510

(*University of Choice*)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE

IN

INFORMATION TECHNOLOGY/COMPUTER SCIENCE

COURSE CODE: BCS 225/BIT 225

COURSE TITLE: DATA STRUCTURES AND ALGORITHMS

DATE: Monday 25/04/2022 **TIME:** 8:00a.m-10:00a.m

INSTRUCTIONS TO CANDIDATES

Answer **Questions ONE** and **ANY OTHER TWO**.

TIME: 2 HOURS

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (30MARKS)-compulsory

a) Define the following terms as applied to Data Structures and Algorithms (3mks)
   i) Postfix expression
   ii) Data Abstraction
   iii) Linked List

b) Explain the process of inserting a new item in a binary search tree (3mks)

c) Using a binary tree, what is the postfix expression of A-D+B*C/E*F (3mks)

d) Name two collision resolution technique used in hashing (2mks)

e) What is the number of nodes in a strictly binary tree having 9 leaves? (2mks)

f) List any three fundamentals rules of recursion (3mks)

d) Write down the heap sort algorithm/ to sort the following data using heap sort method, show the procedure step by step

2, 6, 7, 5, 10, 9, 2, 4 (4mks)

g) Draw a graph to illustrate different big O notation. Explain each graph (4mks)

h) Construct a binary search tree using the following data (3mks)

50 70 25 90 30 55 25 15 25

i) Explain how one will delete node 30 in h) above (3mks)

QUESTION TWO (20 MARKS)

a) Write a code to to show how a bubble sort work (4mks)

b) Calculate the time complexity of the code above (2mks)

c) The following array was passed into the code written in above,

```
int a []= {56,89,23,2,67,80, 89};
```

What will be the out put? Show all steps for maximum marks (4mks)

d) If the int a in c) above was passed into a selection sort algorithm, show the steps that will be used to sort. Which one will run faster? Explain. (4mks)

e) Explain how a selection sort works on an array using a diagram (2mks)

f) Write an algorithm to find the max element from array by using recursion (4mks)

QUESTION THREE (20 MARKS)

a) Name two non linear data structures (2mks)

b) Write a recursive function to add the first ten integers from 1 to 10 (6mks)

c) Represent the following expression as binary tree and write prefix and postfix form of the expression (A+B+C*D)-(A/B-CD+E) (4mks)

d) Using a stack, calculate the value of the following postfix expression
   23*45/- (2mks)

e) Consider the following equation B- 4/5+6/7 /88-94*2+8

i. Draw a tree for the equation (2mks)
ii. What is the prefix of the equation? (2mks)
iii. What is the postfix of the equation (2mks)

QUESTION FOUR (20 MARKS)

a) Define the term height of a tree using an example (2mks)
b) Convert the following infix expression into postfix expression using stack and show each step used. ((A+B)/(C+D)S(E/F))+(G+H)/K (6mks)
c) Write a function to add a node at the start of an empty linked list (3mks)
d) Write a function to delete a node from circular queue (3mks)
e) Make a BTS for the following sequence of numbers
45,32,90,34,68,72,15,24,30,66,11,50,10 (6mks)

QUESTION FIVE (20 MARKS)

a) State two reason why implementation of stack using array is advised (2mks)
b) Define a queue as applied to Data Structures (2mks)
c) A queue operates on the principle of First in First out.
i. Write a code to add an item to the queue using java (2mks)
ii. Write a code to remove an item from the queue (2mks)
iii. Write a code to look up an item from the queue (2mks)
iv. Calculate the time complexity of i,ii,ii above (3mks)
d) Name two recursive algorithms used in sorting (2mks)
e) Consider the following data elements.

12, 28, 45, 17, 25, 3, 7, 9, 12

Using Heap Sort and an array, sort the elements in:

i) Ascending order (2mks)
ii) Descending order (3mks)