B.Tech-4th(CSE/IT)

Design and Analysis of Algorithms

Full Marks : 50

Time : $2\frac{1}{2}$ hours

Answer **all** questions

The figures in the right-hand margin indicate marks

Symbols carry usual meaning

1. Answer all questions : 2×5

(*a*) Solve the recurrence $T(n) = 2T\left(\sqrt{n}\right) + \log n$ using master method.

(*b*) The LCS(X, Y) is solved using Bruteforce algothm. If X and Y have m and n number of elements respectively, what will be the time complexity of the Bruteforce algorithm ?

(*c*) Compute the time complexity of Build-max-heap algorithm.

(*d*) Let A1, A2, A3, and A4 be four matrices of dimensions 10×5, 5×20, 20×10, and 10×5, respectively. Find the minimum number of scalar multiplications required to multiply A1A2A3A4 using chain-matrix multiplication method.

(*e*) Define P, NP and NP- Complete problem with examples. Define the relationship P, NP and NP- Complete using venn diagram.

2. (*a*) Consider the following recurrence and obtain the asymptotic bound. 4

$$T(n) = T\left(\sqrt{n}\right) + 1$$

(*b*) Consider the following recurrence and obtain the asymptotic bound using recursion tree method. 4

$$T(n) = 2T\left(n/3\right) + T\left(2n/3\right) + n$$

Or

(*a*) Write the merge sort algorithm. Sort the following elements using merge sort algorithm and calculate the time complexity of the algorithm. 4
Elements: 16, 2, 11, 7, 15, 4

(*b*) Consider the following recurrence and obtain the asymptotic bound using recursion tree method. 4

$$T(n) = 4T(\lfloor n/2 \rfloor) + n$$

3. (*a*) What is matrix chain multiplication problem ? Find the *m* and *s* table computed by the algorithm for the following matrix dimensions
A1: 15X5 A2: 5X25 A3: 25X10 A4:10X4 4

(*b*) What is Divide and Conquer mechanism ? Sort the following elements using quick sort procedure and also calculate the best

case time complexity for n number of elements.
List of elements are 19 17 18 13 12 11 4

Or

(*a*) Write the LCS algorithm and find the longest subsequence between the given string. 4

X= {A B C B D A B}
Y={B D C A B A}

(*b*) What is Activity Selection Problem? Find the solution of Activity Selection Problem for following set of activities. What is the time complexity of it ? 4

i	1	2	3	4	5	6	7	8	9	10	11
S_i	0	5	12	1	5	2	3	3	8	5	6
F_i	6	6	14	4	9	13	8	5	12	7	10

4. (*a*) Consider following instance of 0/1 knapsack problem: number items(n) = 4, Total capacity of knapsack(W) = 8 kg, (w1, w2, w3, w4) = (2,3,4,5), (p1, p2, p3, p4) = (1, 2, 5, 6). Find the optimal cost and find the solution vector space of the objects into the knapsack using tabular method of dynamic programming. 4

(*b*) Consider following instance of knapsack problem: number of items(n) = 5, Total capacity of knapsack(W) = 60 kg, (w1, w2, w3, w4, w5) = (5,10,20,30,40), (p1, p2, p3, p4, p5) = (30, 20, 100, 90, 160). Find the optimal solution for the fractional knapsack problem making use of greedy strategy. 4

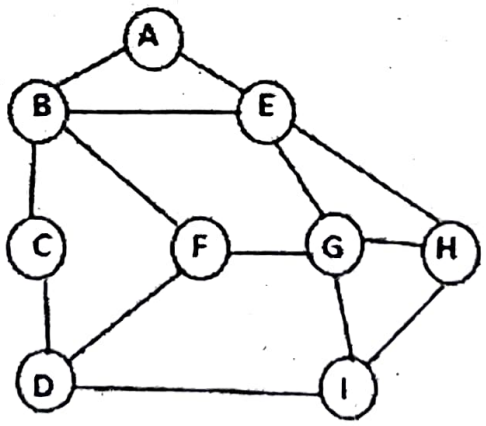
Or

(*a*) Construct a Huffman tree corresponding to the following set of data and find the code length of each character. Find the time complexity of the algorithm. 4

Character	a	b	c	d	e	f
Frequency	5	9	12	13	16	45

(*b*) Write the property of Binary heap. Explain the algorithm to sort the following elements in ascending order using heapsort and calculate the time complexity of heapsort. Elements: 4, 1, 3, 2,16, 9, 10,14,8,7 4

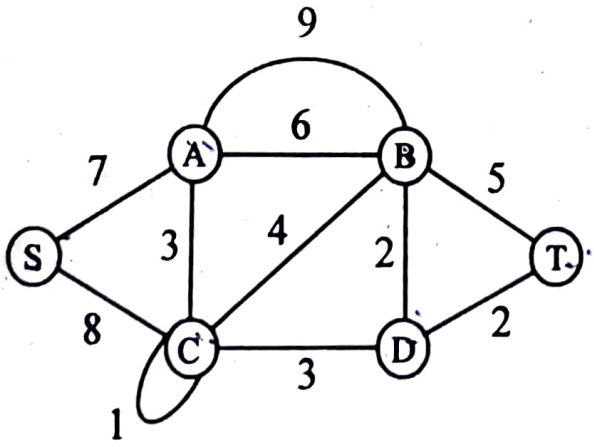
5. (*a*) Write the algorithm of Depth First Search of a graph. Find the DFS of the following graph. Take "A" as the start node. 4



(*b*) Explain Breadth First search with its algorithm and calculate the time complexity of the algorithm. 4

Or

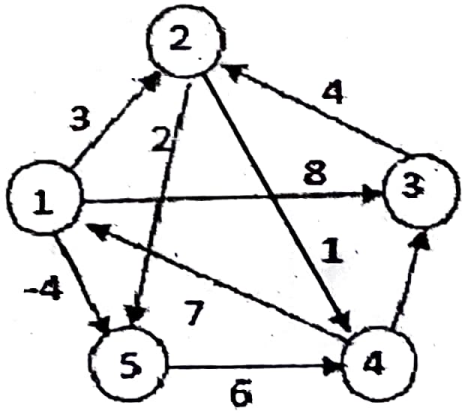
(*a*) What do you mean by spanning tree ? Find the minimum cost spanning tree using Prim's algorithm from the following graph and find the time complexity of the algorithm. 4



(*b*) Write Kurskal algorithm and find the MST for the graph mentioned in *Or* part of Q5(*a*) 4

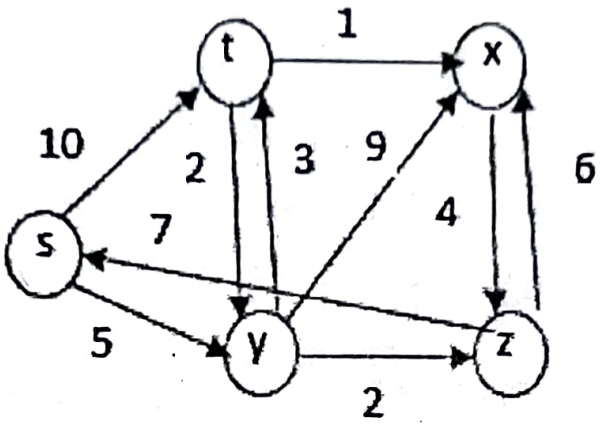
6. (*a*) For the string-matching working module q=11, how many spurious hits does the Rabin-Karp matcher encounter in the text T=31415926535897 93, when looking for the pattern p = 26 ? 4

(*b*) Describe Floyd-warshall algorithm. Apply the same to the following graph which includes edges with negative weights and calculate its time efficiency. 4



Or

(*a*) Write the Dijkstra's algorithm and find the shortest path to all other needs from source *s* of below graph. 4



(*b*) Illustrate the solution of 4-Queens problem using backtracking algorithm. 4
