KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
SECOND YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(COMPUTER SCIENCE)

Date: 1at August, 2022
Time: 8.30am –10.30am

KCS 204 - DATA STRUCTURES AND ALGORITHMS

INSTRUCTIONS TO CANDIDATES

ANSWER **QUESTION ONE (COMPULSORY)** AND **ANY OTHER TWO** QUESTIONS

QUESTION ONE (30 MARKS)

a)   The pop () operation in the stack ADT returns a stack, while the pop () operation in the stack
         interface returns a value of type T. Why are these so different?

(4 marks)

b)   Distinguish the following:

   i)   primitive and standard data types

   ii)   binary search and linear search

   iii)   Tree and Graph   (6 marks)

c)   Explain any three components that can be used in the greedy algorithm:

(6 marks)

d)   There are two types of deque, using illustrations discuss them.

(6 marks)

e)   Suppose the following list of numbers is inserted in order into an empty binary search tree:
         45,32,90,34,68,72,15,24,30,66,11,50,10

   i)   Construct the binary search tree

(4 marks)

   ii)   Find the in-order, pre-order and post-order traversal of BST created.

(4 marks)

QUESTION TWO (20 MARKS)

a)   Traverse the given tree using the various ways mentioned below indicating your answers for each.
         Draw the tree indicating your traverse and the final output.
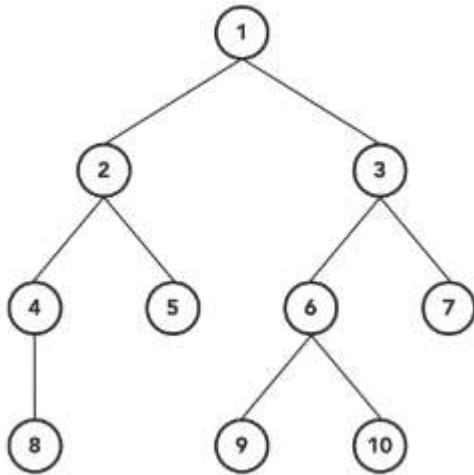
        i)   Inorder :
        ii) Preorder:
        iii) Postorder:
        iv) Level Order: (8 marks)
b)   With an illustration, briefly describe a flowchart and its importance in algorithm presentation
                                                                                 (6 marks)
c)   With an aid of a diagram Divide-and-Conquer method.
                                                                                 (6 marks)

QUESTION THREE (20 MARKS)

a)   There are two types of priority queue, discuss them showing an example of how they are presented:
                                                                                 (8 marks)
b)   Write a C/C++ program to calculate the average of a set of numbers.
                                                                                 (6 marks)
c)   Define the following efficiency measures of an algorithm

        i)   Best Case

        ii)   Average Case

        iii)   Worst Case

                                                                                 (6 marks)

QUESTION FOUR (20 MARKS)

a)   Write a **recursive function** that takes a positive number n as its parameter and returns the nth
        Fibonacci number
                                                                                 (5 marks)
b)   Define (with diagram/example) 'Sibling' and 'Height of Tree'.
                                                                                 (8 marks)
c)   Showing your working, Convert the following expressions to prefix and postfix.
                (((A + B) * C) – D) / F   (7 marks)

QUESTION FIVE (20 MARKS)

a) Convert the following expressions to prefix and postfix, show your workings

$$((P + ((Q \wedge R) - S)) * (U - (P / R)))$$

(8 marks)

b) Suppose an initially empty stack S has performed a total of 25 push operations, 12 top operations, and 10 pop operations, 3 of which returned null to indicate an empty stack. What is the current size of S?

(4 marks)

c) Suppose an initially empty queue Q has performed a total of 32 enqueue operations, 10 first operations, and 15 dequeue operations, 5 of which returned null to indicate an empty queue. What is the current size of Q?

(4 marks)

d) Briefly outline the workings of the bubble sort algorithm. Illustrate your answer.

(4 marks)