2920/103
STRUCTURED PROGRAMMING
November 2021
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

MODULE I

STRUCTURED PROGRAMMING

3 hours

INSTRUCTIONS TO CANDIDATES

This paper consists of EIGHT questions
Answer FIVE of the EIGHT questions in the answer booklet provided.
Candidates should answer the questions in English.

This paper consists of 5 printed pages.

Candidates should check the question paper to ascertain that all the
pages are printed as indicated and that no questions are missing.

Turn over

1. (a) The following segment code was declared in a Pascal program. Use it to answer the questions that follow.

```
TYPE
     Grade=('A', 'B', 'C', 'D', 'E');
VAR
     Mark: Grade;
```

   (i) Name the type of variable used. (1 mark)

   (ii) Using an appropriate predefined function, write a statement that would generate the ASCII value of character 'D'. (2 marks)

   (b) Distinguish between *source code* and *object code* as used in programming. (4 marks)

   (c) Write a program in Pascal language that would generate the following output when executed.

```
&
&&
&&&
&&&&
&&&&&
```
   (4 marks)

   (d) (i) Declare an employee record containing; name, hours worked per day for 5 days and address. (4 marks)

   (ii) Write a program in C language that would create a data file with the following employee details. *Employee number* and *basic pay*. (5 marks)

2. (a) Given the following C program expression:

```
basicpay + allowances>2200 && code= -1||netpay>1000
```

   Write the order of operator precedence. (4 marks)

   (b) Differentiate between *pseudocode* and *structure narratives* as used in programming. (4 marks)

   (c) Write a program in C language that accepts 10 numbers, store them in an array and display the numbers in reverse order. (5 marks)

   (d) (i) Outline **two** functions of a compiler as used in programming. (2 marks)

   (ii) Write a program in Pascal language that prompts a user to enter a price of an item ranging between 10 and 100 shillings. The maximum number of items one could buy is 20. The program then computes and displays the cost of the items. (5 marks)

3. (a) State **two** contents in each of the following documentations:

   (i) program; (2 marks)

   (ii) user. (2 marks)

   (b) (i) Explain **two** approaches used by programmers to improve the readability of a program. (4 marks)

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(ii) A program prompts a user to enter two numbers. The program then divides the first number by the second number and displays the result. When the second number is zero, the program displays an error message "Error!" and terminates the program.

Draw a program flowchart to represent the logic of this program. (4 marks)

(c) Distinguish between *do...while* and *while* loops as used in C programming. (4 marks)

(d) The following program was created during a programming lesson. Use it to answer the question that follows.

```
main()
{
int i,j;
i=12;
j=10;
fn(&i,&j);
printf("%d %d\n" , i,j);
}
fn(m,n);
int*m, *n;
{
(*m)++;
(*n)++;
printf("%d,%d",*m,*n);
}
```

Interpret the program. (4 marks)

4. (a) (i) Outline **three** reasons for creating a documentation during program development. (3 marks)

(ii) Explain **two** types of errors that are likely to occur after a program compilation. (4 marks)

(b) Write a program in Pascal language that prompts a user to enter two integers. The program then checks whether the two integers are equal and displays a Boolean result. (4 marks)

(c) Write an algorithm that could be used to implement a sequential search in an array. (4 marks)

(d) Figure 1 shows a decision tree used by a student to analyse a program for computing customer's discounts. Use it to answer the question that follows.
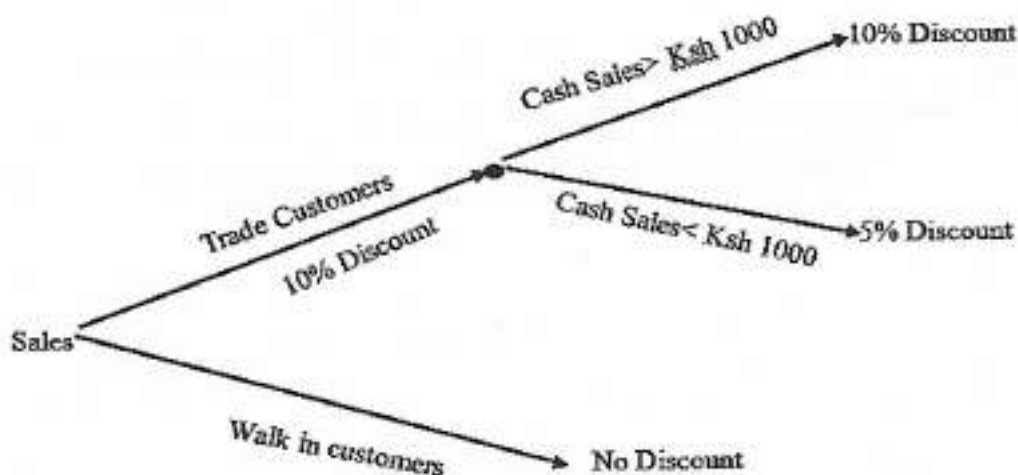

Figure 1

Write a program in C language to implement the logic depicted in figure. (5 marks)

5. (a) Outline **four** characteristics of quicksort technique. (4 marks)

(b) Describe **two** causes of errors likely to occur when a C program fail to read a data file. (4 marks)

(c) Write a Pascal program that prompts a user to enter a digit. The program then computes and displays the square root of the digit using a predefined function. (6 marks)

(d) Draw a program flowchart that could be used to solve the values of x in a quadratic equation: $f(x)=ax^2 +bx +c$. (6 marks)

6. (a) (i) State **two** non-linear data structures used in programming. (2 marks)

(ii) Explain **two** activities that takes place during program compilation. (4 marks)

(b) (i) Given the nodes 15, 22, 9, 5, 29, 3, 11, 10, 6, 14, 24, 30 construct a binary search tree. (4 marks)

(ii) Write the output generated when the tree in (i) is traversed using the post-order strategy. (1 mark)

(c) Differentiate between *dry run* and *walkthrough* program testing methods. (4 marks)

(d) Write a program in Pascal language that uses a function to compute the volume of a cube when its length is passed to it. The program then displays the result. (5 marks)

7. (a) Explain each of the following terms as used in programming:

(i) test data; (2 marks)

(ii) bug. (2 marks)

(b)   (i)   Outline **three** sources of programming projects.   (3 marks)

     (ii)   Outline **three** circumstances that would lead to the use of pseudocodes.

                                                    (3 marks)

(c)   Given the values i=6 and j=10, for a statement j=++i + 6, evaluate:

     (i)   prefix increment;

     (ii)   post fix decrement.   (4 marks)

(d)   Write a program in Pascal language that would read and output temperature readings in four different locations three different times in a day.   (6 marks)

8   (a)   (i)   State **four** examples of structured programming language other than Pascal and C languages.   (2 marks)

     (ii)   Outline **two** advantages of high-level languages.   (2 marks)

(b)   With the aid of a flow chart, describe the insertion procedure of an element in a queue data structure.   (6 marks)

(c)   Write a program in Pascal language that divides two integers; 16 and 3. The program then using two predefined functions to displays the results as integer.   (5 marks)

(d)   Write a program in C language that prompts a user to enter age of a person. The program then displays the age and a message "You are an adult" whenever the age is greater than 18 years.   (5 marks)

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