KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER/SOFTWARE ENGINEERING
FIRST SEMESTER 2022/2023
[SEPTEMBER-DECEMBER, 2022]

COMP/SOEN 301: DATA STRUCTURES AND ALGORITHMS

STREAM: Y3S1 **TIME: 2 HOURS**

DAY: TUESDAY, 12:00 – 2:00 PM **DATE: 06/12/2022**

INSTRUCTIONS

1. ***Do not write anything on this question paper.***
2. ***Answer question ONE and any other TWO questions.***

QUESTION ONE

a) Highlight five features of algorithms and briefly discuss how they are of importance to the different abstract data structure. (10Marks)
b) What is an Abstract Data Type (ADT) (3marks)
c) With the aid of example demonstrate how the following array A = {3, 2, 10, 7} can be sorted using selection and insertion sort. Write C++ implementation codes. (8marks)
d) Briefly discuss how you can analyze the algorithms in (c) above for computer memory usage and on the run time execution efficiency. (4marks)

e) Briefly discuss the real-life applications of the following data structure (5marks)

i. Stack
ii. Queue
iii. Trees
iv. Graphs
v. Lists

QUESTION TWO

a) With the aid of an illustration discuss the concept linked list. (4marks)

b) With the aid of an example and illustration show the steps of deleting a node from the singly linked list. (6marks)

c) Discuss the following stack operations. (4 marks)
   Pop
   Push
d) Write a C++ code to insert an item into a stack. (6marks)

QUESTION THREE

a) What is a recursive algorithm? (2marks)
b) State and Explain TWO properties of recursive algorithms. (4marks)
c) Write a recursive function to determine the Fibonacci series. Given the Fibonacci formula is given as, $\mathbf{F_n = F_{n-1} + F_{n-2}, \text{ where } n > 1.}$ (4marks)
d) Discuss how the breadth first search (BFS) algorithm works. (6marks)
e) List any two practical applications of the BFS algorithm. (4marks)

QUESTION FOUR

a) What is a Binary Tree (2marks)
b) Discuss three methods that can apply in traversing a binary tree (6marks)
c) What is a Binary search tree? (2marks)
d) With the aid of an example discuss how you can insert and item into a binary search tree (8marks)
e) Explain the concept heap sort (2marks)

QUESTION FIVE

a) Explain the difference between a Stack and a Queue data structure (4 marks)
b) Name which data structure is most suitable to model an algorithm for a software programmer who wishing to write a program for printing documents from different computers that use a shared printer. Explain your answer and the operations that the printer program must apply. (8marks)
c) Discuss the following problem-solving strategies (4marks)
   Divide and Concur
   Greedy Algorithm
d) Explain any two graph traversing algorithms (4marks)