Answer ALL the Questions

Question Description   Marks

PART A – (60 Marks)

(a)   i.   Suppose you are working on problem where given needs frequent insertions   6
and deletions at various positions. Which can be best data structure an array
or a linked list for the above task? Justify your answer.

ii.   Given the following code, determine the time complexity using the order of   6
time magnitude execution method. Provide a step-by-step explanation of
your approach.

```c
#include <stdio.h>
int main()
{
    int i, j, N;    // The value for N enter by user at run time.

    for (i = 1; i < N; i = i * 3)      // Outer loop
    {
        j = 2;
        while (j < N)                  // Inner loop
        {
            printf("hello");
            j = j * j;
        }
    }

    return 0;
}
```

OR

(b) . i. Define recursion. What is the basic difference between linear recursion and
binary recursion with example?

6

ii. Solve the given recurrence relation using substitution method: 6

$$T(n) = T(n-1) + T(0) + n \quad \text{if } n > 1$$
$$T(n) = 1 \quad \text{if } n = 1$$

a)   i.   Given a queue Q containing some elements, write an algorithm to reverse the   6
queue. You can only use the methods provided by the Queue Abstract Data
Type (ADT) to reverse the queue, also give time complexity of algorithm.

ii.   Evaluate the postfix expression $928*+3-542*+6+*$ using the stack method.   6
Show all step to solve the given expression. Finally, determine the maximum
stack size required during the evaluation process.

OR

(b) Discuss the following: 6
   i.   Explain infix to postfix conversion algorithm using stack.

   ii.   What is a stack data structure, and what are its fundamental operations?   6
Write a program that removes and returns the top element from the stack
(pop operation)?

(a)   i.   Discuss the concept behind RR, LL, LR and LR rotation in height balance   6
tree creation with example.

   ii.   Insert the following elements into an AVL tree in the order given: 40, 20, 50,   6
10, 30, 60, 5, 15, 35. After inserting each element, determine whether the
tree needs to be rebalanced. Determine how many single and double
rotations are required to balance the tree.

OR

(b) What do you understand by graph traversals? Provide a detailed explanation of the   1
Depth First Traversal algorithm and find all possible traversal order for the
undirected graph given below using Depth First Traversal algorithm.

Un-directed Graph
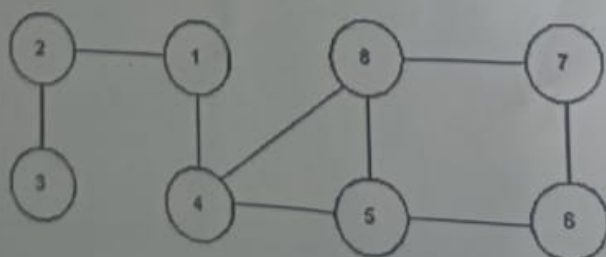
4   (a)   i.   What do you understand by the problem of clustering in hashing? Discuss   6
the methods used to overcome clustering problem with example.

ii.   Given a hash table with a size of 11, and the keys 19, 27, 36, 10, and 64, use   6
quadratic probing to insert each key. The hash function to be used is $h(x) = x$
$mod\ 11$. Show the resulting state of the hash table after all the keys have
been inserted.

OR

(b)   i.   Given the input dataset: 27, 15, 39, 10, 50, 22, 41, apply 3 passes of the   6
quick sort algorithm. What will be the output after these 3 passes? Write the
recurrence equation of quick sort for above input when first element is
selected as pivot.

ii.   Write in short about:
a.   What do you understand by the Greedy Approach of algorithm design?   6
b.   What do you understand by the Dynamic programming Approach of
algorithm design?

5   (a)   Let 'G' be an un-weighted, undirected, connected graph with n-vertices whose   12
adjacency matrix is given by the NxN square matrix.
In which:
1.   All diagonal elements are zero
2.   All Non-diagonal elements are 1's.

Design all possible spanning trees.

OR

(b)   Consider the following undirected, weighted graph: 12
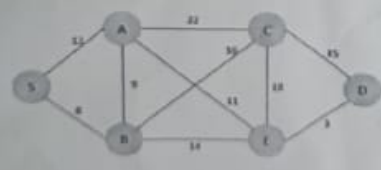
Apply kruskal's algorithm to find the minimum cost spanning tree Also, specify and
explain, the design technique followed by kruskal's algorithm with its time
complexity.

PART B – (40 Marks)

6   Given a sorted linked list with 'n' elements, write a program to insert a new node   8
(new data) into the list with maintaining its sorted order.

7   Let A be a two-dimensional array declared as follows: A[1....10] [1....15] of integers. Assuming that each integer takes one memory locations. The array is stored in row-major order and the first element of array is stored at location 100, what is the address of the element A[i][j]?

8   Write in short about:

i.   Threaded Binary tree.
ii.   Tries Data Structure.

9   Sort the elements 2, 45, 76, 9, 8, 1, 34, 11, 43, 67, and 98 using the heap sort algorithm. Provide a detailed explanation of each step, starting from the heap tree creation, followed by the sequential deletion of elements, and ending with the sorted list.   8

10   Consider the following undirected, weighted graph: 8
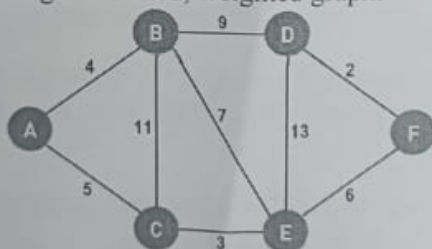
Apply Dijkstra's Algorithm to find the shortest path from source vertex A to the other vertex. Also, specify the design technique followed by Dijkstra's algorithm.

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