TECHNICAL UNIVERSITY OF MOMBASA

INSTITUTE OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR:

BSIT/SEP2023/J-FT, BTIT/SEP2024/S-PT; BSCS/SEP2024/S-PT, BTIT/SEP2023/J-FT, BSCS/SEP2023/J-FT, BSMF/SEP2022/FT.

CCS 4201**: DATA STRUCTURES & ALGORITHMS**

PAPER 2

END OF SEMESTER EXAMINATION

SERIES: Dec2024

TIME:2HOURS

DATE: Pick DateApr2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION 1

(a.) You are employed by a software company designing an application for use by produce wholesalers. Your job is to implement the data structure used to store the inventory of the warehouse containing the produce. The data structure must be able to add a product with an associated code indicating its likelihood to spoil,

remove a product that is most likely to spoil, and return the overall number of products in the inventory. Discuss and justify your Data structure of choice and its implementation. [5marks]

(b.) Define the term algorithm. [2mars]

(c.) In your own experience in today life where do you think you apply the concept of algorithms? Discuss with an example. [4 marks]

(d.) Differentiate between a recursion and an iteration in program development. Use a high level language example to explain the difference. [6marks]

(e.) (i.) What do the terms time efficiency and space efficiency mean with reference to an algorithm? [6marks]

(ii.) State any three factors that influence the running time of an algorithm? [3 marks]

(iii.) Compute the running time for the following algorithm, hence give its asymptotic growth rate. [4marks]

```
sum=0;
for(i=0; i < n; i++){
        j=i;
        while(j !=0){
                if( j % 2 == 0)
                        sum++;
                j /= 2;
        }
}
```

QUESTION 2

(a.) (i.) What is a linked list [2marks]

(ii.) Outline the advantages of a linked list over an Array abstract data type. [4marks]

(iii.) Write an algorithm/ function used to delete an element from the list [6marks]

(b) (i) Write a pseudo code algorithm that prompts the user for three integers, evaluates the largest and print's the maximum [4 marks]

(ii) Implement the algorithm above into a program using a high level language. [4 marks]

QUESTION 3

(a.) (i.) Define a stack ADT. [2marks]

(ii.) Write an algorithm that demonstrates the Push and Pop stack fundamental operations [8marks]

(iii.) Briefly explain any two applications of stack in computer science [4 marks]

(b.) (i.) Define the term Abstract Data Type (ADT) and hence give its properties. [6marks]

QUESTION 4

(a.) Write an algorithm for the merge sort [10 marks]

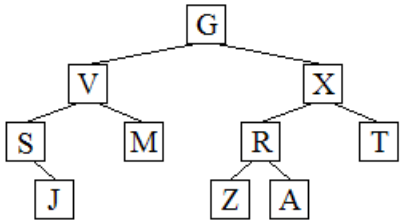
(b.) Given an integer array of size **n**, write a procedure to traverse and print the elements in the array using a high level language of your choice. [10 marks]

Input to the array : arr[] = {2, 1, 5, 6, 0, 3}

Output: , 1, 5, 6, 0, 3

.QUESTION 5

(a) List the order in which the contents of the following tree would be visited, for each of the given traversals:



(i) Preorder [6 marks]
(ii) In order
(iii) Post order

(b) Consider the following code segment

Arr [4] = {6,4,3,1}

j = 0 , k = 10

While (j < 4) do

If (arr [j] < k) then

k =arr [j]

Endif

j = j+1

End while

Display k.

(i) What does the code display, dry run to show your answer [4 marks]

(ii) Using a high level language, Implement the algorithm in to a program [4marks]

(d) Write an algorithm / procedure for deleting a node from a queue. [4marks]