# MACHAKOS UNIVERSITY

**University Examinations for 2022/2023**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY**

**SECOND YEAR SPECIAL / SUPPLEMENTARY EXAMINATIONS FOR**

**BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)**

**SCO 204/SIT 261/SIT206: DATA STRUCTURES AND ALGORITHMS**

**DATE: 27/7/2023** **TIME:11.00-1.00 PM**

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**INSTRUCTIONS:**

**Answer question ONE and any other TWO questions**

**QUESTION ONE [30 MARKS]**

a) Use bubble sort to sort the list of numbers below (5 marks)

{14, 33, 27, 35, 10}

b) i) Discuss the various scenarios in which linear search is used (5 marks)

ii) Write an algorithm (using linear search) to search for an employee ID in an array. (4 marks)

c) Explain the relationship between 'divide' and 'conquer' in algorithms. (4 marks)

d) Explain how timesharing system in a computer occurs and name any one data structure that is used to implement it. (3 marks)

e) The given array is arr = {3,4,5,2,1}. How many iterations are required to sort the array using bubble sort? (4 marks)

f) Using examples explain what a dynamic data structure is. (5 marks)

**QUESTION TWO [20 MARKS]**

a) Form a complete binary tree using the following letters as its nodes;

[a, d, c, d, e , f , g, h, i, j, k, l]. (4 marks)

b) Determine the depth D of the binary complete tree T that you have formed above in (a). (4 marks)

c) Determine its branches from the above information. (4 marks)

d) Name any divide and conquer sorting algorithm used in data structures. (3 marks)

e) 8, 15, 13 and 14 nodes in 4 different trees. Which ONE can form a full binary tree? (5 marks)

**QUESTION THREE [20 MARKS]**

a) i) Given the following array of elements, show how they are represented using a linked list

***[ Number 1, Number 2, Number 3 .....Number n]*** (5 marks)

ii) Outline the benefits of a linked list over an array. (5 marks)

f) What is a stack? Use a diagram to illustrate your answer. (5 marks)

g) Apply the bubble sort algorithm in the following list of numbers and sort them in ascending order.

{32, 51, 27, 85, 66, 23, 13, 57} (5 marks)

**QUESTION FOUR [20 MARKS]**

a) When do we use time-space tradeoff used in management information systems? (5 marks)

b) Explain the difference between a Stack and a Queue**.** (5 marks)

c) Suppose S is the following list of 14 alphabetic characters:

D A T A S T R U C T U R E S

Suppose the characters in S are to be sorted alphabetically. Use the quick sort algorithm to find the final position of the first character in D. (6 marks)

d) Explain the meaning of an elementary item as used in data structures. (4 marks)

**QUESTION FIVE [20 MARKS]**

a) Use a drawing to illustrate a full binary tree. (4 marks)

b) Build a heap H from the following list of numbers;

{44, 30, 50, 22, 60, 55, 77, 55} (5 marks)

c) Briefly describe the three algorithms of traversing a binary tree. (5 marks)

d) The given array is arr = {20, 10, 1, 28, 37, 55}. Use bubble sort to arrange the digits in ascending order. (6 marks)