SECTION (10 X 10 Marks)
Answer __All__ questions

1. (a) Give asymptotic upper and lower bounds for $T(n) = 16T(n/4)+n^2$. Assume that $T(n)$ is constant for $n \leq 2$. Make your bounds as tight as possible, and justify your answer. (5 marks) [10]

   (b) Is $n^5+4n^3+5= \Omega(n^3)$? Justify your answer. (5 marks)

2. Let S1 and S2 be two stacks of integers. The size of S1 and S2 are n and m respectively. Assume z is an integer. A Set SUM is defined as follows. [10]

   SUM={ x ≤ z: x= y1 + y2, where y1 ∈ S1 and y2 ∈ S2}

   That is, the set *SUM* have integers from two stacks having sum less than or equal to z. Write an algorithm to compute the total number of elements in SUM. For example, your algorithm produces output 3 if Z= 100, S1 = { 60, 90, 120}, and S2 = { 100, 10, 11, 250} .

3. Let L be a doubly linked list and let X and Y be two nodes in the list L. Write an algorithm to produce sum of all keys from Head node of L to the node X and also produce sum of all keys from Last node of L to the node Y in the list L. [10]

4. Given two arrays 'ar1' and 'ar2' of sizes 'm' and 'n' respectively. Let 'x' be a given number. Write an algorithm to find all pairs (ar1[i], ar2[j]) such that the absolute value of (ar1[i] + ar2[j] − x) is minimum, where $1 \leq i \leq m$ and $1 \leq j \leq n$. For example, your algorithm produces output (1, 30) for the input ar1[] = [4, 1, 5, 7], ar2[] = [20, 10, 30, 40] and x = 32 . [10]
   Note: absolute value means $|x| = x$ if $x \geq 0$ or $|x|= -x$ if $x<0$

5. AK tree traversal: The order of visiting of the nodes in given binary tree is based on level of the binary tree. If level of the binary tree is even, then visiting of the nodes takes place from left to right direction in the corresponding level. If the level of the binary tree is odd, then visiting of the nodes takes place from right to left direction in the corresponding level. Write an algorithm to perform AK tree traversal for a given binary tree. [10]

6. Chennai Airport has only one runway for flights to land. Reservations have to be made for landing. When a flight lands, it is removed from the request list. When a plane wants to land, it has to send a request stating its landing time 't'. The request is accepted and added to the request list only if there is no flight scheduled to land before or after 3 minutes of 't'. Identify the suitable data structure to solve the problem and write the algorithm for the same. For example, accepted requests: 25, 29 ,34 ,40,48 . If a new request comes with time slot '37', then denied . If the new request comes with another time slot '44', then it is scheduled in the accepted request. [10]

7. A simple path is a path in graph G=(V,E) which does not have repeating vertices. Write an algorithm to find a simple path in G for given vertices, u and v where u, v ∈ V. Illustrate your algorithm with an example. [10]

8. Extract a Minimum Cost Spanning Tree (MST) for the following given graph. Trace out the Prim's algorithm in obtaining the minimum cost spanning tree and write an algorithm for the same. [10]
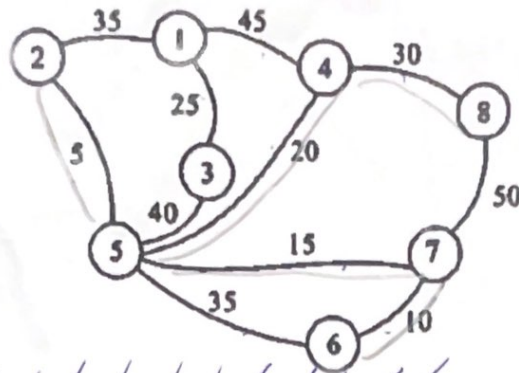
9. Given values {50, 700, 76, 85, 92, 73, 101, 12, 11, 22, 33}, a hash table of size 11 and a hash function h(x) = x mod 11. Show the resultant table after inserting the values in the given order with each of the following collision strategies. [10]
    i) Linear probing   (5 marks)
    ii) Quadratic probing (5 marks)

10. Build an AVL tree using the following keys A,Z,B,Y,C,X,D,W,E,V and F. After the insertion, delete two keys using FIFO (First In First Out) order i.e., first inserted element should be deleted first. Illustrate the insert and delete operations for the given case. Write an algorithm for delete operation for the given case. [10]

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