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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech I/II Semester Supplementary Examinations - July, 2017

Regulation: IARE – R16

**DATA STRUCTURES**

[Common for : II Semester (CSE, IT, ECE and EEE)]

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

## UNIT – I

- (a) What is selection sort? State the process and sort the following set of elements using this technique: 20,35,40,100,3,10,15. [7M]

(b) Write a recursive algorithm for finding solution to the Tower's of Hanoi problem. Explain the working of your algorithm (with 3 disks) with diagrams. [7M]
- (a) An array A contains n unique integers from the range x to y (x and y inclusive where  $n=y-x$ ). That is there is one member that is not in A. Design an  $O(n)$  time algorithm for finding that number. [7M]

(b) What are the characteristics of a good algorithm? What is the relation between the time and space complexities of an algorithm? [7M]

## UNIT – II

- (a) Suppose a queue is housed in an array in circular fashion. Write a procedure ENQ to add a new item into the above house. And also check whether the queue is full. Write another procedure DEQ to delete an element from the queue after checking queue empty status. [8M]

(b) Write an algorithm to evaluate a postfix expression. Execute your algorithm using the following postfix expression as your input: a b + c d +\*f. [6M]
- (a) Using stacks, write an algorithm to determine whether the infix expression has balanced parenthesis or not. [7M]

(b) Illustrate the steps for converting an infix expression into a postfix expression for the following expression  $(a + b) * (c + d) / (e + f)$ . [7M]

## UNIT – III

- (a) Implement a Queue using a singly linked list L. The operations INSERT and DELETE should still take  $O(1)$  time. [9M]

(b) Write a function to reverse the links in a linked list such that the last node becomes the first and the first becomes the last by traversing the linked list only once. [5M]

6. (a) If  $x$  is a pointer to a node in a doubly linked list, then  $x \rightarrow \text{prev}$  is the pointer to the node before it and  $x \rightarrow \text{next}$  is the pointer to the node after it. What does this pair of statements, executed in order, do? [7M]

$(x \rightarrow \text{next}) \rightarrow \text{prev} = x \rightarrow \text{prev};$   
 $(x \rightarrow \text{prev}) \rightarrow \text{next} = x \rightarrow \text{next};$

If we then execute this pair of statements (after executing the first pair of statements), what happens?

$(x \rightarrow \text{next}) \rightarrow \text{prev} = x;$   
 $(x \rightarrow \text{prev}) \rightarrow \text{next} = x;$

Visualize the both conditions using diagrammatic representation.

- (b) Let  $P$  be a pointer to a circularly linked list. Show how this list may be used as a queue. That is, write algorithms to add and delete elements. Specify the value for  $P$  when the queue is empty and show using diagrammatic representation. [7M]

### UNIT – IV

7. (a) Draw a picture of the directed graph, Where graph  $G$  is defined as [7M]

$G = (V, E)$

$V(G) = \{1, 2, 3, 4, 5, 6\}$

$E(G) = \{(1,2), (2, 3), (3, 4), (5,1), (5, 6), (2, 6), (1, 6), (4, 6), (2, 4)\}$

Obtain the following for the above graph:

- i. Adjacency matrix.
- ii. Reachability matrix.

- (b) A binary tree  $T$  has 9 nodes. The in order and preorder traversals of  $T$  yield the following sequence of nodes. [7M]

In Order: EACKFHDBG

Pre Order:FAEKCDHGB

Draw the tree  $T$ . Also give the yield of the Post Order traversal.

8. (a) Explain various graph traversal schemes and write their merits and demerits. [6M]  
 (b) What is a binary tree? Write an algorithm for the preorder traversal of a binary tree using stacks. [8M]

### UNIT – V

9. (a) Suppose that a Binary Search Tree is constructed by repeatedly inserting distinct values in to the tree. Argue that the number of nodes examined in searching for a value in the tree is one plus the number of nodes examined when the value was first inserted in to the tree. [7M]

- (b) The following values are to be stored in a hash table [7M]

25, 42, 96, 101, 102, 162, 197, 201

Use division method of hashing with a table size of 11. Use sequential method of resolving collision. Give the contents of array.

10. (a) Create B-Tree of order 5 from the following list of data items: [7M]

20, 30, 35, 85, 10, 55, 60, 25. What will be the root note for the above B-Tree.

- (b) Draw the 11-item hash table resulting from hashing the keys 12, 44, 13, 88, 23,94, 11, 39, 20, 16 and 5 using the hash function  $h(i) = (2i+5) \bmod 11$ . [7M]

