DPP - 01

CS & IT

Algorithms

Dynamic Programming (DP)

Q1 What is the time complexity of dynamic programming for matrix chain multiplication problem ?

(A) $O(n^2)$ (B) $O(n^3)$

(C) O(nlogn) (D) None of these

Q2 Consider the matrices x, y and z with dimension 10 × 20, 20 × 30 and 30 × 40 respectively. Then what is the minimum number of multiplications required to multiply the matrices ? ________

Q3 What is the length of the LCS for the pair of strings given below

P = ATGACTATAA

Q = GACTAATA

(A) 5 (B) 6

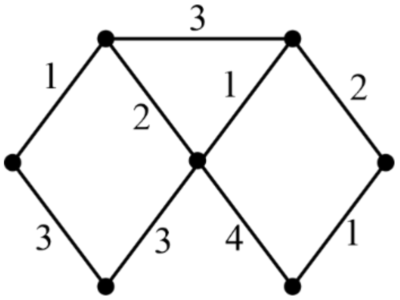
(C) 7 (D) 8

Q4 Consider a connected weighted graph G = (V, E), where |V| = n, |E| = m, if all the edges have distinct positive integer weights, then the maximum number of minimum weight spanning trees in the graph is ?

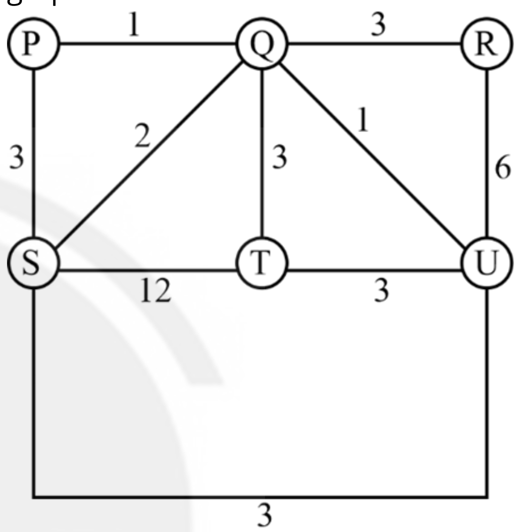
(A) n (B) m

(C) 1 (D) n^{n-2}

Q5 What is the weight of the minimum spanning tree for the graph shown below?



Q6 How many minimum spanning tree does this graph have?



(A) 2 (B) 3

(C) 4 (D) 5

Q7 Consider the following problem with knapsack capacity of 8

Items	Profits	Weights
I_1	13	1
I_2	8	5
I_3	7	3
I_4	3	4

Which of the following item is not selected in the optimal solution of 0/1, knapsack problem?

(A) I1only (B) I2only

(C) I3only (D) I4only

Q8 Consider the following statements:

S_1: for every weighted graph and any two vertices p and q, Bellman ford algorithm starting at p will always return a shortest path to q.

S_2: Dijekstra greedy algorithm for Single source shortest path can be used to solve the all pairs shortest path problem.
Which of the statement is correct?

(A) only S_1
(B) only S_2
(C) Both S_1 and S_2 are true
(D) neither S_1 nor S_2 is true

Answer Key

Q1	B
Q2	18000
Q3	C
Q4	C
Q5	10
Q6	A
Q7	B
Q8	B

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

Time complexity of the matrix chain multiplication problem in dynamic programming approach is $O(n^3)$. Where n is the number of matrices. Because it contains nested loop iterating over the matrix dimension to fill in the optimal costs.

Q2 Text Solution:

Given matrix dimension

x : 10 × 20

y : 20 × 30

z : 30 × 40

Optimal parentification is ((xy)z)

Minimum number of multiplications

= 10 × 20 × 30 + 10 × 30 × 40 = 18000

Q3 Text Solution:

P= A T G A C T A T A A

Q = G A C T A A T A

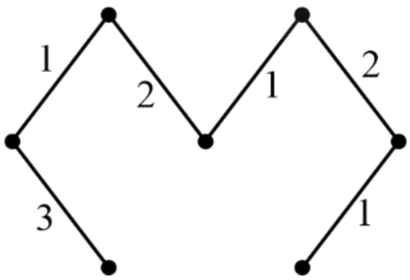
Subsequence 1 = G A C T A T A

Subsequence 2 = G A C T A A A

Q4 Text Solution:

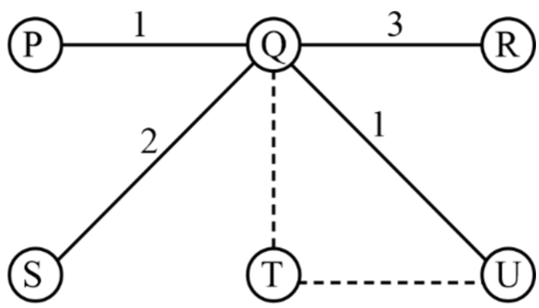
The maximum number of minimum weight spanning tree in a connected weighted graph G(V, E) with |V| = n and |E| = m, where all edges have distinct positive integer weight is 1.

Q5 Text Solution:



1 + 2 + 1 + 2 + 3 + 1 = 10

Q6 Text Solution:



There are 2 dotted lines are the only choices that it has,

Hence are only 2 MST possible here.

Q7 Text Solution:

w = 8(capacity)

Feasible solution

(i) $\{I_1, I_3, I_4\}$

Profit = 13 + 7 +3 = 23

(ii) $\{I_2, I_3\}$

Profit = 8 + 7 = 15

Optimal solution = $\{I_1, I_3, I_4\}$

With the capacity of 8 and maximum profit produced is 23.

I_2 is not selected in the solution.

(b) is correct option.

Q8 Text Solution:

Bellman ford algorithm may not return a shortest path from p to q if there exist -ve edge weight cycle.

S_1 is false.

Dijekstra greedy algorithm for SSSPcan be used to solve the all pairs shortest path problem. **TRUE**