

B.Tech 4th Semester Exam., 2015

DATA STRUCTURES

Time : 3 hours

Full Marks : 70

Instructions :

- (i) All questions carry equal marks.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Answer any seven from the following :

- (a) If the sequence of operations—push(1), push(2), pop, push(1), push(2), pop, pop, push(2), pop are performed on a stack, the sequence of popped out values is

- (i) 2, 2, 1, 1, 2
- (ii) 2, 2, 1, 2, 2
- (iii) 2, 1, 2, 2, 1
- (iv) 2, 1, 2, 2, 2

- (b) Queue can be used to implement

- (i) radix sort
- (ii) quicksort
- (iii) recursion
- (iv) depth first search

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- (c) The number of binary trees with 3 nodes which when traversed in post-order gives the sequence A, B, C is

- (i) 3
- (ii) 9
- (iii) 7
- (iv) 5

- (d) A binary tree has n leaf nodes. The number of nodes of degree 2 in this tree is

- (i) $\log_2 n$
- (ii) $n - 1$
- (iii) n
- (iv) 2^n

- (e) Sparse matrices have

- (i) many zero entries
- (ii) many non-zero entries
- (iii) higher dimension
- (iv) None of the above

- (f) The postfix expression for $* + ab - cd$ is

- (i) $ab + cd - *$
- (ii) $abcd + - *$
- (iii) $ab + cd * -$
- (iv) $ab + - cd *$

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(g) The memory address of the first element of an array is called:

- (i) floor address
- (ii) foundation address
- (iii) first address
- (iv) base address

(h) The memory address of fifth element of an array can be calculated by the formula

- (i) $LOC(Array[5]) = Base(Array) + W(5 - \text{lower bound})$,
- (ii) $LOC(Array[5]) = Base(Array[5]) + (5 - \text{lower bound})$
- (iii) $LOC(Array[5]) = Base(Array[4]) + (5 - \text{upper bound})$
- (iv) None of the above

where w is the number of words per memory cell for the array.

(i) Which of the following data structures are indexed structures?

- (i) Linear arrays
- (ii) Linked lists
- (iii) Both of the above
- (iv) None of the above

(j) Which of the following is not the required condition for binary search algorithm?

- (i) The list must be sorted
- (ii) There should be the direct access to the middle element in any sublist
- (iii) There must be mechanism to delete and/or insert elements in list
- (iv) None of the above

2. (a) What is a data structure? What is the need of data structures?

(b) Explain Big-Oh notation with the help of example.

3. (a) Write suitable array declaration for the following :

- 100 items of integer type
- A string of 25 characters
- An integer matrix of order 5×4

Can an array be initialized? If yes, how?

(b) Write a program that sorts a given list of numbers using quicksort.

4. (a) Explain overflow and underflow conditions of a stack with examples.
- (b) What are priority queues? Write their applications.
5. (a) Write a program that travels a linked list consisting of nodes of the following struct type :
- ```

struct student{
 char name [15];
 int roll;
 struct student *next;
};

```
- While traversing, it counts the number of nodes in the list. Finally, the count is printed.
- (b) Explain the merits and demerits of static and dynamic memory allocation techniques.
6. (a) Define the following terms :
- (i) Root
  - (ii) Leaf nodes
  - (iii) Empty tree
  - (iv) Sub-tree
- (b) What are heap trees? Discuss a minheap and a maxheap tree with the help of examples. What are the operations that can be performed on a heap tree?

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7. (a) Explain the following graph theory terms :
- (i) Node
  - (ii) Undirected graph
  - (iii) Edge
  - (iv) Connected graph
  - (v) Directed graph
  - (vi) Disconnected graph
- (b) Write the Warshall's algorithm.
8. (a) Write an explanatory note on AVL rotations.
- (b) Write an algorithm for inserting a key K, in a B-tree.
9. (a) What is a sparse matrix? What are the methods to represent a sparse matrix?
- (b) Use a stack to convert the following infix arithmetic expression into a postfix expression :
- $$(A - B) * (C / D) + E$$
- Show the changing status of the stack in tabular form.

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