



MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 204: DATA STRUCTURES & ALGORITHMS

DATE: 25/9/2019

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer question one and any other two questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Give one advantage and two disadvantages of using arrays to implement Abstract data Types (ADTs) (3 marks)
- b) Name two parameters that can be used to measure the system efficiency of data structures and algorithms (1 mark)
- c) Using Big Oh notation, give the worst-case running time of each of the following algorithms: Insertion sort, Heap sort, Depth-first search (3 marks)
- d) Define a heap, and give two applications of heaps (3 marks)
- e) Discuss the following as used in data structures. (6 marks)
 - i. Primitive vs. Non Primitive Data structures.
 - ii. Linear vs. Non-Linear data structures.
 - iii. Contiguous vs. Non contiguous.
- f) Name three advantages of linked list implementation of ADTs? (3 marks)
- g) Describe three applications of queue ADT (6 marks)
- h) Differentiate separate chaining from open addressing (2 marks)
- i) Outline THREE most used types of graph representations (3 marks)

QUESTION TWO (20 MARKS)

- a) Illustrate how stacks can be used for post-fix evaluation of the expression below (3 marks)
$$(6+2*3) / ((5-2)*4)$$
- b) Write pseudo-code that can be used to implement selection sort (10 marks)

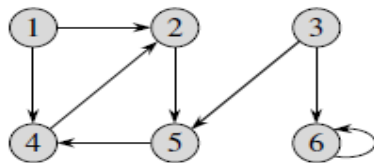
- c) Consider a hash table of size 7 with hash function $h(k) = k \bmod 7$. For each of the collision handling methods below, show the table that results after inserting, in the given order, the values: 19, 26, 13, 48, 17 (7 marks)
- separate chaining
 - linear probing
 - double hashing using a second hash function $h'(k) = 5 - (k \bmod 5)$

QUESTION THREE (20 marks)

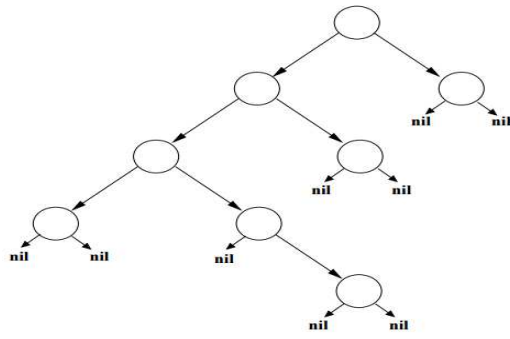
- a) With the help of well-labeled diagrams, demonstrate the following operations on a stack. (6 marks)
- POP ()
- Push ()
- b) Briefly describe ENQUEUE () and DEQUEUE operations on Queue. (4 marks)
- c) Discuss the relevance of computer storage and data management in the study of data structure and algorithms. (5 marks)
- d) Briefly describe (5 marks)
- Complete binary tree and outline Two of its properties.
 - Heap tree.

QUESTION FOUR (20 MARKS)

- a) Given the directed graph G below, use diagrams to show:
- Adjacency-list representation of G (4 marks)
 - Adjacency-matrix representation of G (4 marks)



- b) Assign the keys 2, 3, 5, 7, 11, 13, 17, 19 to the nodes of the binary search tree below so that they satisfy the binary-search-tree property (4 marks)



c) Write a C program that can be used to implement merge sort (10 marks)

QUESTION FIVE (20 MARKS)

a) Give one advantage and one disadvantage of the following data structures

(10 marks)

- i) Queues
 - ii) Linked list
 - iii) Binary tree
 - iv) Hash table
 - v) Stack
- b) Using a hash table, explain how hashing makes it easy to search an item from a long list. (6 marks)
- c) While giving examples, differentiate between breadth first traversal and depth first traversal. (4 marks)