

Course Code : 2101CS401**Date** : 16-04-2024**Course Name** : Design and Analysis of Algorithm**Duration** : 150 Minutes**Total Marks** : 70**Instructions:**

1. Attempt all the questions.
2. Figures to the right indicates maximum marks.
3. Make suitable assumptions wherever necessary.

Q.1 (A) Demonstrate bucket sort for the sequence: 30, 12, 22, 66, 48, 27, 35, 43, 47, 41. **4****(B)** Define term algorithm. Explain various properties of an algorithm. **3****OR**

Define asymptotic notation and arrange $O(n^3)$, $O(n)$, $O(3^n)$, $O(n!)$, $O(\sqrt{n})$ in increasing order.

(C) Write the bubble sort algorithm with example and derive its best case, worst case, and average case time complexity. **7****OR**

Write the Insertion sort algorithm with example and derive its best case, worst case, and average case time complexity.

Q.2 (A) Solve the following using Master's theorem: **4**

a). $T(n) = 4T(n/2) + n^2$

b). $T(n) = 16T(n/4) + n$

(B) Sort the List "D, A, R, S, H, A, N, U, N, I, V, E, R, S, I, T, Y" in alphabetical order using merge sort. **3****OR**

Solve recurrence equation for $T(n) = T(n-1) + 1$ using substitution method.

(C) Explain Binary search algorithm and demonstrate binary search method to search Key = 14, form the array $A = \langle 2, 4, 7, 8, 10, 13, 14, 60 \rangle$. **7****OR**

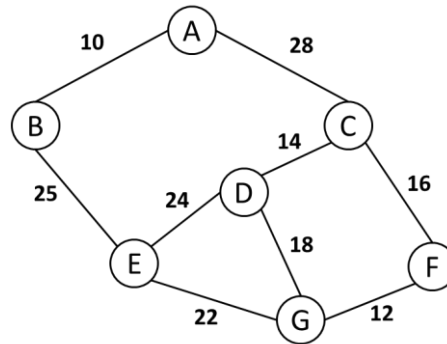
Illustrate the working of the quick sort on input instance: 25, 29, 30, 35, 42, 47, 50, 52, 60. Explain worst and best case of quick sort algorithm.

Q.3 (A) Following are the details of various jobs to be scheduled on multiple processors such that no two processes execute at the same on the same processor. Show schedule of these jobs on minimum number of processors using greedy approach. **4**

Jobs	J1	J2	J3	J4	J5	J6	J7
Start	0	3	4	9	7	1	6
End	2	7	7	11	10	5	8

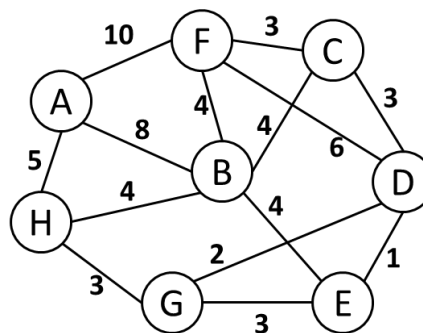
- (B) Illustrate the minimum spanning tree correspond to given graph using Prim's algorithm and find the MST weight:

3



OR

Illustrate the minimum spanning tree correspond to given graph using Krushkal's algorithm and find the MST weight:

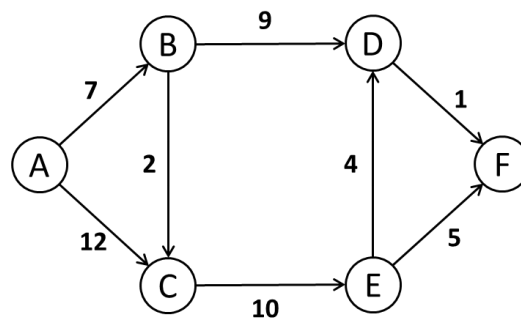


- (C) Construct the Optimal Huffman code for each symbol in following text
ABCCDEBABFFBACBEBDFAAAAABCDEEDCCBFEBFCAE

7

OR

Write Dijkstra's shortest path algorithm and find shortest path from vertex A for given graph.



- Q.4 (A) Given the denominations: $d_1=1$, $d_2=4$, $d_3=6$. Calculate for making change of Rs. 8 using dynamic programming.

4

- (B) Compare Dynamic Programming Technique with Greedy Algorithms.

3

OR

What is Principle of Optimality? Explain its use in Dynamic Programming Method.

- (C) Write algorithm for longest common subsequence and find the LCS for
 $S_1 = [A B C B D A B]$ and $S_2 = [B D C A B A]$.

7

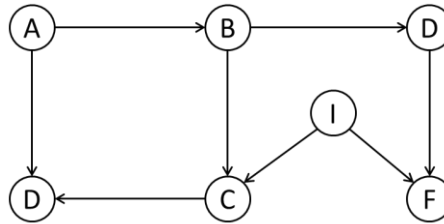
OR

For given matrices of 4×10 , 10×3 , 3×12 , 12×20 and 20×7 , find out the most optimal solution for matrix chain multiplication.

- Q.5 (A)** Define P, NP, NP-complete, NP-Hard problems. Give examples of each. **4**
- (B)** Differentiate BFS and DFS. **3**

OR

Demonstrate Topological sort for the given graph.



- (C)** Explain spurious hits in Rabin-Karp string matching algorithm with example. **7**
Working modulo $q=13$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T = 2359023141526739921$ when looking for the pattern $P = 26739$?

OR

What is N-Queens Problem? Write an algorithm for 4-Queens Problem using Backtracking Method.
