KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2023/2024 ACADEMIC YEAR
SECOND YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE
## KCS 204 – DATA STRUCTURES AND ALGORITHMS

Date: 14TH December 2023
Time: 8:30AM – 10:30AM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS
QUESTION ONE (30 MARKS)

a)   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. Showing your workings, What is the current size of Q?   (4 Marks)

b)   There are two types of priority queue, discuss them showing an example of how they are presented:
                                                                                        (6 Marks)

c)   Using various ways as indicated below while indicating your answers for each, Traverse the given tree. Draw the tree indicating your traverse and the final output for each.   (6 Marks)
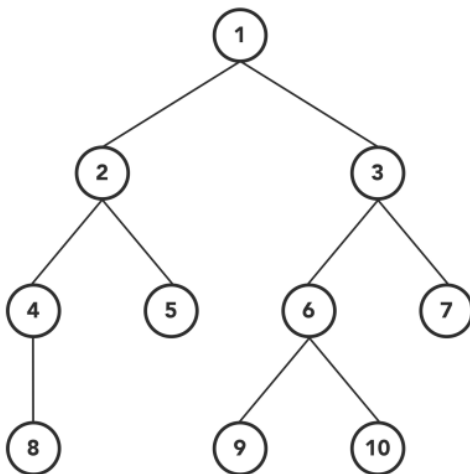
   i)   Inorder :
   ii)   Preorder:
   iii) Postorder:

d)   Differentiate between 'Sibling' and 'Height of Tree' with the aid of illustrations.   (6 Marks)

e)   Showing your working, Convert the following expressions to postfix.   (4 Marks)
   (((A + B) * C) – D) / F

f)   Define the following terms
   i)   Data Structures   (2 Marks)
   ii)   Algorithms   (2 Marks)

QUESTION TWO (20 MARKS)

a) Briefly outline the workings of the bubble sort algorithm. Illustrate your answer. (4 Marks)

b) There are two types of deque, using illustrations discuss them. (8 Marks)

c) Convert the following expressions to prefix and postfix, show your workings (8 Marks)

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

QUESTION THREE (20 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) Using suitable examples explain four types of linked lists (8 Marks)

c) Distinguish between primitive and standard data types as used in data structures. (4 Marks)

d) Explain any two properties of an array as illustrated in data structures (4 Marks)

QUESTION FOUR (20 MARKS)

a) Distinguish between the Analysis of algorithm and complexity of algorithm giving examples (6 Marks)

b) Study the pseudo code below:

Start
Declare variables profit, cost, loss, sellprice
Get value of cost and sellprice
IF cost>sell_price
Loss=cost-sellprice
ELSE IF sell_price>cost
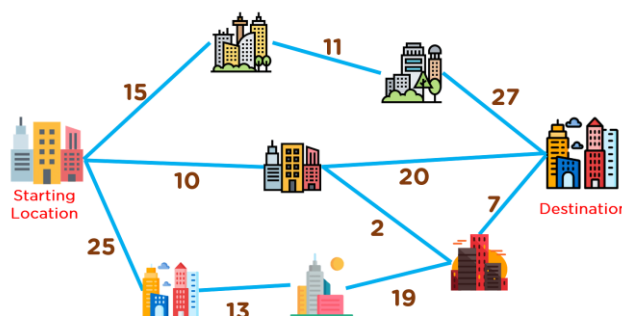Profit=sellprice-cost
ELSE
Display "no profit nor loss"
END IF
Stop

Required: Use test values sellprice=4000 and cost=5000 to perform a dry run for this pseudocode. (8 Marks)

c) Find the best route to reach the destination city from the given starting point using a greedy method. Show your workings. (6 Marks)

QUESTION FIVE (20 MARKS)

a) Demonstrate four operations of a stack as used in Data Structures. (8 Marks)

b) The following is a list created by a student during a Data Structures and Algorithm class. Use it to answer the question that follows.

List = {32, 43, 29, 46, 67, 59, 71, 14}

Write the output when each of the following operations are carried out on the list.

    i.   Head(Tail)(Tail)(List)

    ii.   Empty(List) (6 Marks)

c) Explain three types of time complexity. (6 Marks)