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Roll No:

(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004 SEMESTER EXAMINATIONS. APRIL 2019 (PHASE I)

MCA Semester: 1

15MX14 **DATA STRUCTURES**

Time: 3 Hours **Maximum Marks: 100**

INSTRUCTIONS:

- 1. Answer ALL questions. Each question carries 20 Marks.
- 2. Subdivision (a) carries 3 marks each, subdivision (b) carries 7 marks each and subdivision (c) carries 10 marks each.
- a) Analyze the time complexity of the following code snippet

ALGORITHM (A,n)

// A is an array of size n

fori=1 to n

for j=2*ito n

A[i]=A[i]+1

- i) Given an array of size n, write an algorithm to check if it is sorted in ascendingorder or not. Use iterative approach.
 - ii) Consider an array A[1:45, -4:34, 5:10] represented in row major order where each cell occupies two bytes of memory. Find the address of the element A[12,10,7] if the base address is 50. Also, find the total memory required to store the array [3]
- c) What is sparse matrix? Describe how an array can be effectively used to store a sparse matrix. Write an algorithm to convert the given sparse matrix to its triplet notation and extend the same to find transpose of a given sparse matrix using triplet notation.
- What are the advantages of implementing a queue as a circular array rather than a linear array?
 - b) Explain the advantages of using circular queue. Show the circular Queue configuration after each operation mentioned below (MAX Queue capacity = 4).

Insert K, L, M

Delete

Delete

Insert N, P

Delete

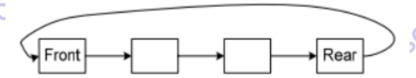
Delete

c) Write procedures to perform PUSH and POP operations on a stack implemented as an array. Apply the procedures to convert an infix expression to a postfix expression. Trace the algorithm to find the postfix equivalent of a+b*c+d*e↑f where ↑ represents exponentiation. Assume normal operator precedence. PSG TEC PSG TEC

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3. a) Is Linked list a linear or non-linear data structure? Justify your answer.

b) Consider a queue that is implemented using a circular linked list as shown below. The queue can be accessed only using a pointer 'p'. To which node should 'p' point so that enqueue and dequeue operations are performed in constant time? Write a procedure to perform enqueue and dequeue operations on this queue.



- c) Discuss the advantages and disadvantages of a circular linked list. Write procedures to insert and delete in a circular linked list. Write an algorithm to shift the elements of a singly linked list by one position towards the right. If the linked list has 12→56→34→40→7, then, after shift, the list is 7→12→56→34→40.
- a) What is an expression tree? Construct an expression tree for the postfix expression ABC*FHV+.
 - b) i) Prove that the maximum number of elements in a binary tree is 2h-1.
 - ii) The nodes of a binary tree are labeled A to H. The in-order listing is B D E C A G F H and the post order listing is E D C B G H F A. Construct the binary tree and list the nodes in preorder.
 - c) Write an algorithm to convert the expression $(a + b) c * (-d) / f ^ e$ using expression trees and traverse the tree in in-order, pre-order and post-order.
- 5. a) Write an algorithm to perform quick sort. Give an example.
 - b) Discuss and apply the selection, insertion and bubble sorting algorithms to sort the list of elements 12, 25, 3, 45, 56, 34, 70, 27. Trace the sequence of these sorting using and analyze time complexity of these algorithms.
 - c) Construct a hash table for the set of keys 85, 90, 70, 9, 56, 11, 71, 54, 10, 27, 35, 40, 64, 13, 31, 22, 77, 89, 53 using H(x) =x mod 9 as the hash function. Assume that the collisions are resolved using rehashing. Assume the rehashing function as H(k)=7- (k mod 7). Find the average number of probes required for successful and unsuccessful search.

/END/

FD/RL