



MACHAKOS UNIVERSITY

University Examinations for 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

**SECOND YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR OF
SCIENCE (COMPUTER SCIENCE)**

SCO 204: DATA STRUCTURES AND ALGORITHMS

DATE: 13/12/2017

TIME: 11.00-1.00 PM

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

QUESTION ONE (30 MARKS)

- a) List TWO basic ways of representing linear structures in memory. (2 marks)
- b) Differentiate between a class and an object. Use a class diagram to illustrate your answer. (4 marks)
- c) Explain the principle of encapsulation in object oriented design. (2 marks)
- d) Give TWO applications of each of the following data structures (4 marks)
 - i. Stack
 - ii. Queue
- e) Write an algorithm to implement Quick Sort. (5 marks)
- f) Give four operations performed on a linked list. (4 marks)
- g) 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.

- h) Outline THREE most used types of graph representations (3 marks)

QUESTION TWO (20 MARKS)

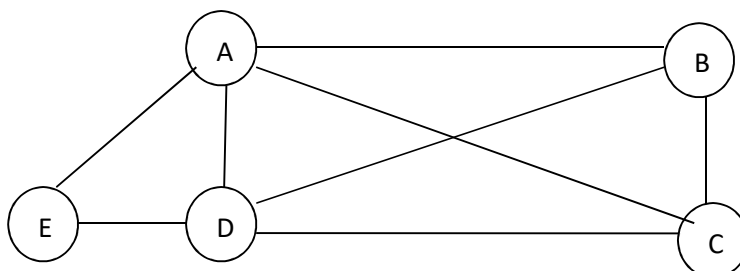
- a) With the help of well-labeled diagrams, demonstrate the following operations on a stack.
POP ()
Push () (6 marks)
- b) Briefly describe ENQUEUE () and DEQUEUE operations on Queue. (4 marks)
- c) Discuss the relevance of computer storage and data management in the study of data structure and algorithms.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

QUESTION THREE (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)

QUESTION FOUR (20 MARKS)

- a) Write down adjacency matrix for the graph below. (5 marks)



- b) Write a program for breadth first traversal in a binary tree. (5 marks)
- c) Differentiate between: (4 marks)
- i. Sequential and binary search.
 - ii. Quick Sort and Heap Sort.
- d) Give a recursive function that accepts the base, p and power, q, entered from the keyboard as its input and computes and displays p raised $q(p^q)$. (6 marks)

QUESTION FIVE (20 MARKS)

- a) Using big oh notations, Give the time performance for the following. (3 marks)
- i Selection sort
 - ii Bubble sort
 - iii Quick Sort
- b) 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: 8, 12, 9,6,25 and 22 (7 marks)
- i. Separate chaining
 - ii. Linear probing
 - iii. Double hashing using a second hash function $g'(k)=5-(k \bmod 5)+1$
- c) Write a C program that can be used to implement merge sort (10 marks)