

KENYA METHODIST UNIVERSITY  
END OF TRIMESTER EXAMINATION, APRIL 2009

FACULTY : ARTS AND SCIENCES  
DEPARTMENT : COMPUTER INFORMATION SYSTEMS  
COURSE CODE : CISY 212  
COURSE TITLE : DATA STRUCTURES AND ALGORITHMS  
TIME : 2 HOURS

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INSTRUCTIONS: Answer Question One and ANY OTHER TWO questions

**Question One (30 marks):**

- a) Define the following terms;
- i. Data abstraction
  - ii. Abstract data type (ADT)
  - iii. Binary tree
  - iv. Algorithm [4 marks]
- b) Distinguish between a linear list and a linked list give and state the advantage of linked list over linear list [4marks]
- c) Explain how circular implementation of queue using an array eliminates rightward drift. Write an algorithm on how to detect whether the circular queue is full or empty [8 marks]
- d) Outline any five atomic data types that are used in programming [5 marks]
- e) A queue is referred to as FIFO explain [3 marks]
- f) Define data encapsulation and give any two advantages [3 marks]
- g) Define time complexity. Why is it important in analysis of algorithms [3 marks]

**Question Two (20 marks):**

- a) Define a linear list ADT [2 marks]
- b) Write a C program that achieves the following in an array list ADT implementation [5 marks]
- i) Add a new item X at position  $i$
  - ii) Deletes item at position  $i$

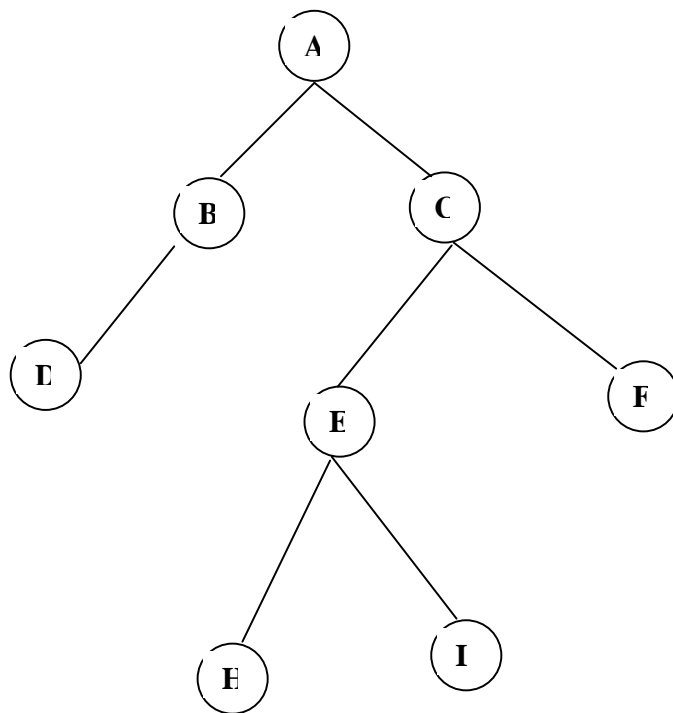
- c) i) discuss the heap operations [4 marks]  
 ii) Represent the array below in a binary tree. Perform a heap sort on it [5 marks]

[0]	70
[1]	60
[2]	12
[3]	40
[4]	30
[5]	8
[6]	10

- d) Write an algorithm to perform of binary search [4 marks]

**Question Three (20 marks):**

- a) i) Define a stack ADT [2 marks]  
 ii) Define the sequential search [2 marks]
- b) Show how the following items; 40 50 30 can be implemented in stack ADT as an array [1 marks]
- c) Write a C program to PUSH two elements 70 and 80 then POP one element from the stack above [5 marks]
- d) Give all order of traversal for following binary tree [5 marks]



- e) Write a program that captures 5 elements from an array and displays them, and also returns the smallest element in the array [5 marks]

**Question Four (20 marks):**

- a) Given the equation  $(A+B)*C$  convert it post-fix and pre-fix notation [4 marks]
- b) Discuss any three linked list implementations [6 marks]
- c) Define a binary search tree and outline four of its properties [6 marks]
- d) The cost of sequential search is  $O(n)$  and that of the binary search is  $O(\log_2 n)$   
Which faster between the two. Justify your answer [4 marks]