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Roll No. :
Invigilator's Signature :

CS / B.TECH (BT) / SEM-3 / CS-315 / 2010-11

2010-11

DATA STRUCTURE AND ALGORITHM

Time Allotted : 3 Hours

Full Marks : 70

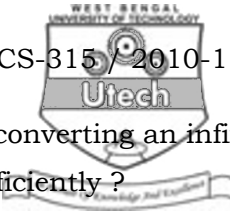
The figures in the margin indicate full marks.

*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) Which is better computing time (in respect of analysis of algorithm) ?
 - a) $O(n)$
 - b) $O(2n)$
 - c) $O(\log 2n)$
 - d) None of these.
 - ii) In 2D array char $a[5][6]$ is stored at '1000', in column-major manner. The address of $a[j]$ would be
 - a) $1000 + i + j * 5$
 - b) $1000 + i * 4 + j$
 - c) $1000 + i + j * 6$
 - d) $1000 + i * 6 + j$.



- iii) Which of the following is essential for converting an infix expression to the postfix expression efficiently ?
- a) An operator stack
 - b) An operand stack
 - c) An operand stack and operator stack
 - d) A parse tree.
- iv) A dynamic data structure where we can search for desired records in $O(\log n)$ time is
- a) heap
 - b) binary search tree
 - c) circularly linked list
 - d) array.
- v) The inorder traversal of some binary tree produced the sequence CBDA, and the postorder traversal of the same tree produced the sequence CDBA. Which of the following statements is TRUE for the given tree ?
- a) Left subtree is empty, and the total number of nodes in its right subtree is 3
 - b) Right subtree is empty, and the total number of nodes in its left subtree is 3
 - c) Both left subtree and right subtree must be non-empty
 - d) None of these.



- vi) A threaded binary tree has which of the following problems ?
- a) More time consuming tree traversal
 - b) Nonsequential memory allocation
 - c) Additional storage requirement
 - d) None of these.
- vii) The maximum possible height of an AVL tree with 7 nodes is
- a) 3
 - b) 4
 - c) 5
 - d) None of these.
- viii) A strictly binary tree with n leaves will contain how many nodes ?
- a) $2n + 1$
 - b) $2n - 1$
 - c) n
 - d) n^2 .
- ix) Breadth first search
- a) scans all incident edges before moving to other vertex
 - b) scans adjacent unvisited vertex as soon as possible
 - c) is same as backtracking
 - d) none of these.



- x) Which of the following is a hash function ?
- a) Quadratic probing b) Chaining
- c) Open addressing d) Folding.

GROUP - B

(Short Answer Type Questions)

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

2. a) What is the time complexity of a linear search algorithm, binary search ?
- b) Explain the advantages of Binary search over other searching algorithms. $3 + 2$
3. Evaluate the following into postfix expression using Stack :
- $(a - b * c + d) / (e + f)$
4. What is a circular queue ? How does it differ from linear queue ? $2 + 3$
5. a) Define hashing.
- b) Define linear probing.
- c) What is B-Tree ? $2 + 2 + 1$
6. a) How does an AVL differ from a binary search tree ?
- b) How are AVL trees represented in computer memory ?
- c) What are the advantages and disadvantages of linked list data structure over array ? $2 + 2 + 1$

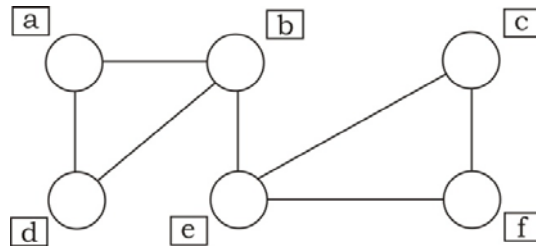


GROUP - C

(Long Answer Type Questions)

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

7. a) What is a Stack ? Write an algorithm to convert an Infix Expression to a Prefix Expression.
- b) Write an algorithm to generate first ten Fibonacci numbers recursively.
- c) What is recursion ? How does it differ from iteration ?
- d) Write an algorithm to implement queue using linked list. $(2 + 4) + 3 + 2 + 4$
8. a) Explain the operation of Breadth First Search on an undirected graph given below, taking vertex 'b' as source.



- b) The order of nodes of a binary tree in pre-order and in order traversal are as under

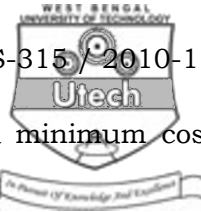
In order : *D B F E G H I A C*

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

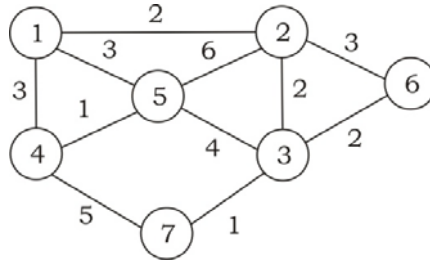
Construct the corresponding binary tree.



- c) Compare tree and graph.
 - d) How does static allocation differ from dynamic allocation of memory ?
 - e) Illustrate the operation heapify () on the sequence 13, 10, 5, 7, 22, 11, 9, 18 in order to build a min heap.
 $3 + 4 + 2 + 2 + 4$
9. a) Write an algorithm to sort a list of numbers using Merge sort.
- b) Write and explain an algorithm to search a list of numbers using binary search method. Calculate its time complexity.
- c) Show the insertion sort steps for the following numbers :
- 25 10 72 18 40 11 32 9
- d) Indicate the importance of time and space complexity of an algorithm ?
 $5 + (3 + 3) + 2 + 2$
10. a) Define *B*-tree of order *m* [minimum degree *m*].
- b) What do you mean by Double ended queue ?
- c) What is a Spanning Tree ? When can it be called a minimum cost spanning tree ?



- d) Find all possible spanning trees and a minimum cost spanning tree for the following graph :



$$2 + 2 + (2 + 2) + (4 + 3)$$

11. a) What is a circular linked list ? How do you perform insertion and deletion operation in such a list ?
- b) Write short notes on any *two* of the following :
- i) Indexed sequential file organization
 - ii) Sequential file organization
 - iii) Hashed files
 - iv) Inverted files.
- c) What do you mean by Depth First Search ?
- d) Insert the following keys in the order to build them into an AVL tree :
- k, m, u, t, v, p.
- Clearly mention different rotations used and balance factor in each node.

$$(2 + 3) + (3 + 3) + 1 + 3$$

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