

2920/103

STRUCTURED PROGRAMMING

July 2019

Time: 3 hours

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THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

MODULE I

STRUCTURED PROGRAMMING

3 hours

INSTRUCTIONS TO CANDIDATES

*This paper contains **EIGHT** questions.
Answer any **FIVE** 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.

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Turn over

1. (a) (i) Outline **two** advantages of using assembly language to create a program. (2 marks)
- (ii) Distinguish between *procedural* and *non-procedural* programming languages. (4 marks)
- (b) Explain **two** reasons that would make a programmer to opt for top-down design when developing a program. (4 marks)
- (c) Assuming Pascal programming language, evaluate the expression:

$$Y = \text{sqr}(a) + b * c \bmod 4 / d$$
given that $a = 4$, $b = 6$, $c = 10$ and $d = 3$. (4 marks)
- (d) A technical institute allocates hostels to students on first come first served basis. A student first registers for the term, pays fees and then applies for a hostel room. A room is allocated to students who meet this criterion.
Draw a flow chart to represent the logic in the narrative. (6 marks)

2. (a) (i) Explain the term *user-defined data type* as used in programming. (2 marks)
- (ii) A programmer created a program for a hospital to store patient details as a single entity consisting of: *PatientNo*, *Patient_Name*, *Gender* and *Age*.
 - (I) Identify the most appropriate data structure the programmer could have used. (1 mark)
 - (II) Using Pascal language declare a data structure that could be used to store this data. (4 marks)
- (b) (i) Outline **three** operations that may be carried out on a stack data structure. (3 marks)
- (ii) Distinguish between *queue* and *linked list* data structures. (4 marks)
- (c) Table 1 shows the criteria used by Tusome Technical Institute to award grades to students. Use it to answer the question that follows:

Points	Grade
1	Distinction
2	Credit
3	Pass
4	Fail

Table 1

Write program in C language that would prompt a user to enter the points obtained by a student. The program then displays the corresponding grade. Use *switch* statement. (6 marks)

3. (a) (i) Explain **two** characteristics of an algorithm. (4 marks)
- (ii) Write an algorithm that could be used to implement a quick sort. (4 marks)

- (b) Write a program in C language that would prompt a user to enter an integer. The program then checks whether the integer entered is a prime number or not and displays an appropriate message. (6 marks)
- (c) Write a program in Pascal language that prompts a user to enter a positive integer. The program then computes the sum of all integers from 0 to the integer. (6 marks)

4. (a) Outline **two** types of utility programs used in program translation. (2 marks)
- (b) (i) A student created a program that could write data into a file. Describe **three** file organization techniques he could have used. (6 marks)
- (ii) The following is C language program. Study and use it to answer the question that follows.

```
#include <stdio.h>
int main ()
{
    int Myarray[ 4 ]={10,20,30,40};
    int j;
    for (j = 3; j >= 0; j-- )
    {
        printf("Element[%d] = %d\n", j, Myarray[j]);
    }
    return 0;
}
```

Interpret the program line by line. (4 marks)

- (c) (i) Describe the term *comment* as used in Pascal programming language. (2 marks)
- (ii) Figure 1 shows the floor area of a rectangular room that has been fitted with a circular carpet. Use it to answer the question that follows.

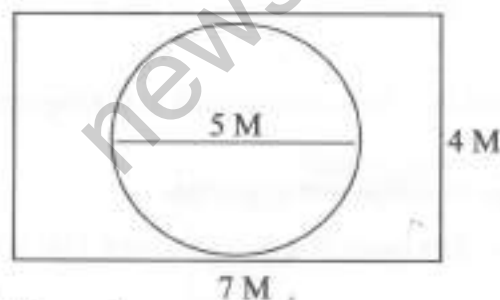


Figure 1

Write a program in Pascal language to compute the area not covered by the carpet. (6 marks)

5. (a) (i) Explain the term *module* as used in programming. (2 marks)
- (ii) State **two** differences between a *function* and a *procedure* as used in Pascal language. (4 marks)

- (b) Write a pseudocode that could be used to sort items in a list using bubble sort technique. (4 marks)
- (c) Outline the use of each of the following C language file functions.
- (i) `putc()`
- (ii) `fprintf()` (4 marks)
- (d) Write a program in C language that could be used to generate the following output.
- ```

4
4 5
4 5 6

```
- (6 marks)
6. (a) Outline **two** reasons for using data structures in a program. (2 marks)
- (b) (i) Describe **two** types documents that could be included in a new program. (4 marks)
- (ii) Distinguish between `writeln( )` and `write( )` functions as used in Pascal. (4 marks)
- (c) Given the data items: *Peter, George, Tom, Beatrice, Wayne, Joan* and *Ray*.
- (i) Construct a binary tree; (3 marks)
- (ii) State the level of the data item *Ray* in the binary tree in (i). (1 mark)
- (d) A program prompts a user to enter the code '1234' in order to log in to a system. If the entered code is correct a message "Welcome" is displayed otherwise a message "The code is incorrect" is displayed. The program allows up to a maximum of three entries. Write a program in Pascal language that could be used to implement this logic. (6 marks)
7. (a) Explain the use of each of the following reserved words in structured programming.
- (i) `break;`
- (ii) `continue.` (4 marks)
- (b) Distinguish between `realloc` and `free` functions as used in C programming language. (4 marks)
- (c) (i) Outline **two** advantages of merge sort algorithm. (2 marks)
- (ii) Figure 2 shows a list of data items in a data structure. Use it to answer the question that follows.

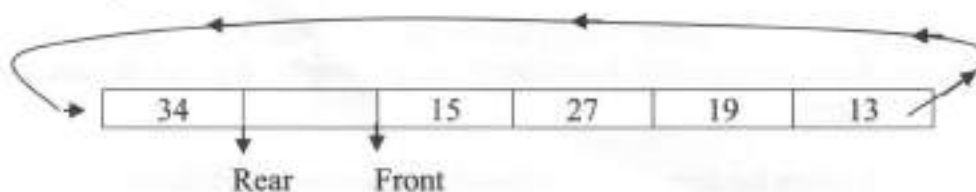


Figure 2

Describe the data structure depicted in the figure.

(4 marks)

- (d) Write a program in Pascal language that could be used to create a two by two array, enter values into the array. (6 marks)

8. (a) (i) State **two** ways other than comments through which a programmer could make a program more understandable. (2 marks)
- (ii) A student created a program using C language; identify an escape sequence he could use to format the output as a table. (2 marks)

- (b) Outline the meaning of each of the following escape sequences as used in C programming language.

- (i) \a
- (ii) \b
- (iii) \\
- (iv) \0 (4 marks)

- (c) (i) Outline **two** types of errors that one could encounter when working with a stack. (2 marks)

- (ii) Describe **two** error trapping functions used in C programming language. (4 marks)

- (d) Table 2 shows the criteria used by a county government to allocate bursaries to students. Use it to answer the question that follows.

| Status             | Amount Allocated |
|--------------------|------------------|
| Orphan             | 15,000           |
| Needy              | 13,000           |
| Affirmative Action | 13,000           |
| Other              | 0                |

Table 2

Write a program in Pascal language that would prompt a user to enter the status of a student. The program then outputs the amount allocated to the student. Use *nested if* statement. (6 marks)

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