



KISII UNIVERSITY
UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF THE

**DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE / SOFTWARE
ENGINEERING / MATHEMATICS AND COMPUTING / BIOMETRY AND
INFORMATICS / BACHELOR OF BUSINESS INFORMATION AND
MANAGEMENT**

FIRST SEMESTER, 2023/2024

(AUGUST-DECEMBER, 2023)

COMP 301 / SOEN 301 / BINM 354: DATA STRUCTURES AND ALGORITHMS

STREAM: Y3 S1

TIME: 2 HOURS

DAY: MONDAY, 03.00- 05.00 PM

DATE: 21/11/2023

INSTRUCTIONS

- 1. Do not write anything on this question paper.***
- 2. Answer Question ONE [Compulsory] and any other TWO Questions***

QUESTION ONE [30 MARKS]

- Explain any two (2) operations that can be performed on a tree (2 marks)
- Explain the following terminologies :
 - Data item (2marks)
 - Data structure (2marks)
- Give any two considerations that determine the choice of a particular data model. (4 marks)
- By the use of an appropriate diagram, explain the procedure that can be used to add an element at a given position in a doubly linked list (4 marks)
- Given an array A of integer elements which is not sorted, write a program that may be used to display the largest element. Make use of at least one user defined function. (4 marks)

- f) By using the following integers 112, 121, 345, 231, 673, 925, 645, 384 and 239 simulate how radix sort operates (6 marks)
- g) Write a pseudocode for binary search (6 marks)

QUESTION TWO [20 MARKS]

- a) Explain the meaning of **Asymptotic** in relation to complexity of algorithms (4 marks)
- b) Define the Big -oh (O) notation (4 marks)
- c) Explain any two (2) basic ways of representing linear structures in a computer (4 marks)
- d) Given the following five (5) integer elements of an array A: 45,34,57,24 and 14 demonstrate how the section sort technique operates (8 marks)

QUESTION THREE [20 MARKS]

- a) Represent the following algebraic expression E involving only binary operations using a binary tree T

$$E = (a-b) / ((c * d) + e)$$
 (4 marks)
- b) Describe PREORDER, POSTODER and INORDER methods of traversing a binary tree T with root R (6 marks)
- c) Write a program to demonstrate the PUSH and POP operations of a stack (10 marks)

QUESTION FOUR [20 MARKS]

- a) With the use of appropriate diagram explain any practical use of the header node in a circular doubly linked list (5 marks)
- b) Explain any five (5) basic operations that can be performed on a linked list (5 marks)
- c) Convert the following INFIX expression $Q : A + (B * C \uparrow (D / E \quad F) * G) * H$ to its equivalent POSTFIX expression P using Polish Algorithm (10 marks)

QUESTION FIVE [20 MARKS]

- a) Write a pseudocode to insert a node at the beginning of a circular linked list (4 marks)
- b) Give any four practical applications of Graphs in real life (4 marks)
- c) With the use of appropriate examples, explain infix, postfix and prefix expressions (6 marks)
- d) Write a recursive program to display the GCD of two numbers (6 marks)

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