



(Knowledge for Development)

KIBABII UNIVERSITY COLLEGE

**A CONSTITUENT COLLEGE OF
MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS
2014/2015 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER
MAIN EXAMINATION
FOR THE DEGREE OF BSC COMPUTER SCIENCE**

COURSE CODE: CSC 224

COURSE TITLE: DATA STRUCTURES

DATE: 29TH APRIL, 2015

TIME: 800AM-10.00AM

INSTRUCTIONS TO CANDIDATES

Answer Question One in Section A and Any other (2) Questions in Section B

TIME: 2 Hours

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no question is missing.

QUESTION 1 (COMPULSORY)

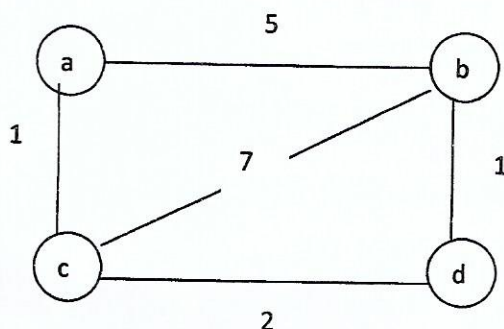
[30 MARKS]

- a) In an array implementation of a binary tree, the root of the tree is in position 0. For each node n, give the position of n's left child and n's right child. **[2 marks]**
- *b) Here is an array with exactly 15 elements:
- | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
- i. Suppose that we are doing a sequential search for an element. Write any elements that will be found by examining/comparing two or fewer numbers from the array. **[2 marks]**
- ii. Suppose that we are doing a binary search for an element. Write any elements that will be found by examining two or fewer numbers from the array. **[3 marks]**
- c) What is the load factor and how does it affect table size? **[2 marks]**
- d) What is a collision in a hash table? **[1 mark]**
The situation where two elements or keys map to the same location in the table is called a collision.
- *e) Why is sorting important? **[1 marks]**
- f) If the characters 'D', 'C', 'B', 'A' are placed in a queue (in that order), and then removed one at a time, in what order will they be removed? **[1 mark]**
- *g) What are the steps to inserting a new item at the head of a linked list? Use one short English sentence for each step. **[2 marks]**
- h) Given an array containing the digits **5 3 9 5**, show how the order of the digits changes during each step of [i] insertion sort, [ii] selection sort, [iii] mergesort, and [iv] bubble sort. Show the array after each swap, except in insertion sort. For insertion sort, show the array after each insertion. **[6 marks]**
- i) Draw the directed graph that corresponds to this adjacency matrix: **[3 marks]**
- | | | | | | | |
|---|---|-------|-------|-------|-------|--|
| | 0 | 1 | 2 | 3 | | |
| 0 | | true | false | true | false | |
| 1 | | true | false | false | false | |
| 2 | | false | false | false | true | |
| 3 | | true | false | true | false | |
- *j) What is the importance of the stopping case in recursive methods? **[1 marks]**
- k) Outline any two implementation strategies for binary trees **[2 marks]**
- l) Briefly describe the following data structures. **[4 marks]**
- Stack
 - Queue
 - Linked list
 - * iv. Hash table

QUESTION 2

(20 marks)

- a) Draw the directed graph that is represented by the following: [4 marks]
Vertices: 1, 2, 3, 4, 5, 6, 7
Edges: (1, 2), (1, 4), (2, 3), (2, 4), (3, 7), (4, 7), (4, 6), (5, 6), (5, 7), (6, 7)
- b) Outline two principal methods for representing graphs for computer algorithms [4 marks]
- c) If a graph is sparse which representation will you use and why? [2 marks]
- d) Consider the weighted graph given below:



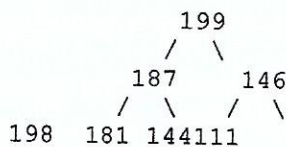
Represent the weighted graph using the two representation methods described in part (b) above. [4 marks]

- e) Define the following terms [2 marks]
 - i. Spanning tree
 - ii. Minimum spanning tree
- f) Let A be the adjacency matrix of an undirected graph. Explain what property of the matrix: [4 marks]
 - i. indicates that the graph is complete.
 - ii. the graph has a loop, i.e., an edge connecting a vertex to itself.
 - iii. the graph has an isolated vertex, i.e., a vertex with no edges incident to it.

QUESTION 3

(20 marks)

- a) State with reasons whether the following binary tree is a heap structure or not: [2marks]



- b) Draw an expression tree for the expression $(90 + 40) * 50 + (40 - (60 - 30))$. [4 marks]
- c) Give the output of the three traversal orders of the generated expression tree. [6 marks]
- d) Draw the binary search tree that results from adding the following integers (134, 145, 13, 187, 165, 132, 11, 112, 117). [4 marks]