

**CHUKA UNIVERSITY**  
**DEPARTMENT OF COMPUTER SCIENCE**  
**SECOND YEAR SEMESTER TWO EXAMINATION FOR BACHELOR OF SCIENCE**  
**IN COMPUTER SCIENCE**

**COSC 223: OBJECT ORIENTED PROGRAMMING**

**INSTRUCTIONS:**

1. Answer Question One and any other two questions
2. Use Java Programming Language for all code samples

**Question One (30 marks)**

- (a) Discuss the three access modifiers in Java program. (3 marks)
- (b) Explain three differences between a constructor and a method. (3 marks)
- (c) Using Java code samples, discuss the following object oriented concepts. (4 marks)
- (i) Encapsulation
  - (ii) Inheritance
- (d) Using a Java program code sample, explain the following variable types. (4 marks)
- (i) local variable
  - (ii) Instance variable
- (e) Define a class BankAccount with private data members: account name, account number, interest and balance. The class will have instance methods: deposit, withdraw, get interest (interest rate 15% per annum) and check balance. All the methods should return the new balance after a transaction is completed. (4 marks)
- (f) Define a parameterized constructor for the class in (e) above that will initialize all the data members during instantiation of the class. (4 marks)
- (g) Modify the method withdraw in (e) above so that it will throw an `IllegalArgumentException` with the message "Withdrawal amount entered is above daily withdrwal amount. Limit is Ksh. 40, 000 per day" if the amount entered is above ksh. 40, 000.00. (4 marks)
- (h) In the main method, write java code that calls all the methods defined in the class in (e) above catching all thrown exceptions. (4 marks)

**Question Two (20 marks)**

- (a) Show the output when the following code executes. Explain. (4 marks)

```
int y = 53, count = 7;
while (true){
    System.out.println("Y value: " + y);
    count = y % count;
    y += count;
    if (count > 100 ){
        break;
    }
}
```

- (b) Write a Java method for finding the average of an array of scores passed to the method. The method returns the average. If the array has no scores an exception is thrown. (6 marks)
- (c) Write a Java program to model the operations of a student management system. The system has three classes: Student, Course, and Lecturer. A student takes a maximum of three courses in a session. A lecturer teaches only 1 course in a session. At the end of a session, a report of every student showing the scores in each of the three subjects shall be produced. The report shows grade for each course, the lecturer who taught the course and overall mean score and mean grade. (10 marks)

**Sample report:**

Student#1:

Name: James Otieno

Reg. No: 56789

Course code	Score	Grade	Lecturer
COSC 100	71%	A	Dr Joel
COSC 110	65%	B	Mr Kunga
COSC 332	57%	C	Prof. Kiama

Mean Score: 64.3      Mean Grade: B

**Question Three (20 marks)**

- (a) Explain the difference between method overloading and method overriding. (4 marks)
- (b) Explain what an interface in Java is. Using a Java code snippet, show the definition of an interface and how they are utilized in a computer program. Use the example of a Shape and a Circle where shape is the interface with a method draw and circle is the concrete class. (6 marks)
- (c) Explain what is Exception propagation? Illustrate your answer with Java code snippet using throw new ArgumentException("Illegal input to the method.").

(5

marks)

- (d) Write a Java method in Java code for searching an element in a list. The method takes array list and a search item as arguments. It then returns true if item is found in the list or false if item is not in the list. (5 marks)

#### Question Four (20 marks)

- (a) Using a sample Java code, explain the importance of exceptions handling in a computer program. (4 marks)
- (b) Define a class Person with the private data members: first name, last name, and date of birth; public methods: get name and get date of birth and a constructor to initialize the data members. (8 marks)
- (c) Define another class Student that inherits from class Person and has with the following properties: student registration number, address, and programme and the public methods: get grade and a constructor to initialize student address and programme. Ensure that the Person constructor is called in the Student constructor. (8 marks)

#### Question Five (20 marks)

- (a) Consider the code sample provided below. Show the print out expected when the code executes. (4 marks)

```
class A
{
    public A()
    {
        super();
        System.out.println("Class A");
    }
    void print(){
        System.out.println("Hello in A");
    }
}

class B extends A
{
    public B()
    {
        super();
        System.out.println("Class B");
    }
    void print(){
        System.out.println("Hello in B");
    }
}
```

```

}

class C extends B
{
    public C()
    {
        super();
        System.out.println("Class C");
    }
    void print(){
        System.out.println("Hello in C");
        super.print();
    }
}

public class MainClass
{
    public static void main(String[] args)
    {
        C c = new C();
        c.print();
    }
}

```

- (b) Write a Java method to find the grade of a score entered. The method should throw an exception “Invalid score entry” if the score entered is not in the range 0 to 100. (6 marks)
- (c) Write a calculator program with the operations add, multiply, divide, subtract and remainder. The calculator has two instance variables x and y with appropriate methods for setting values of x and y, and getting the values of x and y. The program should catch errors resulting from illegal inputs and erroneous computations like divide by 0 for the values of x and y.

(10

marks)