



MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MATHEMATICS AND COMPUTER SCIENCE)

SMA 191: INTRODUCTION TO PROGRAMMING

DATE: 20/4/2023

TIME: 2:00 – 4:00 PM

INSTRUCTIONS:

Answer Question ONE and other TWO Questions

Marks are awarded for clear and concise answers

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define the following terms: (4 marks)
 - i) Array
 - ii) Heap
- b) Outline TWO advantages of linked linear lists over arrays (2 marks)
- c) Explain THREE rules of naming variables using suitable examples. (3 marks)
- d) Enumerate THREE advantages of modular programming compared to procedural programming language. (3 marks)
- e) Data types are core to programming languages. What do you understand by the term “Data type”? Giving examples explain any four of the main data types supported in C. (4 marks)
- f) Briefly explain the purpose of the following statements used in C. (4 marks)
 - i) `#include <stdio.h>`
 - ii) `main ()`
- g) Using a function write a program that adds and subtracts two numbers and displays the result. (7 marks)
- h) State any THREE characteristics of a good algorithm. (3 marks)

QUESTION TWO (20 MARKS)

- a) A company requires a program to enter employee name, hours worked and rate per hour of an employee then calculate basic pay= hours worked multiplied with rate per hour. Tax is calculated on basic pay as follows:

Basic pay	Tax
Over 50000	20% of basic pay
Between 20000 and 50000	10% of basic pay
Below 20000	No discount

- Write a C program that will enable the user to enter the above details and calculate basic pay, tax and net pay = basic pay – tax. (6 marks)
- b) Distinguish between Local variables and Global variables as used in programming and support your answer with a C program example. (8 marks)
- c) Abel wrote the C program below but did not run. Study it and rewrite the correct code by removing the errors (6 marks)

```
#include<stdio.>

void main()
{
    int a, b, sum, product
    double 8average;
    printf("Enter a value for a\n");
    scanf("%d",a);
    printf("Enter a value for b\n");
    scanf("%d",&c);
    sum = a + b;
    product=a*b;
    average = (double) sum/2;
    printf("\n%d+%d=%d",num1,num2,sum);
    printf("The average is %4.2lf\n");
    return 0;
}
```

QUESTION THREE (20 MARKS)

- a) Clearly explain the following terms (8 marks)
- i. Linking
 - ii. Data type
 - iii. Operand
 - iv. Pre-processing
- b) CHINA WU-YI Construction Company will pay employees gratuity on termination of the SGR contract computed as follows:
gratuity = (basic_salary x fixed_rate x months_worked).
- i) Identify the variables in the problem. (2 marks)
 - ii) Formulate an algorithm that can be used to calculate gratuity. (4 marks)
 - iii) Represent the algorithm in b (ii) above using a program flow chart. (2 marks)
 - iv) Write a program using C to implement b (iii) above (4 marks)

QUESTION FOUR (20 MARKS)

- a) Using examples, discuss the THREE types of control structures as used in C programming language. (6 marks)
- b) Consider the code below. Show and explain the final output of the program. (7 marks)

```
1 // my first pointer
2 #include <stdio.h>
3 using namespace std;
4
5 int main ()
6 {
7     int firstvalue, secondvalue;
8     int * mypointer;
9
10    mypointer = &firstvalue;
11    *mypointer = 10;
12    mypointer = &secondvalue;
13    *mypointer = 20;
14    printf ("firstvalue is %d", firstvalue);
```

```

15 printf ("secondvalueis %d", secondvalue);
16
17 return 0;
    }

```

- c) Peterson invests Kshs.1000, 000 in savings account yielding 5% interest. Assuming that all interest is left on deposit account, write a program will compute and display the interest after 5 years. (7 marks)

QUESTION FIVE (20 MARKS)

- a) State TWO disadvantages of using pointers. (2 marks)
- b) The following is an algorithm used to solve a computer problem:
- i. Declare the variables x, y, z and the result to be of type int (in separate statements).
 - ii. Prompt the user to enter three integers.
 - iii. Read three integers from the keyboard and store them in the variables x, y and z.
 - iv. Compute the product of the three integers contained in variables x, y and z and assign the result to the variable result.
 - v. Print “the product is ” followed by the value of the variable result
- i) Write a program in C to implement the above pseudo-code. (4 marks)
 - ii) Use a pseudo code to implement the fragment in (i) above. (4 marks)
- c) A learning institution wishes to develop C software system for registering students. The program should prompt the User to enter Marks for 3 Courses undertaken by a student within a particular semester, declare an array structure and write a program to store the above information if the institution would not wish to register more than 100 students in the current academic year. (10 marks)