



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

SECOND YEAR FIRST SEMSTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

BACHELOR OF SCIENCE (APPLIED PHYSICS)

SIT 261/ SIT 206: DATA STRUCTURES AND ALGORITHMS

DATE: 12/8/2021

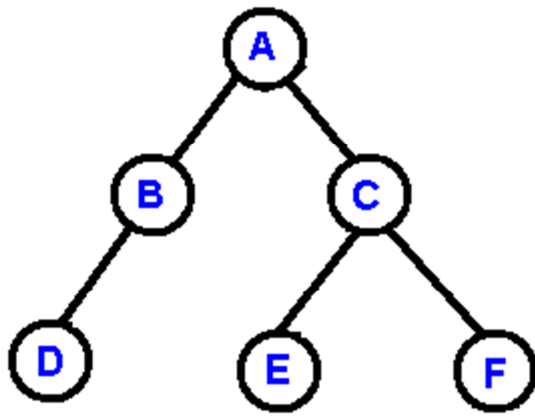
TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer Question **ONE** and any other **TWO** Questions.

QUESTION ONE (COMPULSORY) (30 MARKS)

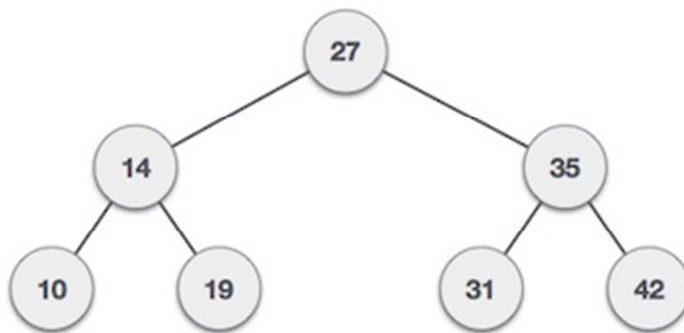
- a) Explain the meaning of the following as used in data structures
- i) Data-structures. (4 marks)
 - ii) The term 'sinking'. (3 marks)
 - iii) Time-space complexity (3 marks)
- b) Describe THREE characteristics of a an algorithm (3 marks)
- c) Use bubble sort to sort the list of numbers below (4 marks)
- 14, 33, 27, 35, 10**
- d) Convert the following binary tree into an extended 2-tree. (2 marks)



- e) The list below consists of elements arranged in ascending order. Design a linear search algorithm to locate element 33. (5 marks)
 {10, 14, 19, 26, 27, 31, 33, 35, 42, 44}
- f) i) Explain the relationship between 'divide' and 'conquer' in algorithms. (4 marks)
 ii) Explain how timesharing system in a computer occurs and name any one data structure that is used to implement it. (2 marks)

QUESTION TWO (20 MARKS)

- a) Use a drawing to illustrate a full binary tree. (2 marks)
- b) Explain the meaning of time-space tradeoff and describe its usefulness in management information systems? (5 marks)
- c) Build a heap H from the following list of numbers; (4 marks)
 {44, 30, 50, 22, 60, 55, 77, 55}
- d) You are required to: (4 marks)
- i) Briefly describe the three algorithms of traversing a binary tree. (4 marks)
- ii) Traverse the binary tree below in Post Order showing all the steps and give the results afterwards. (5 marks)

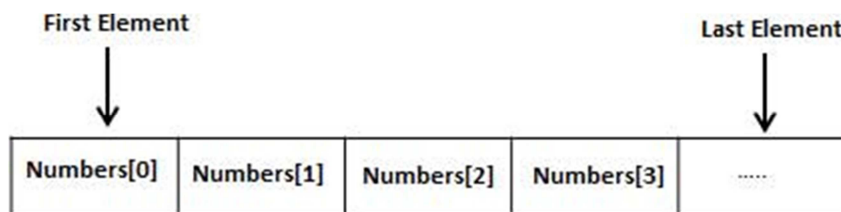


QUESTION THREE (20 MARKS)

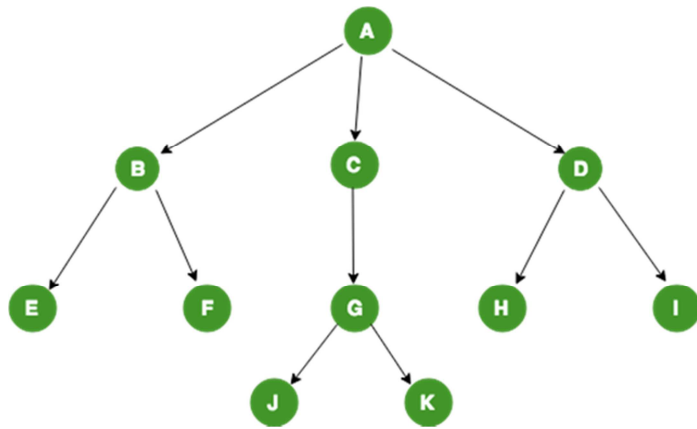
- a) Explain the difference between a Stack and a Queue. (4 marks)
- b) Discuss greedy algorithm and outline one example. (4 marks)
- c) Discuss dynamic programming approach in relation to 'divide and conquer' algorithm. (4 marks)
- d) Explain the meaning of the following:
 - (i) Elementary item (2 marks)
 - (ii) Entity Set (2 marks)
 - (iii) Attribute (2 marks)
 - (iv) Record (2 marks)

QUESTION FOUR (20 MARKS)

- a) i) Given the following array of elements, show how they are represented using a linked list. (3 marks)



- ii) Name two types of linked list. (2 marks)
- iii) Explain why we need to do analysis in algorithms. (3 marks)
- b) From the tree drawn below, you are required to identify the following;
- i. Edge (1 mark)
- ii. Branch (1 mark)
- iii. Path (1 mark)
- iv. Leaf (1 mark)



- c) 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)
- d) An array is one of the most used data structures, explain one major disadvantage that is associated with arrays. (3 marks)

QUESTION FIVE (20 MARKS)

- a) Given the following letters that represent nodes, [a, d, c, d, e, f, g, h, i, j, k, l].
- Use the above given nodes to form a complete binary tree T. (3 marks)
 - What is a binary search tree? (3 marks)
 - Give one application where tree data structure can be implemented in computer systems. (2 marks)
- b) Use merge sort algorithm to sort the following unsorted array $A = [2, 8, 1, 3, 6, 7, 5, 4]$ as used with divide and conquer paradigm. (5 marks)
- c) Describe stack data structure and give one application. (3 marks)
- d) Given 4 different nodes as follows; 8, 15, 13 and 14. Indicate the ones that can form a full binary trees? (4 marks)