (JDK)

(iii) Bytecode

(e) Write Java code segments to perform each of the following.

(i) Write a Java program to find and store only the even numbers from a given integer array "numbers".

```
int[] numbers = new int[10];
```

(ii) Write a code segment to extract and print the last name from a full name input.

Ex: Full name: Harin Disan Senanayake → Last name: Senanayake

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

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

2.

(a) How do instance variables differ from static variables in Java?

(b) Explain the immutability of String objects in Java.

(c) Both StringBuilder and StringBuffer allow for mutable string operations. However, StringBuilder tends to perform better. What is the reason behind this?

(d) Mention two (02) benefits and two (02) drawbacks of using arrays in Java.

(e) Consider the following code.

```
1.  class Student {
2.      private String name;
3.      private int age;
4.
5.      Student(String n, int a) {
6.          name = n;
7.          age = a;
8.      }
9.
10.     void printInfo() {
11.         System.out.println("Name: " + name);
12.         System.out.println("Age: " + age);
13.     }
14.
15.     public static void main(String[] args) {
16.         Student s = new Student();
17.         s.printInfo();
18.     }
19. }
```

(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 version of the code.

(iii) What will be the output of the corrected code, if the name is "Kavindi" and age is 21?

3.

(a) What is constructor overloading in Java? Write code examples to demonstrate how it is used within a class.

(b) List two (02) benefits of using packages in large-scale Java applications.

(c) Discuss the role of the private, default, and public access modifiers in controlling access to class members.

(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) Trying to access a private variable of a class directly from a different class in the same package.

(ii) Declaring a class as final and then extending it in a subclass.

(iii) Having two classes in different packages, both with default access, and trying to instantiate one from the other.

(e) Design two (02) Java classes as described below:

(i) Create a class Rectangle with private fields width and height. Include:

- A constructor to initialize both fields.
- A method getArea() that returns the area of the rectangle.
- A method toString() that returns a string in the format "Rectangle(width=4, height=5)".

(ii) Create a class Box that contains a Rectangle object and an additional depth field. Include:

- A constructor that takes a Rectangle object and the depth.
- A method getVolume() that returns the volume as area × depth.
- A method toString() that returns a string in the format "Box(Rectangle(width=4, height=5), depth=6)".

(iii) Write a client class BoxClient that creates a Rectangle of width 4 and height 5, wraps it in a Box of depth 6, and prints both the box and its volume.

4.

(a) Define method overloading and method overriding.

(b) What is the role of polymorphism in object-oriented systems?

(c) What is the key benefit of inheritance?

(d) What is the significance of the super keyword in Java? Explain with the help of a constructor invocation example.

(e) A university has a Vehicle Management System. Different types of vehicles are managed, including Bicycles, Motorbikes, Cars, and Buses. Some vehicles are

electric, and others are fuel-powered. All vehicles have license numbers and owners, and they can be booked by staff or students.

(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: Vehicle, ElectricVehicle, Car, and Bus.

(iv) Write the Java syntax to make the ElectricVehicle class an abstract class and define one abstract method calculateChargeTime().

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