CP 21 A/12/2006

INTER ENGG. (COMP. SC. & ENGG.) EXAMINATION, 2006

(1^{st} Semester)

DATA STRUCTURES AND ALGORITHMS

Time : Three hours | Full Marks : 100

Answer question no. 1 and any *four* from the rest.

1. (a) Show the 2-3 tree formed by entering the following characters in the given sequence into an initially empty tree:

A B C D E F G H I. 2

(b) What do you mean by the notation O(f(x))? Prove that

$O(f(x)) + O(g(x)) = O(\max(f(x), g(x))$ 5

(c) A sparse matrix is represented by the following triples; find the original matrix:

(6, 5, 6), (1,3, -4), (2, 1, 2), (2,4, 10), (4,2, 50), (4, 5,29), (5, 4, 33). 2

(d) Show how the following postfix expression will be evaluated:

6 3 5 + * 22 4–36+ //$

where $ is the sentinel. 2

(e) What do you mean by a Transitive Closure Matrix? Explain with an example. 3

(f) What is a synonym? Explain. 2

(g) What is a Priority Queue? 4

2. Define the ADT for Doubly Linked List.

For a C pointer based linked representation of a Doubly Linked List, write the functions for the following operations:

i) Insert a new node pointed to by *target* before an existing node pointed to by *cur*.

ii) Delete a node pointed to by cur.

10+5+5

3. Why is Stack an important Data Structure? Is it possible to implement the Single Dimension Array Data Structure using a Stack? If possible, how?

State and explain with a simple example how you can use a stack for converting an infix expression to the postfix notation. 10+10

4. What is a Binary Search Tree (BST)? What are the operations on BST? Explain how a given data can be deleted from a BST. What are the average time complexities for different operations on BST?

Explain the problem of inefficiency cropping up by inserting the following elements in the given order in a BST:

1,2,3,4,5,6,8,9,10,7,11.

How can the problem be solved? 12 + 8

contd.

5. Explain the rationale of Heapsort. What are the different approaches to develop the algorithm for Heapsort. Explain with an informal analysis, the time complexity of Heapsort.

   Describe one algorithm of Heapsort and explain its working with the help of the following input array:
   23, 33, 13, 83, 43, 93, 53, 73, 100.

   12 + 8

6. What are the different kinds of Recursion? Explain with examples.
   Write a recursive algorithm for Depth First Search of a Graph. Convert the algorithm to an iterative one. Take an example graph and show how the algorithm works.

   8 + 12

7. What do you mean by Hashing? What is the complexity of insertion, deletion and search in a hash table? Explain how you can delete an element from a hash table. Explain with an example, how coalesced chaining works.

   What are the advantages and disadvantages of Quadratic Probing and Double Hashing? Explain with their definitions.

   12 + 8

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