



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH (CSE,IT,ECE,EE(N),EEE,ICE)/SEM-3/CS-302/2010-11

2010-11

DATA STRUCTURE AND 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 :

$10 \propto 1 = 10$

- i) Which of the following is the best time for an algorithm ?
- a) $O(n)$
- b) $O(\log_2 n)$
- c) $O(2^n)$
- d) $O(n \log_2 n)$.

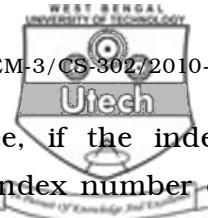


- ii) The Ackerman function, for all non-negative values of m and n is recursively defined as

$$A(m, n) =$$

- i) $n + 1$ if $m = 0$
 - ii) $A(m - 1, 1)$ if $m \neq 0$ and $n = 0$
 - iii) $A(m - 1), A(m, n - 1)$ if $m \neq 0, n \neq 0$

Therefore the value of A (1, 2) is



- vi) In array representation of Binary tree, if the index number of a child node is 6 then the index number of its parent node is
- a) 2
 - b) 3
 - c) 4
 - d) 5.
- vii) Maximum number of edges in a n -node undirected graph without self loop is
- a) n^2
 - b) $\frac{n(n-1)}{2}$
 - c) $n-2$
 - d) $\frac{(n+1)(n)}{2}$.
- viii) Four algos do the same task. Which algo should execute the slowest for large values of n ?
- a) $O(n^2)$
 - b) $O(n)$
 - c) $O(\log_2 n)$
 - d) $O(2^n)$.
- ix) The adjacency matrix of an undirected graph is
- a) unit matrix
 - b) asymmetric matrix
 - c) symmetric matrix
 - d) none of these.
- x) BFS constructs
- a) a minimal cost spanning tree of a graph
 - b) a depth first spanning tree of a graph
 - c) a breadth first spanning tree of a graph
 - d) none of these.



GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following.

$$3 \times 5 = 15$$

2. a) Convert the following infix expression into equivalent postfix expression using stack.

$$(A + B)^* C - (D - E) / (F + G).$$

- b) What is dequeue ? 4 + 1

3. a) How a polynomial such as $6x^6 + 4x^3 - 2x + 10$ can be represented by a linked list ?

- b) What are the advantages and disadvantages of linked list over an array ? 2 + 3

4. Define Big O notation. Show that the function $f(n)$ defined by

$$F(1) = 1$$

$$F(n) = f(n-1) + 1/n \quad \text{for } n > 1$$

has the complexity $O(\log n)$. 2 + 3

5. a) Write down the recursive definition for generation of the Fibonacci sequence.

- b) Assuming $\text{Fib}(n)$ is a recursive function, draw a recursive tree for $\text{Fib}(6)$. 2 + 3

6. What is the precondition of performing binary search in an array ? Write the Binary Search algorithm.



3 × 15 = 45

GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following.

7. a) What is Circular queue ? Write *Q*-insert algorithm for the circular queue. 1 + 4

- b) Construct the expression tree for the following expression : 2

$$E = (2a + 5b)(x - 7y)^4 .$$

- c) Write the recursive function for the problem of Tower of Hanoi problem. 3

- d) Write a C function for selection sort and also calculate the time complexity for selection sort. 3 + 2

8. a) Show the stages in growth of an order – 4 *B*-tree when the following keys are inserted in the order given : 5

74 72 19 87 51 10 35 18 39 60 76 58 19 45

- b) How do AVL trees differ from binary search tree ?

Insert the following keys in the order given below to build them into an AVL tree :

8 12 9 11 7 6

Clearly mention different rotations used and balance factor of each node. 5

- c) Explain with suitable example the principle of operation of Quick sort. 5



9. a) Given the preorder and inorder sequence and draw the resultant binary tree and write its postorder traversal :

5

Pre-order : A B D G H E I C F J K

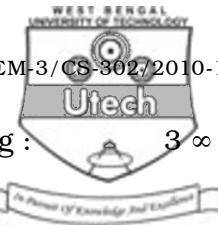
In-order : G D H B E I A C J F K

- b) Write non-recursive algorithm for inorder traversal of a binary tree. 5
- c) Write an algorithm to search a node in a binary search tree. 5

10. a) Define 'Hashing'. 2

- b) Explain with a suitable example the collision resolution scheme using linear probing with open addressing. 5
- c) What is index ? What are the various types of indexing ? State the advantages of using indexing over a sequential file. 5

- d) Discuss the differences between command file and executable file. 3



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3 ∞ 5

11. Write short notes on any *three* of the following :

- a) Radix sort
 - b) Index sequential file ordering
 - c) Tail recursion
 - d) Threaded binary tree
 - e) BFS *vs* DFS.
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