

[Total No. of Questions: 09]

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Uni. Roll No. ....

**Program:** B.Tech. (Batch 2018 onward)

**Semester:** 3<sup>rd</sup>

**Name of Subject:** Data Structures

**Subject Code:** PCIT-101

**Paper ID:** 16040

Scientific calculator is Allowed

**Time Allowed: 03 Hours**

**Max. Marks: 60**

**NOTE:**

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice.
- 3) Any missing data may be assumed appropriately

**Part – A**

**[Marks: 02 each]**

**Q. 1**

- a) State the significance of maintaining AVAIL list and the process used by operating system to perform garbage collection.
- b) Illustrate the efficient way of storing sparse matrices in memory.
- c) Describe quadratic probing as a technique to resolve collision(s) in hashing.
- d) Illustrate the use of adjacency matrix and adjacency list to represent a graph in memory.
- e) Evaluate the order of magnitude of the time complexity function Big Oh of the following algorithms, where n is the size of input data:-

**(i) Algorithm A:**

1. for (i = 1; i ≤ n; i++)
2.     for (j = 1; j ≤ n, j++)
3.         Module X
4.     end of Step 2 loop
5. end of step 1 loop

**(ii) Algorithm B:**

1. for (k = n; k > 1; k = k/2)
2.     Module Y
3. end of step 1 loop

- f) Compare Breadth First Search (BFS) and Depth First Search (DFS) graph traversal techniques.

- Q. 2 Explain the ways by which an unbalanced Binary Search Tree (BST) can be made as an AVL Tree (i.e. a balanced tree).
- Q. 3 Apply Heapsort Algorithm on the following data to sort it in ascending order:-  
81, 89, 9, 11, 14, 76, 54, 22
- Q. 4 Illustrate the operations of insertion and deletion of nodes in a linked list.
- Q. 5 Design a recursive algorithm to solve Tower of Hanoi problem.
- Q. 6 Analyze and compare the mechanisms to implement priority queue.
- Q. 7 Defend the statement that a B-tree makes an  $m$ -way search tree as a balanced tree by maintaining a height close to  $\log_m(n+1)$ .

## Part – C

[Marks: 12 each]

- Q. 8 Describe the implementation of circular queue (using array) and explain how it overcomes the limitations of a linear queue.

OR

Elaborate the algorithm to implement stack using linked list.

- Q.9 Suppose the table T (circular) has 11 memory locations.  $T[1], T[2], \dots, T[11]$  and suppose the File F consists of 9 records; P, Q, R, A, B, C, V, W, X with the following hash addresses:-

Records:	P	Q	R	A	B	C	V	W	X
H(k):	5	4	5	6	8	11	11	1	4

Suppose the records are entered into the table T in the above order. Examine the efficiency of the given hash function with linear probing as the collision resolution technique.

OR

Defend the statement that a Threaded Binary Tree enhances the speed of tree traversal techniques.

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