Code : **051403**

B.Tech 4th Semester Exam., 2019

DATA STRUCTURES

Time : 3 hours   Full Marks : 70

Instructions :

(i) *The marks are indicated in the right-hand margin.*

(ii) *There are **NINE** questions in this paper.*

(iii) *Attempt **FIVE** questions in all.*

(iv) *Question No. **1** is compulsory.*

1. Choose the correct answer of the following (any *seven*) :   2×7=14

   (a) Which of the following best describes an array?

      (i) A data structure that shows a hierarchical behaviour

      (ii) Container of objects of similar types

      (iii) Container of objects of mixed types

      (iv) All of the above

   (b) The process of removing an element from stack is called

      (i) create

      (ii) push

      (iii) evaluation

      (iv) pop

   (c) In a stack, if a user tries to remove an element from empty stack it is called

      (i) underflow

      (ii) empty collection

      (iii) overflow

      (iv) garbage collection

   (d) A linear collection of data elements where the linear node is given by means of pointer is called

      (i) linked list

      (ii) node list

      (iii) primitive list

      (iv) None of the above

(e) What would be the asymptotic time complexity to add a node at the end of singly linked list, if the pointer is initially pointing to the head of the list?

(i) O (1)

(ii) O (n)

(iii) Θ (n)

(iv) Θ (1)

(f) With what data structure can a priority queue be implemented?

(i) Array

(ii) List

(iii) Heap

(iv) All of the above

(g) What is the functionality of the following piece of code?

```
Public void fun (int x)
{
  q1.offer (x);
}
```

(i) Perform push( ) with push as the costlier operation

(ii) Perform push( ) with pop as the costlier operation

(iii) Perform pop( ) with push as the costlier operation

(iv) Perform pop( ) with pop as the costlier operation

(h) In a max-heap, element with the greatest key is always in which of the following nodes?

(i) Leaf node

(ii) First node of left subtree

(iii) Root node

(iv) First node of right subtree

(i) What is the specialty about the in-order traversal of a binary search tree?

(i) It traverses in a non-increasing order http://www.akubihar.com

(ii) It traverses in an increasing order

(iii) It traverses in a random fashion

(iv) None of the above

(j) Which of the following is not an application of priority queue?

(i) Huffman codes

(ii) Interrupt handling in operating system

(iii) Undo operation in text editors

(iv) Bayesian spam filter

2. (a) Explain array implementation of priority queues and list implementations of priority queues. 7

(b) Differentiate between row major and column major array index notations. How is index calculated in both? Explain your answer by using the example of an integer array int a [10] [10] and the element a [2] [5] is to be accessed. 7

3. (a) What is doubly linked list? What are its applications? Explain how an element can be deleted from the list using appropriate pseudocode. 7

(b) Consider two strings $X = x_1, x_2 ..... x_n$ and $Y = y_1, y_2 .... y_n$, where $x_i, 1 \le i \le n$ and $y_j, 1 \le j \le m$ are the members of finite set symbols. Write an algorithm to generate a string by taking 1 element from each list. When any one string is exhausted, the output string should store rest of the elements of other string. 7

4. (a) What do you understand by 'garbage'? Explain how garbage collection method is used for allocating and freeing memory storage. 7

(b) Suppose the following eight numbers are inserted in order into an empty binary search tree :

T : 50, 33, 44, 22, 77, 35, 60, 40

Draw the tree T. 7

5. (a) Discuss pre-order and post-order tree traversal techniques. Write the pseudo-code for these two traversal methods. 7

(b) Write the algorithms for insertion sort and merge sort with examples and discuss their complexities. 7

6. (a) Write an algorithm to perform breadth first search (BFS). Compare the BFS and DFS search techniques. 7

(b) Explain the working of merge sort on the following data :

{10, 15, 0, 17, 20, 25, 30, 16, 70, 6}

Show all intermediate steps. Also, mention its time complexity. 7

7. (a) What is meant by a spanning tree of a graph? Give an algorithm to find a spanning tree. What is the complexity of your algorithm? 7

(b) What do you mean by tree traversal? Give a recursive algorithm for tree traversal. Determine the complexity of your algorithm. 7

8. (a) Algorithm A requires n^2 days and algorithm B requires n^3 sec to solve a problem. Which algorithm would you prefer for a problem instance with $n = 10^6$?   7

(b) Assume the recurrence relation

$$T(N) = 2T(N/2) + N, \ N \geq 2$$

with boundary condition $T(1) = 0$. What is the time complexity?   7

9. Write short notes on the following : $3\frac{1}{2} \times 4 = 14$

(a) Hashing methods

(b) Height balanced tree

(c) Operation in circular queue

(d) AVL tree

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