AUTUMN END SEMESTER EXAMINATION-2018

3rd Semester B.Tech & B.Tech Dual Degree

DATA STRUCTURES AND ALGORITHMS

CS-2001

[For 2018(L.E.) & 2017 Admitted Batches]

Time: 3 Hours | Full Marks: 50

Answer any SIX questions including question No.1 which is compulsory.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. Answer all the questions. [1 × 10]

(a) Write a pseudo code to traverse a binary tree in in-order using a user defined stack.

(b) How many different Binary Search Tree(BST) can be constructed 4 different values.

(c) Write postfix expression of the following prefix.

+a//-b^c*de-+fghj

(d) Define following terminologies in graph with suitable examples

i. Pendant vertex ii. Multi graph
iii. Complete graph iv. Bi connected graph

(e) Construct a binary tree with the following set of traversal sequences. The alphabets represents the node information.

Preorder Traversal : ABCDEGKLHFIMNPOJ

In-order Traversal : ACKGLEHDMIPNOFIB

(f) Write a recursive function to find the height of a binary tree.

(g) Justify the best case and worst case time complexity of insertion sort.

(h) What is the complexity of the following code segment:

```
i =1;
w h i l e ( i <n ) {
        count =0;
        f o r ( j=n/ i ; j<=n ; j=j +(n/ i ) ) {
                count++;
        }
        i += count ;
}
```

(i) How data structures and abstract data type are related to each other? Justify that STACK can be an abstract data type.

(j) Write a modified bubble sort algorithm to minimize the number of comparison in case of best case.

2. (a) Write a function to perform the following operations on the node of a binary search tree. [4]

   i) If the degree of the node is two, delete it.

   ii) If the degree of the node is one, then add a child node with a value one more or one less than the node depending on the position of the existing child node.

   (b) Consider two singly linked list *L1 and *L2. Write a function to multiply both the linked list as Cartesian product, so the final list *L3 must only contain unique elements. [4]

   E.g.:

   *L1: 2->3->6->5->NULL

   *L2: 7->3->2->8->4-> NULL

   *L3: 14->6->4->16->8->21->9->24->12->42->18->48 ->35->15->10->40->20->NULL

3. (a) Write a C function to display "nth" element from the end of a single linked list. [4]

(b) What is a height balanced binary search tree known as? How is it different from binary search tree? Construct a height balanced binary search tree with the following elements where the elements are added to the tree one after the other in the given sequence. Mention the type of rotation applied whenever required. [4]

53, 11, 27, 9, 7, 33, 41, 65, 101, 93, 75, 88, 99

4. (a) Let a programming language does not support the "structure" kind of user defined data type where multiple types of elements can be stayed together. In order to store *n* number of students roll numbers and marks, we prefer to store these information in a single integer array considering both the roll number and the markas integer type. We store these information in the following manner, where 65, 43, 54, 75, and 32 are the marks of the students with the roll number 102, 194, 176, 201, and 146 respectively. [4]

102	65	194	43	176	54	201	75	146	32

So, write an insertion sort function to sort the array based on the student's mark.

(b) Write PUSH and POP function of a QUEUE using STACK data structure. [4]

5. (a) Given a number n = abc and with the hash function $f(n)=(a*3^0+b*3^1+c*3^2) \bmod 9$. Then generate the hash table by following linear and quadratic probing resolution separately for the following data set . [4]

476,192,215,729,318,620,586,828,434

(b) "If the height of a tree is reduced and balanced, then the searching time also get reduced." (True/ False) Justify. [4]

Construct a B-tree of order three with the following set of elements where the elements are added to the tree one after the other in the given sequence.
23, 64, 48, 96, 101, 34, 55, 11, 22, 41, 89, 71, 78, 61, 83, 94, 8, 27, 35, 1

6. (a) Consider a matrix of MxN. Define two functions for sorting each row of the matrix individually and sorting each column of the matrix individually. Write a C program to suggest the end user which order the sorting should be carried out so that we can get maximum total number of sorted rows and sorted columns. [4]

   (b) An arithmetic expression has different token including different parenthesis like '(', ')', '[', ']', '{', '}'. Write a pseudo code to check the correct order and pairing of all the parenthesis. [4]

7. (a) How to represent a graph ADT in memory? Which data structures are used to implement breadth-first-search algorithm and depth-first-algorithm? Briefly discuss the working of breadth-first-search algorithm with a suitable example. [4]

   (b) Given two sorted arrays A and B. Array A is full whereas array B is partially empty and number of empty slots are just enough to accommodate all elements of A. Give an algorithm to merge the two sorted arrays to fill the array B. [4]

8. Write Pseudo code (Any two) [4×2]
   (a) Implementation of one-way threaded binary tree
   (b) Finding a loop in the singly linked list
   (c) Priority Queue using a heap

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