

B.TECH / BT /5<sup>TH</sup> SEM/ CSEN 3106/2017  
DATA STRUCTURES & ALGORITHM  
(CSEN 3106)

Time Allotted : 3 hrs

Full Marks : 70

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

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

**Group - A**

**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Given two sorted files of size 'm' and 'n' respectively. The number of comparisons needed in the worst case by the merge sort algorithm will be  
(a)  $m \times n$  (b) maximum of m, n (c)  $m + n$  (d)  $m + n - 1$ .
- (ii) A hash function f, defined as  $f(\text{key}) = \text{key} \bmod 7$ , with linear probing, is used to insert the keys 37, 38, 72, 48, 98, 11, 56 into a table indexed from 0 to 6. What will be the location of key 11?  
(a) 3 (b) 4 (c) 5 (d) 6.
- (iii) As a part of the maintenance work, you are entrusted with the work of rearranging the library books in a shelf in proper order, at the end of each day. The ideal choice will be  
(a) Bubble sort (b) Insertion sort  
(c) Selection sort (d) Heap sort.
- (iv) Which data structure is used for implementing recursion?  
(a) Queue (b) Stack (c) Array (d) List.
- (v) Linked list is considered as an example of \_\_\_\_\_ type of memory allocation.  
(a) dynamic (b) static (c) compile time (d) none of the mentioned.
- (vi) Using Bubble sort, to sort 100 names, the maximum number of comparisons will be  
(a) 4950 (b) 5050 (c) 10000 (d) 100.

B.TECH / BT /5<sup>TH</sup> SEM/ CSEN 3106/2017

- (vii) What is a complete binary tree?  
(a) Each node has exactly zero or two children  
(b) A binary tree, which is completely filled, with the possible exception of the bottom level, which is filled from right to left  
(c) A binary tree, which is completely filled, with the possible exception of the bottom level, which is filled from left to right  
(d) None of the above mentioned.
- (viii) The postfix equivalent of  $(A + B) * (C - D)$  is  
(a) ABCD + - \* (b) AB+ \* CD-  
(c) AB + CD - \* (d) CD- AB+ \*.
- (ix) A graph is a collection of nodes, called ..... and ..... connect pair of nodes.  
(a) edges, vertices (b) vertices, edges  
(c) vertices, path (d) graph node, edges.
- (x) What is an AVL tree?  
(a) A tree which is balanced and is a height balanced tree  
(b) A tree which is unbalanced and is a height balanced tree  
(c) A tree with three children  
(d) A tree with atmost 3 children.

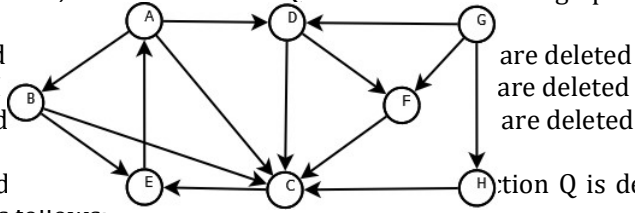
**Group - B**

2. (a) Write down the basic features of an algorithm.  
(b) Write an algorithm to transpose a sparse matrix stored in a special way (row, col, value).  
(c) Let  $f(n) = 3n^2 + 4n + 1$ . Show  $f(n)$  is  $O(n^2)$ .
- 4 + 4 + 4 = 12**
3. (a) Consider an array of  $50 \times 5$  called Score to store the numerical grades of 50 students in five different subjects. Suppose base address of Score is 1000 and  $w = 4$  bytes. What will be the address of  $\text{Score}[27,4]$ , i.e., the 4th subject score of 27th student in Row-Major order? What will be the address of the same in Column-Major order?  
(b) Write a C function to insert a new node at the end of a singly linked list.  
(c) Write a C function to count the number of nodes in a singly linked list.
- (2 + 2) + 4 + 4 = 12**

7. (a) Define Binary Search Tree (BST). Define complete and full Binary tree with example.

4. (a) Consider the following queue of characters, where QUEUE is a circular queue of size 10. At its present point, FRONT=2, REAR=4 and QUEUE: A, C, D, 76, 23, 89, 115, 98, 39, 41, 56, 69, 48

(b) Here “ ” denotes an empty cell in the array. What will be the value of FRONT and REAR, also describe the QUEUE as the following operations takes place.



- (a) F is added
- (c) K, L and M are deleted
- (e) R is added

(b) Let a and b be defined recursively as follows:-

$$Q(a,b) = \begin{cases} 0 & \text{if } a < b \\ Q(a,b) + 1 & \text{if } b \leq a \end{cases}$$

$3 + 6 + 3 = 12$

8. (a) Consider the list of numbers :- 99, 78, 72, 66, 54, 48, 43, 34, 22, 19, 11, 7. Find the value of Q(2,3) and Q(14,3).

Assume your target is 34 and the value of low and high are 0 and 11 respectively at the beginning. You are applying Binary Search algorithm.

5. (a) Write algorithms to insert and delete elements from circular queue using array. What will be the value of high and low when you find your target?

(b) Evaluate the following postfix expression by using Stack. Show every step. 9, 6, -, /, 4, +

(b) Draw stack and show what happens with proper explanation search for a particular number.

Which searching algorithm you will use and how to find it in minimum time.

**Group - D**

(c) Deduce the average case time complexity of Linear Search.  
6. (a) A binary tree T has 9 nodes. The Inorder and Preorder traversals of T yield the following sequences of nodes:

9. (a) Consider the initial list:- 11, 7, 12, 14, 19, 1, 6, 18, 8, 29, 3  
Inorder: E A C K F H D B G  
Preorder: F A E K C D H G B

You are going to sort the above numbers by quick sort and your pivot is the first number. Show step by step, how pivot will partition the list.

(b) Construct an expression tree for the expression E = (2x + y) \* (5a - b) which are greater than the pivot. Under what circumstances, the time complexity of quicksort is O(n<sup>2</sup>)

(c) Write the algorithm for Preorder traversal of a binary tree.  
(b) How do collisions happen during hashing? Explain two techniques to resolve it.

$(6 + 1) + (2 + 3) = 12$