



Name :

Roll No. :

Invigilator's Signature :

CS / B.TECH (EIE) / SEM-4 / CS-405 (EI) / 2011

2011

DATA STRUCTURE & ALGORITHMS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$
 - i) A full binary tree with n leaves contains
 - a) n nodes
 - b) $\log n$ nodes
 - c) $2n - 1$ nodes
 - d) 2^n nodes.
 - ii) traversal of binary search tree gives the sorted list in ascending order.
 - a) In-order
 - b) Post-order
 - c) Pre-order
 - d) All of these.
 - iii) Reverse polish notation is also called
 - a) Postfix
 - b) Prefix
 - c) Infix
 - d) Undefined.
 - iv) The evaluation of the postfix expression $23\ 5\ 7\ *\ -12\ +$ is
 - a) 12
 - b) 0
 - c) -12
 - d) 35.



- v) A linear list that allows elements to be added or removed at either end but not in the middle is called
- stack
 - queue
 - dequeue
 - priority queue.
- vi) Number of possible binary trees with 3 node is
- 3
 - 2
 - 4
 - 5.
- vii) In external sorting technique all data reside in
- primary memory
 - secondary memory
 - both (a) and (b)
 - none of these.
- viii) In a height balanced tree, heights of two sub-trees of every node differs by at most
- 2
 - 0
 - 1
 - 1.
- ix) Ratio of number of items in hash table, to the table size is called
- Load factor
 - Item factor
 - Balanced factor
 - All of these.
- x) What is the big oh notation of the following expression ?
- $$F(n) = n \log n^2 + n^2 + e^{\log n}$$
- $O(n)$
 - $O(n^2)$
 - $O(n \log n^2)$
 - $O(e^{\log n})$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- What do you mean by recursion ? Write a C code to implement Tower of Hanoi problem using recursion.
- Define and distinguish between binary tree and B-tree.
- What is stack ? Write and explain the operations associated to stack.
- Write algorithms to insert into and delete elements from a doubly linked list.



6. Define hashing. Explain with suitable example the collision resolution technique using linear probing with open addressing.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) In a nonempty Binary tree, the following list occurs after tree traversal :

In-order : DGBAHEICF

Post-order : GDBHIEFCA

Generate the complete binary tree indicating all intermediate steps. Hence find the preorder traversal.

- b) Write down the algorithm to convert an expression from infix to postfix.
c) Using the above algorithm, find out the postfix notation of the following infix expression.

$5\ 6\ 2\ +\ *\ 1\ 2\ 4\ /\ -$

$7\ +\ 5\ +\ 3$

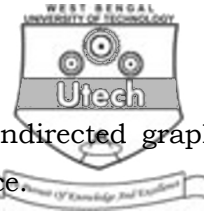
8. a) Write an algorithm to reverse a single linked list using as minimum memory as possible.

- b) Write a recursive algorithm for binary search.
c) Compute the time complexity of your algorithm.
d) Prove that for any no-empty binary tree T , if n_0 is the number of leaves and n_2 is the number of nodes of degree 2, then $n_0 = n_2 + 1$.

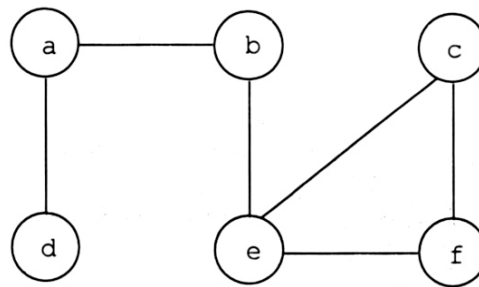
$4\ +\ 4\ +\ 3\ +\ 4$

9. a) What is a complete graph ? Show that sum of degree of all the vertices in a graph is always even.

- b) Write down BSF algorithm for searching a graph. Compare it with DFS.



- c) Explain the operation of BFS on an undirected graph given below, taking the vertex b as source.



$$4 + (4 + 3) + 4$$

10. a) Define circular queue.
 b) Write an algorithm to insert an item in circular queue.
 c) Compare and contrast between Dequeue and Priority queue.
 d) What is the addressing formula for an element $A[i][j]$ in column major order, if i and j are bounded by the lower and upper limits as $l^1 \leq i \leq u^1$ and $l^2 \leq j \leq u^2$? Assume that the base address is L and w be the number of words allocated to each element.
11. Write short notes on any three of the following :
- Quicksort
 - Tail recursion
 - Double ended queue
 - AVL tree
 - Threaded binary tree.

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