

AMIETE – CS/IT (OLD SCHEME)

Time: 3 Hours

JUNE 2012

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. _____ defines an upper bound function $g(n)$ for $f(n)$ which represents time and space complexities of an algorithm with input n characteristics.
- (A) Small o (B) Omega Ω
(C) Big O (D) Theta Φ
- b. In linked list, the link field of last node is set to
- (A) ONE (B) NULL
(C) Double (D) All of the above
- c. Balance factor is used in the _____
- (A) B-Trees (B) Searching
(C) AVL trees (D) Heap Trees
- d. Preorder traversal is given by
- (A) Root, left sub-tree and right sub-tree
(B) Left sub-tree, root and right sub-tree
(C) Left sub-tree, right sub-tree and root
(D) Right sub-tree, left sub-tree and root
- e. In hashing, _____ technique divides key into several parts and later transforms it to create target address.
- (A) Mid-Square (B) Division
(C) Extraction (D) Folding

- f. In minimum spanning tree, the following is a valid statement
- (A) Edges have no weights
 - (B) Edges contain infinite weights
 - (C) For a graph, more than one spanning tree exist
 - (D) Node contain self-loops
- g. Which of the following verbs can be represented by MTRANS in Schank's CD formalism?
- (A) push
 - (B) eat
 - (C) give
 - (D) speak
- h. Worst case complexity of heap sort is given as
- (A) $O(n \log n)$
 - (B) $O(n^2)$
 - (C) $O(n^2 \log n)$
 - (D) $O(\log n)$
- i. m -way search trees are used in
- (A) Sparse Matrin
 - (B) Spanning trees
 - (C) B-Trees
 - (D) None of the above
- j. Stack over can occur in the _____.
- (A) Hashing
 - (B) Recursion
 - (C) Binary sort
 - (D) Sparse matrix sort

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

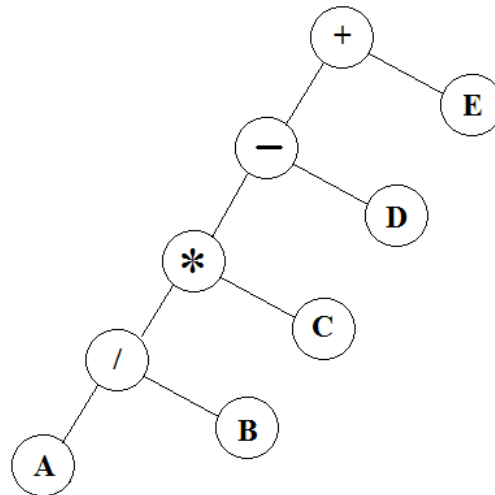
- Q.2** a. Define ordered list. Give any four properties. (5)
- b. Let J and K be integers. Suppose $Q(J, K)$ is recursively defined by
- $$Q(J, K) = \begin{cases} 5 & \text{if } J < K \\ Q((J - K), K + 2) + J & \text{if } J \geq K \end{cases}$$
- Find $Q(2, 7)$ and $Q(15, 2)$. Give sequence of steps. (5)
- c. Explain the concept of abstract data types. (3)
- d. Differentiate between space complexity and time complexity. (3)

- Q.3** a. Write a program to insert a node in single linked list at the following position:
 (i) Start (ii) End
 (iii) After a given node position P (9)

- b. Write a program to implement polynomial addition using linked list. (7)

- Q.4** a. If a complete binary tree with n nodes is represented sequentially, then for any node with index i , $1 \leq i \leq n$, prove the following: (6)
 (i) $LeftChild(i)$ is at $2i$ if $2i \leq n$.
 (ii) $RightChild(i)$ is at $2i+1$ if $2i+1 \leq n$

- b. Give inorder, preorder and postorder traversals for the following binary tree. (6)



- c. Give the representation of threaded binary tree. Give an example to insert an element in threaded binary tree. (4)

- Q.5** a. Explain the properties of binary search tree. (4)

- b. Explain how heaps are used to implement priority queues. (3)

- c. Write a program to insert an element into a heap. (5)

- d. Mention various operations used in AVL trees. Give its applications. (4)

- Q.6** a. Give time complexity of the following sorting techniques:
 (i) Bubble sort (ii) Merge sort
 (iii) Quick sort (iv) Heap sort (8)

- b. Explain the binary search technique by using an example. (4)

- c. Give the analysis of heap sort algorithm. (4)

- Q.7** a. Write an algorithm for minimum spanning tree. Give an example with sequence of steps for finding minimum spanning tree. (6)

- b. Give the analysis of Dijkstra's shortest path algorithm. Suggest a method to improve the performance of the algorithm. (4)
- c. Differentiate between the DFS and BFS traversal technique. (6)
- Q.8** a. How sparse matrix represented? Explain any one of representation method. (3)
- b. Explain B-Trees of order m . Give its properties. (5)
- c. Write a program to evaluate arithmetic expression. Explain with an example. (8)
- Q.9** a. Write a program to insert a node at the following positions in a binary search tree:
- (i) Root node
 - (ii) After a node position P
 - (iii) Leaf node (9)
- b. Define threaded binary tree. Explain inorder threading using suitable example. Discuss advantages of the threaded binary tree. (7)