B.TECH/ECE/3RD SEM/ECEN 2102/2016

DATA STRUCTURE
(ECEN 2102)

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) Linked list is used to implement data structures like
(a) queue (b) tree (c) stack (d) all of these.

(ii) The minimum number of edges required to connect all the nodes of a graph with *m* nodes is
(a) $2m$ (b) m^2 (c) $m - 1$ (d) $m + 1$.

(iii) Which data structure is used for the depth first traversal of a graph?
(a) stack (b) tree (c) queue (d) linked list.

(iv) There are 64, 31, 30 and 27 nodes in 4 different trees. Which one of them can form a full as well as complete binary tree?
(a) tree with 64 and 31 nodes
(b) tree with 27 and 31 nodes
(c) tree with 30 nodes
(d) tree with 31 nodes.

(v) The postfix equivalent of the prefix expression * + p q – r s is
(a) p q + r s - * (b) p q r s + - *
(c) p q + r s * - (d) p q + - r s *.

(vi) How much time does an AVL tree take to perform search, insert, and delete operations in the average case as well as in the worst case?
(a) O(n) (b) O(log n) (c) $O(n^2)$ (d) O(n log n).

(vii) Maximum number of nodes possible at the n^{th} level of a binary tree is
(a) 2^n (b) $2^n - 1$ (c) $2^n + 1$ (d) 2^{n+1}.

(viii) The Linear Probing Hashing Technique for collision resolution may lead to
(a) overflow (b) efficient storage utilization
(c) primary clustering (d) secondary clustering.

(ix) If a binary tree is threaded for in-order traversal, a right NULL link of any node is replaced by the address of its
(a) root (b) own
(c) predecessor (d) successor.

(x) In worst case, time required to build a binary heap of n elements is
(a) O(n log n) (b) O(log n)
(c) O(n) (d) $O(n^2)$.

Group – B

2. (a) Write the pseudo-code to take an m x n sparse matrix (M) as input, convert it into its triplet representation (M_Triplet) and then find the transpose of the matrix using M_Triplet.

(b) Explain f(n) = O(g(n)).

(c) Given an array A[3][4] in which the base address is 1200 and word width is 2 bytes. Find the address of A[2][3] in both row-major and column-major order.

6 + 2 + (2 + 2) = 12

3. (a) Write a function to add a new node to an ascending order linked list.

(b) For the function defined by $f(y) = 2y^2 + 3y \log_2 y + y$ show that $f(y) = O(y^2)$. Find n_0 and c in this respect.

(c) Write a function to insert a node at any given position of a doubly linked list.

5 + 3 + 4 = 12

Group – C

4. (a) Write the pseudo code to reverse the contents of a stack using a queue.

(b) Write an algorithm that converts an in-fix expression to post-fix expression. Using the algorithm transform the following infix expression to postfix.
(A – 2 * (B + C) /D * E) + F

6 + (3 + 3) = 12

5. (a) What do you understand by recursion? What is tail recursion? Write a program to find the factorial of a given number using tail recursion.

(b) Write insert and delete functions for a queue using linked list.

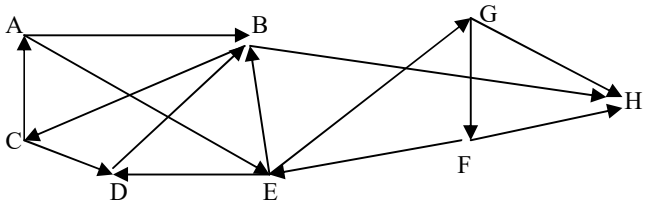
(c) What is Deque? How the disadvantages of linear queue can be overcome using a circular queue?

(1 + 1 + 3) + 4 + (1 + 2) = 12

Group – D

6. (a) The in-order and pre-order traversal sequence of a binary tree is given below:
In-order: 13 7 22 5 25 15 30 9 18
Pre-order: 5 7 13 22 9 15 25 30 18
Draw the binary tree and explain the logic used to construct the tree.

(b) Write the result of running BFS and DFS on the directed graph given below using vertex 3 as the source. Show the status of the data structure used at each stage. Write down the in-degree of the vertices.



5 + (3 + 3 + 1) = 12

7. (a) Construct an AVL search tree by inserting the following elements in the order of their occurrence. 64, 1, 14, 26, 13, 110, 98, 85
Now, delete the nodes in the order of 1, 13, and 98.
Show the rotations required to balance the tree.

(b) Write an algorithm to find the largest number in a binary search tree.

(c) Define complete binary tree. Give an example.

6 + 4 + 2 = 12

Group – E

8. (a) Write the algorithm of binary search and calculate the complexity for best, worst and average cases.

(b) Explain the operation of Quick sort using a suitable example.

(c) Define Hashing. With suitable example, explain the Collision resolution scheme using linear probing with open addressing.

4 + 3 + (1 + 4) = 12

9. (a) Consider a hash table of size 10. Use quadratic probing to insert the keys 72, 27, 36, 24, 63, 81, 101 into the table. Take $c_1 = 1$ and $c_2 = 3$.

(b) Build a max heap from the given set of data elements:
45, 36, 54, 27, 63, 72, 61, 18.
Show each step of the operations.

6 + 6 = 12