

# CS & IT ENGINEERING

Algorithms

'Dynamic Programming' & 'Graph  
Algorithm'

**DPP Discussion** Notes



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A stylized laptop icon with a blue screen and an orange base. The screen displays the text 'TOPICS TO BE COVERED'.

# TOPICS TO BE COVERED

A dashed orange line with an arrow pointing from the laptop screen to the '01 Question' box.

**01 Question**

A dashed orange line with an arrow pointing from the laptop screen to the '02 Discussion' box.

**02 Discussion**

Q.1

What is the time complexity of dynamic programming for matrix chain multiplication problem? [MCQ]



- A.  $O(n^2)$
- B.  $O(n^3)$
- C.  $O(n \log n)$
- D. None of these

Handwritten notes illustrating the time complexity of matrix chain multiplication using Dynamic Programming (DP):

- A sequence of matrices is shown:  $[ \dots (1, n) \dots ]$ .
- The complexity for multiplying two matrices is noted as  $1 \cdot n^2$ .
- The overall time complexity is calculated as  $n \times n^2 = n^3$ .
- The final result is boxed as  $O(n^3)$ .
- A note states: "w/o DP = TC =  $O(n^3)$ ".
- A note states: "S.C =  $n + n = O(n)$ ".

Q.2



Consider the matrices  $x$ ,  $y$  and  $z$  with dimension  $10 \times 20$ ,  $20 \times 30$ ,  $30 \times 40$  respectively. Then what is the minimum number of multiplications required to multiply the matrices? [NAT]

18000

$$\begin{array}{l} x = 10 \times 20 \\ y = 20 \times 30 \\ z = 30 \times 40 \end{array} \begin{array}{l} \searrow 10 \times 30 \\ \searrow 20 \times 40 \end{array}$$

$(x \ y \ z)$

$(x \ y) \ z$   
 $10 \times 30 \ 30 \times 40$

$$\begin{array}{r} + \ 10 \times 20 \times 30 = 6000 \\ \quad 10 \times 30 \times 40 = 12000 \\ \hline 18000 \end{array}$$

$x \ (y \ z)$   
 $10 \times 20 \ 20 \times 40$

$$\begin{array}{r} 20 \times 30 \times 40 = 24000 \\ + \ 10 \times 20 \times 40 = 8000 \\ \hline 32000 \end{array}$$

Q.3

What is the length of the LCS for the pair of subsequences given below.

P = ATGACTATAA

Q = GACTAATA

[MCQ]

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

A.

5

B.

6

C.

7

D.

8



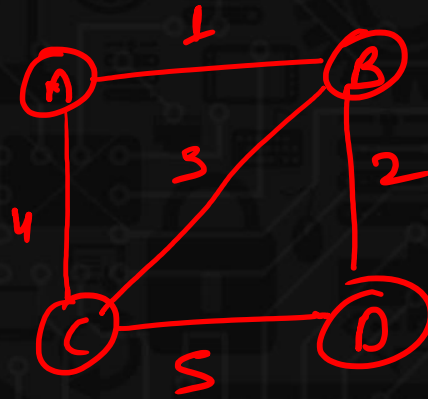
Q.4



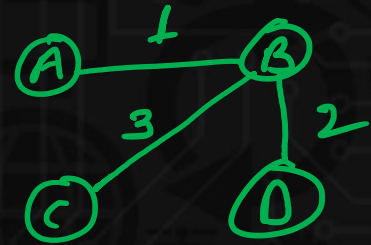
Consider a connected weighted graph  $G = (V, E)$ , where  $|V| = n$ ,  $|E| = m$ , if all the edges have distinct positive integer weights, then the maximum number of minimum weight spanning trees in the graph is ?

[MCQ]

- A.  $n$
- B.  $m$
- ☒ C. 1
- D.  $n^{n-2}$



$$|V| = 4$$
$$|E| = 5$$

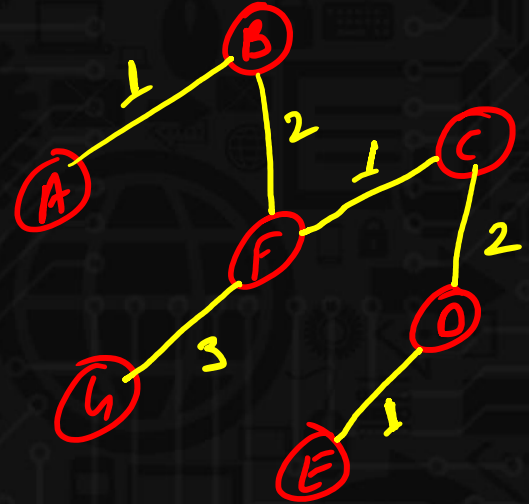
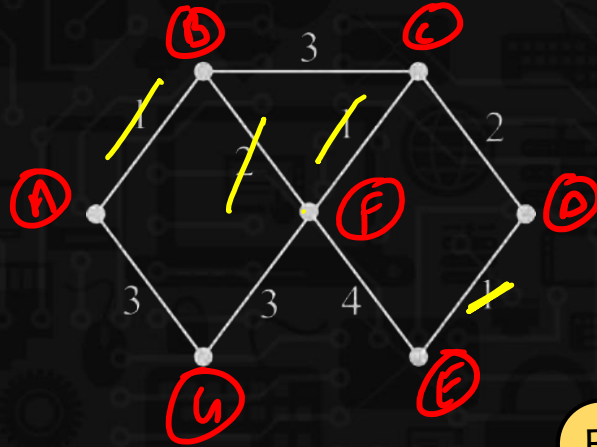


$\{ n \text{ vertices } \}$   
 $\{ (n-1) \text{ edges } \}$  MST



Q.5

What is the weight of the minimum spanning tree for the graph shown below? [MCQ]



$$\begin{array}{r} 1 + 1 + 1 + 2 + 2 + 3 \\ \hline 10 \end{array}$$

A. 7

C. 9

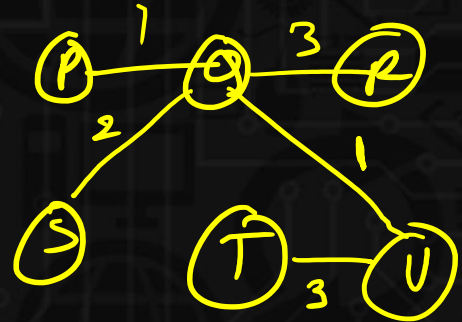
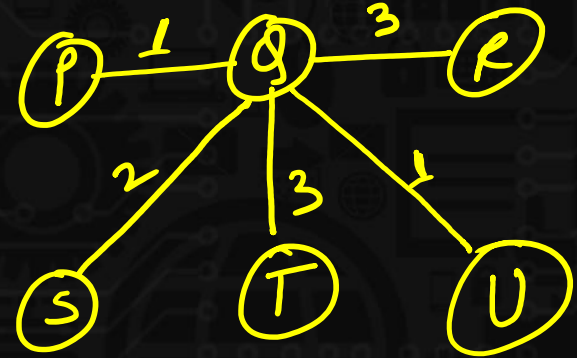
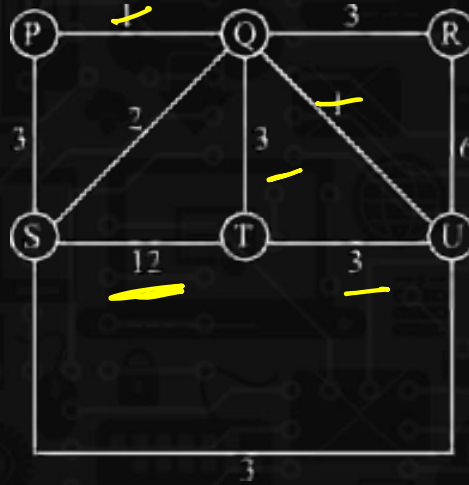
B. 8

☒ D. 10

Q.6

How many minimum spanning tree does this graph have?

[MCQ]



A.

2

C.

4

B.

3

D.

5



Q.7

Consider the following problem with knapsack capacity of 8



| Items  | Profits | Weights |
|--|---------|---------|
| <input checked="" type="checkbox"/> I <sub>1</sub> | 13      | 1       |
| <input checked="" type="checkbox"/> I <sub>2</sub> | 8       | 5       |
| <input checked="" type="checkbox"/> I <sub>3</sub> | 7       | 3       |
| <input checked="" type="checkbox"/> I <sub>4</sub> | 3       | 4       |

weight = 8

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

[MCQ]

Profit = 23

A. I<sub>1</sub> only

☒ B. I<sub>2</sub> only

C. I<sub>3</sub> only

D. I<sub>4</sub> only

$$I_1 - 13 \quad 1$$

$$I_2 - 8 \quad 5$$

$$I_3 - 7 \quad 3$$

$$I_4 - 3 \quad 4$$

$$S, 3 = 8 + 7 = 15$$

$$\underline{1, 3, 4} = 13 + 7 + 3 = 23$$

Q.8



Consider the following statements

S1: 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. *In correct.*

S2: At the termination of Bellman ford algorithm even if graph has negative weight cycle, correct shortest path is found for vertex for which shortest path is well-defined. *Incorrect*

[MCQ]

Which of the statement is correct?

A.

only S1

B.

only S2

C.

Both S1 and S2 are true

D.

~~neither S1 nor S2 is true~~

Before solve DPP  
 revision notes at least once  
 Numerical of class

$DPP \rightarrow WT \rightarrow PYQ$   
 $\downarrow$   
 $TS$

