Total No. of Pages- 03

Roll No-.....

4th Semester

B.Tech

END TERM EXAMINATION

MAY-2023

CO208 ALGORITHM DESIGN AND ANALYSIS

Time-3:00 Hours

Max. Marks-50

Note: Answer any 5 Questions.
Write pseudo codes for all algorithms asked.
Assume suitable missing data, if any.

Q1 (a) Write an optimized algorithm to find k largest values from an array of size n. Also discuss about the time and space complexity of the proposed algorithm.
Example: Input: $n = 7$, array = [10, 5, 90, 3, 15, 70, 20], $k = 4$
Output: 15 20 70 90

[6M][CO2]

(b) Using greedy strategies for the fractional knapsack find an optimal profit to the knapsack instance with number of items (n)=7, weight of knapsack (m)=15, profit vector as (10,5,15,7,6,18,3), and weight vector as (2,3,5,7,1,4,1).

[4M][CO3]

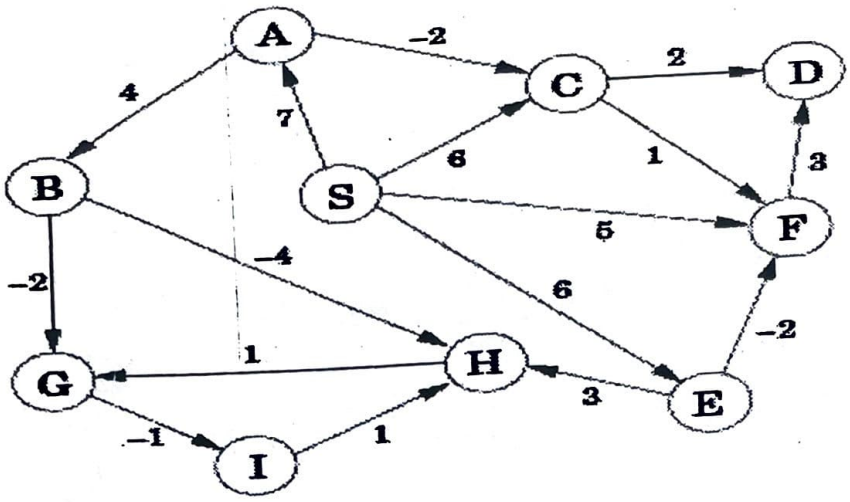
Q 2 (a)Consider an undirected graph $G = (V,E)$ with nonnegative edge weights $w_e >= 0$. Suppose that you have computed a minimum spanning tree of G, and that you have also computed shortest paths to all nodes from a particular node $S \in V$. Now suppose each edge weight is increased by i.e. the new weights are $w'_e = w_e + 1$.

(i) Does the minimum spanning tree change? Give an example where it changes or prove it cannot change.
(ii) Do the shortest paths change? Give an example where they change or prove they cannot change.

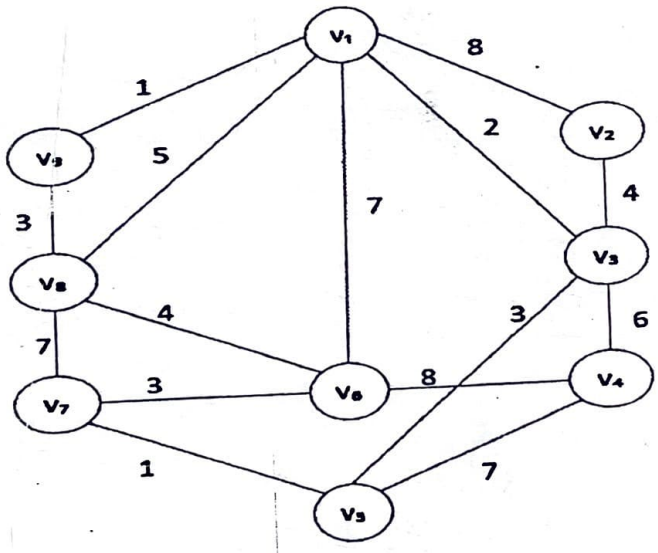
[2+2=4M] [CO4]

(b)Suppose Bellman Ford Algorithm for a single source shortest path problem is run on the following graph. Draw a table showing the intermediate distance values of all the nodes at each iteration of the algorithm and show the final shortest-path tree by taking vertex 'A' as a source vertex.

[CO4] [7M]



Q3.(a) Find the minimum spanning tree of the graph given below using Kruskal's algorithm. Clearly write all steps involved.



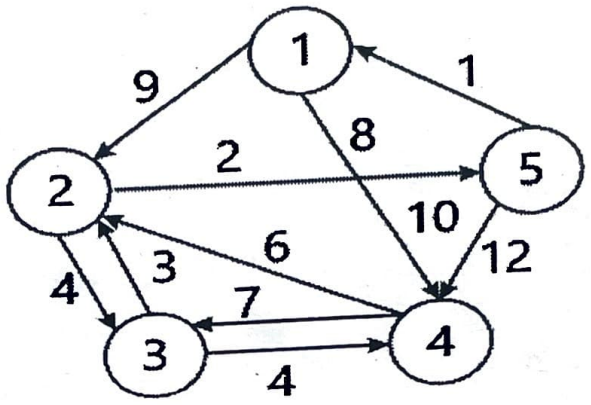
[7M][CO4]

(b) A long string consists of the four characters A, C, G, and T. They appear with frequency 31%, 20%, 9% and 40%, respectively. What is the Huffman encoding of these four characters? [3M] [CO3]

Q4. Using the idea of dynamic programming perform the matrix chain multiplication of four matrices, namely, A, B, C, D with order as 10x5, 5x15, 15x8, 8x20, respectively. Find the minimum number of scalar multiplications needed to parenthesize the matrices and also produce the corresponding parenthesized matrices. [10M][CO5]

Q5. What is travelling salesman problem (TSP)? Find the solution of following travelling salesman problem using branch and bound method. Obtain the reduced cost matrix and the portion of the state space tree that will be generated by LCBB (Least cost branch and bound).

[10M][CO6]



Q6. (a) Given an array of n distinct integers which denotes the denominations and a target integer which denotes the total amount, your task is to write an algorithm using the **Backtracking strategy** which will output all distinct ways of creating the total amount from the given denominations. Also, discuss the time and space complexity of the proposed algorithm.

Example: Denominations = [2, 3, 5], Total amount = 8

Output:

[2, 2, 2, 2]

[2, 3, 3]

[3, 5]

Note that the same denomination can be chosen unlimited number of times. You have to output only the unique combinations, for example, [3,5] and [5,3] are considered equivalent. [8M] [CO6]

(b) What do you mean by optimal substructure and overlapping subproblems in Dynamic programming. [2M] [CO 5]

CO-208

OMOS

The edge from vertex 1 to vertex 4 has weight 8. The edge from vertex 2 to vertex 5 has weight 2. Discard weight 10 from the graph