

THE UNIVERSITY OF ZAMBIA

School of Natural Sciences

Department of Computer Science

FINAL EXAMINATION

CSC 2000

Computer Programming

Date: 11th January 2021
Time: 09:00hrs – 11:00hrs
Duration: 2 Hours
Venue: Sports Hall

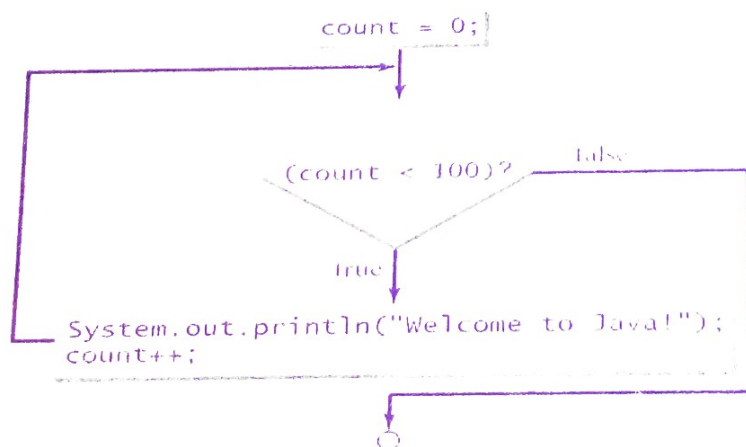
Instructions

1. There are **two (2) sections** in this exam paper.
2. Only the java programming language should be used in this exam
3. *Answer all* the questions in **Section A** and choose *any two (2)* questions from **Section B**

SECTION A. Short answers (40 marks)

You are required to answer all questions in this section.

- ✓1. What is polymorphism and how is it related to dynamic binding and method matching? [6 marks]
- ✓2. What is method overloading and overriding? [4 marks]
- ✓3. The Java programming language is said to be both an interpreted and compiled language. Briefly discuss the pros and cons of this approach as compared to interpreted only and compiled only languages. [6 marks]
- ✓4. Briefly discuss any four key characteristics of Java. [4 marks]
- ✓5. Is there a difference in performance of Java programs that implicit and explicit importing? [2 marks]
- ✓6. Java purists often emphasize the importance of following naming conventions when coming up with identifier names. Why is it important to follow naming conventions? [4 marks]
- ✓7. List relational operators that are implemented in the Java programming language and the corresponding mathematical operators. [3 marks]
- ✓8. What are selections and why are they important in programming? [4 marks]
- ✓9. Write java code that implements the following flow chart. [2 marks]



- ✓10. Write short code showing the implementation of an enhanced for loop and how it can be used to traverse an array. [5 marks]

SECTION B (40 marks)

Answer any two (2) of the three (3) questions. Each question carries 20 marks

* 1. Loops are a fundamental concept in all programming languages. For this reason, java also has loop implementations.

- ✓ a) What is a sentinel and when does it come in useful? [3 marks]
- ✓ b) How do you write an infinite loop using the "while", "for" statement? [2 marks]
- ✓ c) Consider the following code snippet. What is wrong with the code and what would you propose as a remedy. [3 marks]

```
double item = 1; double sum = 0;
while (item != 0) {
    sum += item;
    item -= 0.1;
}
System.out.println(sum);
```

d) Hexadecimals are often used in computer systems programming. To convert a decimal number d to a hexadecimal number you need to find the hexadecimal digits $h_n, h_{n-1}, h_{n-2}, \dots, h_2, h_1$, and h_0 such that

$$d = h_n \times 16^n + h_{n-1} \times 16^{n-1} + h_{n-2} \times 16^{n-2} + \dots + h_2 \times 16^2 + h_1 \times 16^1 + h_0 \times 16^0$$

These hexadecimal digits can be found by successively dividing d by 16 until the quotient is 0. The remainders are $h_0, h_1, h_2, \dots, h_{n-2}, h_{n-1}$, and h_n .

I. Write java code for a class called MyInteger. MyInteger should have one constructor that accepts an integer as an argument. It should also have a method that returns the hexadecimal equivalent of the integer. [8 marks]

II. Write a test class for MyInteger. [4 marks]

2. Two programming students decide to meet at a restaurant between 12:00hrs and 13:00hrs. They agree that whoever arrives first should wait for the other for no more than 15 minutes. One of the students develops a concern for the possibility of them successfully meeting. Being a programming savvy he decides to write a program to estimate the probability of them meeting. For this he uses a Monte Carlo simulation.

- a) Monte Carlo simulations require random number generation. Which java class can be used to generate random numbers? [2 marks]
- b) How can a java programmer write code to make use of code written by other programmers? Write code for making sure that the class in Q2(a) is made available. [4 marks]
- c) Either student can arrive from the 1st to 59th minute in the 12:00-13:00 period. The students arrive at times x_1 and x_2 . If $|x_1 - x_2| \leq 15$ it implies that the students meet and

thus we consider this as a hit. The probability of the students meeting is approximately $\text{numberOfHits} / \text{numberOfTrials}$. Assuming the students arrive between 12:00 and 13:00, write code for a class that can be used to generate MonteCarlo objects. The class should have two constructors. One for specifying the number of trials and another that sets the number of trials to 1000000. The class should also have a method for generating a random number using the same seed and also a method for invoking the experiment that returns the probability of meeting. **[8 marks]**

- d) Write code for a class for running 10 experiments using the MonteCarlo class. The class then reports the probability as an average of running the 10 experiments. **[6 marks]**

✗ 3. Methods as procedures are fundamental for defining behavior of objects. Grasping the key aspects of defining methods is crucial when writing good and succinct code.

- ✓ a) What is a method? **[2 marks]**
- ✓ b) What is the difference between passing by value and passing by reference? **[4 marks]**
- ✓ c) What are local variables and how is their scope related to methods? **[4 marks]**
- ✓ d) Write code for a java class that implements the following
 - ✓ i. a method that gets an array of integers as an argument and returns the sum of the integers. **[5 marks]**
 - ✓ ii. a method that gets an array of integers as an argument and returns indicating whether the sum of the integers is an even number or not. **[5 marks]**