(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

First YEAR 1ST SEMESTER EXAMINATIONS

BACHELOR OF SCIENCE IN
Computer Science, mathematics, physics, information technology, education technology

COURSE CODE: **BCS 111 / BIT 112**
COURSE TITLE: **INTRODUCTION TO PROGRAMMING**

DATE: 13/12/2022 **TIME: 08:00-10:00PM**

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INSTRUCTIONS TO CANDIDATES

Answer Question **ONE (1)** and Any **OTHER 2** questions
Ensure your answers/ideas are clearly expressed
All your answers must be clearly numbered
Write in ink. Rough work can be done in pencil and will not be marked. Cross out any rough work. Calculators, phones, tablets, computers not allowed

TIME: 2 Hours 20 Minutes (20 minutes for reading and choosing questions)

MMUST observes ZERO tolerance to examination cheating

QUESTION ONE: COMPULSORY QUESTION [20 MARKS]

(a) Define the following terms as used in Computer programming. [4 Marks]

(i) Program

(ii) Function

(iii) Constant

(iv) Data type

(b) With illustration, explain what is a **runtime error** as used in Computer programming. [2 Marks]

(c) Write a function that returns **Least Common Multiple (LCM)** of two integers it receives as parameters [5 Marks]

(d) What would be the exact output of the code segment below. [2 Marks]

```
int a = 5;
float b = --a + 0.25 * 9 + a--;
printf("a = %d\t", a);
printf("b = %.1f", b);
```

(e) Declare and initialize with arbitrary values an array that can store programming marks of 5 students. [2 Marks]

(f) Consider the code below

```
int i = 0;
do{
  if (i < 5 || (i > 5 && i % 2 == 0)){
    printf("%d ", i);
    //break;
  }
  i += 2;
}while(i <= 10);
}
```

(a) Rewrite the do...while loop in the code above as a for loop. [3 Marks]

(b) What would be the output of the code above. [2 Marks]

QUESTION TWO [20 MARKS]

(a) The n^{th} number in the Tribonacci sequence is given by

$$F_n = F_{n-1} + F_{n-2} + F_{n-3} \qquad \text{for} \qquad F_0 = 0 \quad F_1 = 1 \text{ and } F_2 = 1$$

write a C program that will receive an integer **n** from the user and display the first **n** Tribonancci numbers. [4 Marks]

(b) With illustration, explain what is a dangling else as used in a C programming language. [2 Marks]

(c) With illustrations, highlight **TWO** types of comments used by C programmers. [4 Marks]

(d) With illustration, explain what is a **syntax error** as used in Computer programming. [2 Marks]

(e) Using • while loops, write a code excerpt that will give the output below. *[6 Marks]*

```
*
**
***
****
*****
```

(f) What is a compiler as used in computer programming. [2 Marks]

QUESTION THREE [20 MARKS]

(a) In a neural network, a sigmoid activation function is defined as

$$f(x) = \frac{1}{1 + e^{-x}}$$

where **e** is a mathematical constant whose value is **2.7128**. Write a function that receives a value **x** calculates and returns the output of the sigmoid function. *Hint: Use pow(x, y) function of the math.h library.* [4 Marks]

(b) The **Greatest Common Divisor(GCD)** of two numbers is a number less of equal to the minimum number in the set, and can divide the two numbers without getting a remainder

(i) Write definition of a function **minimum** that returns the minimum number between the two integers it receives as parameters. [4 Marks]

(ii) Write the function gcd that returns the GCD of two integers it receives as parameters. Re-use the function defined in (i) above. [4 Marks]

(iii) Write the main function, prompt the user to enter two integers, call the gcd function defined in (ii) to calculate the GCD and display the results. Your program output should match sample format shown below. [4 Marks]

Example Output - User input underlined

```
Enter First Number : 12
Enter Second Number: 15
-----------------------
GCD of 12 and 15 = 3
-----------------------
```

(c) Write a recursive function that calculates and return factorial of non-negative integer it receives as a parameter. [4 Marks]

QUESTION FOUR [20 MARKS]

(a) Distance d between two points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ in a 2D space is given by

$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

using **sqrt(x)** function of math.h library, write a program that will read radius of a circle from the keyboard as an integer, the x and y coordinates of the centre of a circle and x and y coordinates of a point and determine if the point is within a circle or outside the circle. [10 Marks]

(b) What would be the output of the code below. Explain.

```
#include <stdio.h>
int main()
{
  int a = 10;
  for( ; a > 5 ; )
    a -= 1;
    printf("%d\t", a);
}
```

[2 Marks]

(c) The value of π can be approximated as

$$\pi = \sum_{n=1} \frac{(-1)^{n+1}}{2n-1}$$

using a while loop, write a program that can estimate π using the series above where n is the number of times the estimation is improved [5 Marks]

(d) State **FOUR** rules that variable names must observe. [4 Marks]