

BACHELOR OF COMPUTER SC. & ENGINEERING EXAMINATION, 2018
(2nd Year, 1st Semester)

DATA STRUCTURES AND ALGORITHMS

Time : Three hours

Full Marks : 100

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

1. (a) What do you mean by Transitive Closure Matrix? Explain with an example. 5
 - (b) What is Load Factor in the context of Hashing? What is its significance? 3
 - (c) What do you mean by a sentinel? Explain when you use sentinels. 2
 - (d) Comment on the correctness of the recursive function given below:


```
int R1 (int n) {
    if (n == 0)
        return 1;
    else return (R1(n-2) * R1(n-3));
}
```

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 - (e) Show how the following elements will be inserted in the given order in a Binary Search Tree:
 K M E T C Y N F A Z 2
 - (f) Show how the following array will be sorted in *increasing order* using Bucket Sort algorithm:
 6 4 1 3 6 4 1 3 7 5 1 3 7 5 8 9 4
2. Define the ADT for Priority Queue.
 What are the possible implementations of Priority Queue based on arrays and based on linked list?
 Explain the implementations and compare their time complexities for different queue operations.

4+6+6+4=20
 3. A rat has entered in a checkerboard maze through one corner, where the white boxes are open and black boxes represent obstacles. Develop an algorithm by which the rat can exit the maze though the opposite corner (these two corner boxes are open). Clearly explain the representation of the maze and any specific data structure you have used for the algorithm.

4. A text file MARKS.TXT, where each line contains the roll number, name of student and his/her aggregate marks obtained in a certain examination is given. You are asked to write a C program to store the merit list in another file MERIT.TXT, where the names of the students are ordered according to the aggregate marks obtained. Each line of this file contains the merit position and the name of the corresponding student. Select a suitable Data Structure for the problem and write a commented C program for producing the merit list. List all the assumptions you have made.

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5. Write a recursive algorithm to find whether a given binary tree is a Binary Search Tree. What is the type of recursion you have used? Explain.
What are the problems of Binary Search Tree regarding the complexity of search and insertion? How can you solve the problem by balancing the tree? Explain.
Explain with examples how an element can be inserted in such a balanced tree. Are there any special cases to be handled in such insertion algorithm? Explain with examples.

$5+3+2+3+4+3 = 20$

6. What do you mean by Hashing? What is the complexity of insertion, deletion and search in a hash table? Explain in detail the coalesced chaining method of hashing.
What is Bucket Hashing? Explain how it is used to store records in a hard disk. What is the basic parameter on which the efficiency of disk based Bucket hashing depends?

$4+2+8+2+3+1=20$

7. A number of cities are connected by a road network. You are to find the shortest route from a designated city to all other cities. Explain how to model the problem using a suitable data structure. Explain how the data structure is implemented in C language.
Give an algorithm to solve the problem to output the distance to be travelled for a destination city as well as the actual route. Find the time complexity of your algorithm.

$2+4+6+2+6=20$

8. Write the following functions in C with proper comments. Define the data types you have used:
- Your friend has implemented a data structure for Binary Search Tree of integers. S/he has given you the function templates to initialize a BST and insert an integer in the BST. Write a C function to sort a given list of integers using the above two functions.
 - To check whether an array is sorted in increasing or decreasing order.
 - To rotate right a binary tree around its root.
 - To compute a Minimum Cost Spanning Tree of a Weighted Graph.

$6+6+2+6=20$

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