Branch : CSE/IT Batch : Hinglish

WEEKLY TEST – 05

Subject : Algorithms

Topic : Dynamic Programming

Maximum Marks 12

Q.1 to 4 Carry ONE Mark Each

[MCQ]

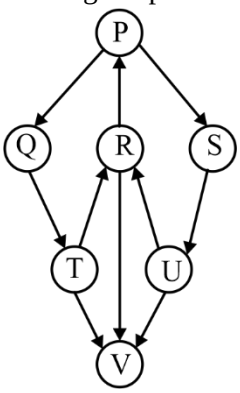
1. What is the running time of a efficient algorithm for finding the shortest path between two vertices in a directed graph? (Assume that all edges are having equal weights, V is set of vertices and E is set of edges)

(a) |V| log |E| (b) |V|

(c) O(|V| + |E|) (d) None of these

[NAT]

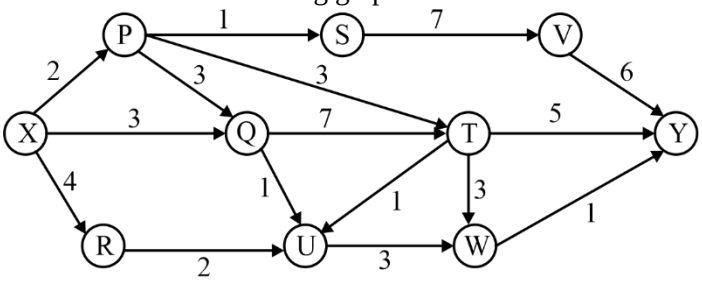
2. Consider the following Graph G:



Apply DFS on G starting at vertex P and selection of adjacent vertex in DFS divided by the Lexicographical order in Graph G, Q and S are adjustment to P. First it selects Q because Q comes first in Lexicographical order. Then what is the number of cross edge when the DFS performed on G is _____.

[NAT]

3. Consider the following graph G



The minimum distance from X to Y is _____ (where X is source and Y is destination)

[MCQ]

4. Consider two strings, S = "AGGTCAK" and T = "GTCACAK". What is the length of the Longest Common Subsequence (LCS) between these two strings?

(a) 2 (b) 3

(c) 4 (d) 5

Q.5 to 8 Carry TWO Mark Each

[MSQ]

5. Which of the following statements is/are false?

(a) In an undirected graph, the shortest path between two nodes always lies on some minimum spanning tree

(b) If every edge of the graph has distinct weight, then highest weight spanning tree is unique.

(c) In Huffman coding, the item with the second lowest probability is always at the leaf that is farthest from the root

(d) in Huffman coding, the item with the highest probability is always at a leaf that is the child of the root.

[MCQ]

6. Consider the statements

S1: Starting from vertex V_0 in a graph, the time required by DFS to find a path (if exists) to some vertex V is less than that is required by BFS.

S2: The space required by DFS is less than that is required by BFS

Which of the following statement is true

(a) Only S1 (b) Only S2

(c) Both S1 and S2 (d) Neither S1 Nor N2 is true

[MCQ]

7. Consider the following matrices with given dimensions

x_1 is 4×6

x_2 is 6×8

x_3 is 8×4

x_4 is 4×5

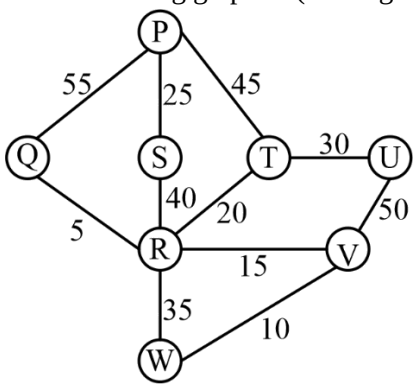
Which of the following multiplication order gives optimal solution.

(a) $((x_1x_2)x_3)\ x_4$ (b) $(x_1\ (x_2\ x_3))\ x_4$

(c) $x_1((x_2\ x_3)\ x_4)$ (d) $(x_1\ x_2)(x_3\ x_4)$

[NAT]

8. Consider the following graph G (starting from P)



The cost of minimum cost spanning tree is _____.

Answer Key

1. **(c)**
2. **(2 to 2)**
3. **(8 to 8)**
4. **(d)**
5. **(a, d)**
6. **(a)**
7. **(b)**
8. **(145 to 145)**

Hints and Solutions

1. (c)

Using BFS by treating all edges as unweighted, it takes O (|V| + |E|) time

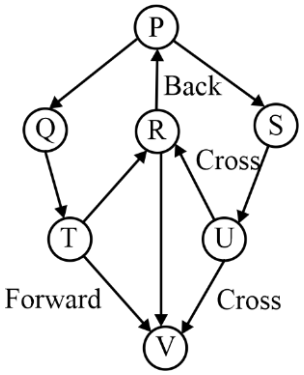
2. (2 to 2)

2 Cross edges in G

1 forward edge in G

1 backward edge in G

∴ Total number of cross edges = 2



3. (8 to 8)

X ⟶ Q ⟶ U ⟶ W ⟶ Y

Minimum distance = 3 + 1 + 3 + 1 = 8

4. (d)

The given strings are S = "AGGTCAK" and T = "GTCACAK". The Longest Common Subsequence (LCS) is the longest sequence of characters that appears in both strings in the same order.

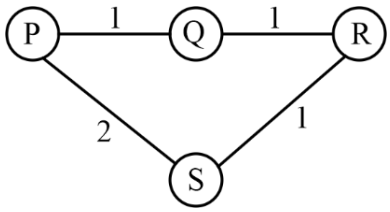
Looking at the strings, we can identify the LCS: "GTCAK". The length of this LCS is 5.

So, the correct answer is d

5. (a, d)

(a) False

Eg:



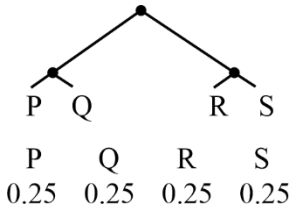
Shortest path: P → S

(b) True: Just by taking negative weight and applying prims' and Kruskal's we get unique weight which is also unique MST.

(c) True: we choose lowest and 2nd lowest for the farther leaves

(d) False:

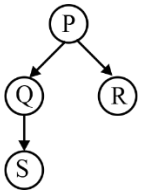
Eg:



6. (a)

Eg:

S1:



P → Q → S → R

Here DFS takes more time

For P to R

BFS → P → Q → R

When far from root → DFS

Near root → BFS

S2: DFS space complexity → O(n) height of graph

BFS space complexity → O(w) → width of graph

Both are unrelated Hence it is false

∴ Only S1 is true

7. (b)

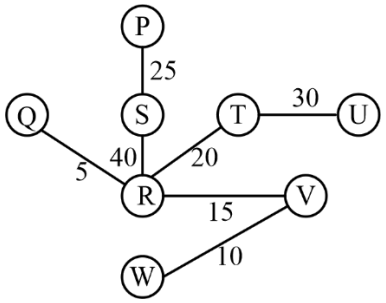
(a) $((x_1x_2)x_3)\ x_4$ required $(4 \times 6 \times 8 + 4 \times 8 \times 4 + 4 \times 4 \times 5) = 400$ multiplications

(b) $(x_1\ (x_2\ x_3))\ x_4$: requires $(6 \times 8 \times 4 + 4 \times 6 \times 4 + 4 \times 4 \times 5) = 368$ multiplications

(c) $x_1((x_2\ x_3)\ x_4$ requires $(6 \times 8 \times 4 + 6 \times 4 \times 5 + 4 \times 6 \times 5) = 432$ multiplications

(d) $(x_1\ x_2)(x_3\ x_4)$ requires $4 \times 6 \times 8 + 8 \times 4 \times 5 + 4 \times 8 \times 5 = 512$ multiplication

8. (145 to 145)



5 + 10 + 15 + 25 + 30 + 40 = 145