

MACHAKOS UNIVERSITY
UNIVERSITY EXAMINATIONS
YEAR FOUR EXAMINATIONS FOR THE AWARD OF THE DEGREE OF BACHELOR OF
BUSINESS INFORMATION TECHNOLOGY

SCO 204: DATA STRUCTURES AND ALGORITHMS

STREAM: YEAR TWO SEMESTER ONE

TIME: 2 HOURS

DAY/DATE:

INSTRUCTIONS

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

Marks are awarded for clear and concise answers

PART A: ANSWER ALL QUESTIONS

QUESTION ONE (30 MARKS)

- (a) Explain the following terms in analysis of algorithms
 - (i) Input size
 - (ii) Running time (4 Marks)
- (b) Describe **FOUR** main qualities that a data structure should have in order to be considered as efficient. (4 Marks)
- (c) Write an algorithm to implement quick sort. (8 marks)
- (d) Differentiate between a linked list and an array. (4 Marks)
- (e) Discuss the following as used in data structures. (6 Marks)
 - (i) primitive versus non-primitive
 - (ii) linear versus non-linear
 - (iii) Contiguous versus non- contiguous
- (f) Explain how a divide-and-conquer algorithm works. (4 Marks)

PART B: ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

- (a) Given the following data set 14, 33, 27, 10, 35, 19, 42, 44,

Sort the list using insertion sort (Clearly explain each step)

(10 Marks)

(b) Give the algorithm for the process 2(a) above.

(10 Marks)

QUESTION THREE (20 MARKS)

(a) Using clearly labeled diagrams, illustrate the result of each operation in the sequence PUSH (S, 4), PUSH (S, 1), PUSH (S, 3), POP.S, PUSH (S, 8), and POP (S) on an initially empty stack S stored in array S [1... 6].

(10 Marks)

(a) Given the following list data set, 54, 26, 93, 17, 77, 31, 44, 55, 20, use quick sort to arrange in ascending order.

(10 Marks)

QUESTION FOUR (20 MARKS)

a) Consider a hash table of size 7 with hash function $h(k) = k \bmod 7$. For each of the collision handling methods below, show the table that results after inserting, in the given order, the values: 19, 26, 13, 48, 17

(7 marks)

i. separate chaining

ii. linear probing

iii. double hashing using a second hash function $h'(k) = 5(k \bmod 5)$

(b) Briefly describe ENQUEUE () and DEQUEUE operations on Queue. (4 Marks)

(c) While giving examples, differentiate between breadth first traversal and depth first traversal. (4 Marks)

(d) Write an algorithm for inserting an element x in the linked list. (5 Marks)

QUESTION FIVE (20 MARKS)

(a) What is the importance of algorithm analysis? (4 Marks)

(b) Using a Hash table explain how hashing makes it easy to search an item from a long list.

(6 Marks)

(i) Write down adjacency matrix for the graph below. (5 Marks)

(ii) Give the adjacency list for the graph above. (5 Marks)

