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Answer :-

Q17 $m[i, w] = \max\{m[i-1, w],\ m[i-1, w-w[i]] + p[i]\}$

capacity = 6

item	P_i	W_i	i ↓ / w →	0	1	2	3	4	5	6
			0	0	0	0	0	0	0	0
1	30	3	1	0	0	0	30	30	30	30
2	25	2	2	0	0	25	30	30	55	55
3	30	4	3	0	0	25	30	30	55	55
4	20	2	4	0	0	25	30	45	55	55
5	35	1	5	0	35	35	55	55	80	90

X_1	X_2	X_3	X_4	X_5
1	1	0	0	1
30	↓ 55			↓ 90

$55 - 25 = 30$ $90 - 35 = 55$

item	weight	Value
5	1	35
2	2	20
1	3	30
	6	90

Therefore, Maximum Profit is 90.

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Q2.)

	1	2	3	4
Keys	A	B	C	D
Frequency	0.5	0.3	0.2	0.2

in an optimal Binary Tree,

$$c[i,j] = \min[c(i,k-1) + c(k+1,j)] + \sum_{s=1}^{j} P_s$$

i \ j	0	1	2	3	4
1	0	0.5	1.1	1.7	2.3
2		0	0.3	0.7	1.2
3			0	0.2	0.6
4				0	0.2
5					0

i \ j	0	1	2	3	4
1	0	1	1	1	2
2		0	2	2	3
3			0	3	3
4				0	4
5					0

By Putting in above, we find the above value;

$c(1,2)$ $k=1$ $c(1,0) + c(2,2)$

$0 + 0.3 = 0.3$

$k=2$ $c(1,1) + c(3,2)$

$0.5 + 0 = 0.5$

$= 0.3 + 0.8$

$= 1.1$

$c(2,3)$ $k=2$ $c(2,1) + c(3,3)$

$0 + 0.2 = 0.2$

$k=3$ $c(2,2) + c(4,3)$

$0.3 + 0 = 0.3$

$= 0.2 + 0.5$

$= 0.7$

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$C(3,4)$ $k=3$, $C(3,2)+C(4,4)$
$= 0 + 0.2 = 0.2$

$k=4$, $C(3,3) + C(5,4)$
$= 0.2 + 0 = 0.2$

$= 0.2 + 0.4$
$= 0.6$

$C(1,3)$

$k=1$, $C(1,0) + C(2,3)$
$= 0 + 0.7$

$k=2$, $C(1,1) + C(3,3)$
$0.5 + 0.2 = 0.7$

$k=3$, $C(1,2) + C(4,3)$
$= 1.1 + 0 = 1.1$

$= 0.7 + 1.0$
$= 1.7$

$C(2,4)$ $k=2$, $C(2,1) + C(3,4)$
$0 + 0.6 = 0.6$

$k=3$, $C(2,2) + C(4,4)$
$= 0.3 + 0.2 = 0.5$

$k=4$, $C(2,3) + C(5,4)$
$= 0.7 + 0 = 0.7$

$= 0.5 + 0.7$
$= 1.2$

$C(1,4)$, $k=1$, $C(1,0) + C(2,4)$
$= 0 + 1.2 = 1.2$

$k=2$, $C(1,1) + C(3,4)$
$= 0.5 + 0.6 = 1.1$

$k=3$, $C(1,2) + C(4,4)$
$= 1.1 + 0.2 = 1.3$

$k=4$, $C(1,3) + C(5,4)$
$= 1.7 + 0 = 1.7$

$= 1.1 + 1.2$
$= 2.3$

We can verify the final Binary tree,

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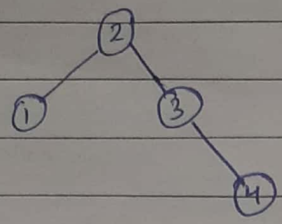
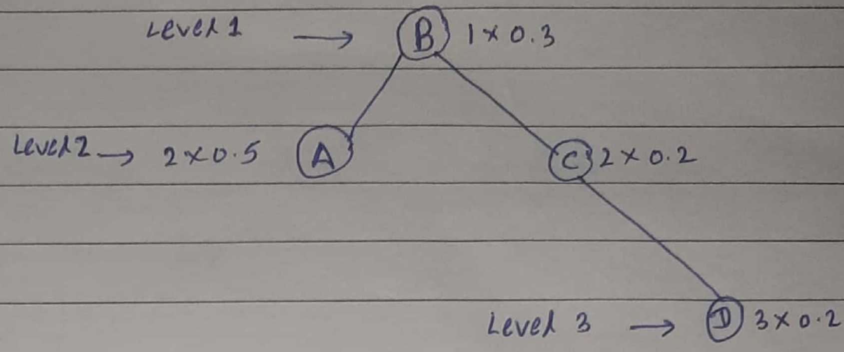
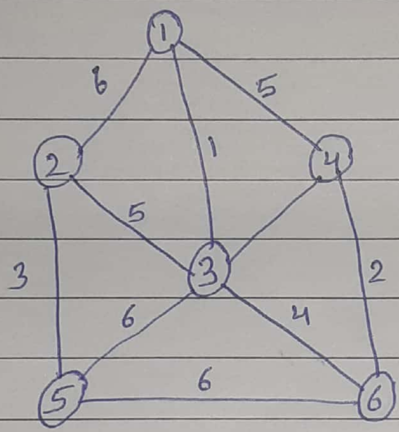




Total = 2.3

Q3.7



n - vertices => n-1 = edges

By Prims algorithm

V = { 1, 2, 3, 4, 5, 6 }

	1	2	3	4	5	6
1	0	6	1	5	∞	∞
2	6	0	5	∞	3	∞
3	1	5	0	5	6	4
4	5	∞	5	0	∞	2
5	∞	3	6	∞	0	6
6	∞	∞	4	2	6	0

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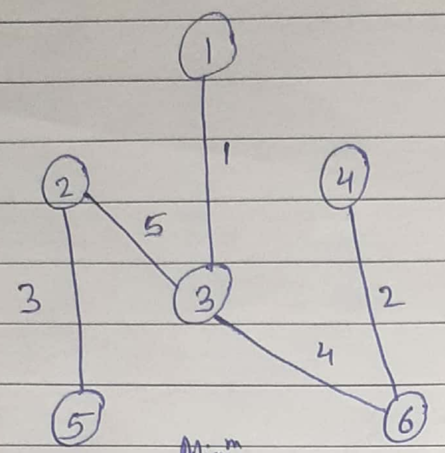

$1 + 2 + 3 + 5 + 4$
$= 15$

Final Min^m Spanning Tree (MST)

∴ Total weight of MST is 15

Q 4.) To find the sequence and minimum number of multiplication required to multiply the given matrices is as follows :-

$$m[i,j] = \min\{ m[i,k] + m[k+1,j] + d_{i-1} + d_k + d_j \}$$

M_1	M_2	M_3	M_4
2×4	4×3	3×3	3×2

Step ⇒ 1,

$M[1,1] = M[2,2] = M[3,3] = M[4,4] = 0$

i \ j	1	2	3	4
1	0	24	42	54
2		0	36	42
3			0	18
4				0

	1	2	3	4
1	1	2	2	2
2		2	2	2
3			3	3
4				4

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Step ⇒ 2

M[1,2]	M[2,3]	M[3,4]
$= M_1 . M_2$	$= M_2 . M_3$	$= M_3 . M_4$
$= 2 \times 4 \times 3$	$= 4 \times 3 \times 3$	$= 3 \times 3 \times 2$
M[1,2] = 24	M[2,3] = 36	M[3,4] = 18

Step ⇒ 3 M[1,3], we have to multiply 3 Matrices then,

(i) A.(B.C)	(ii) (A.B).C
$M_1 . (M_2 . M_3)$	$(M_1 . M_2) . M_3$
$= M[1,1] + M[2,3] + 2 \times 4 \times 3$	$= M[1,2] + M[2,3] + 2 \times 3 \times 3$
$= 0 + 36 + 24 = 60$	$= 24 + 0 + 18$
	$= 42$

$M[1,3] = \min(m_1.(m_2.m_3), (m_1.m_2).m_3) = 42$

Step ⇒ 4 M[2,4]

$= M_2 . (M_3 . M_4) = B.(C.D)$	$(B.C).D = (M_2 . M_3) . M_4$
$= M[2,2] + [3,4] + 4 \times 3 \times 2$	$= M[2,3] + M[4,4] + 3 \times 2 \times 4$
$= 0 + 18 + 24 = 42$	$= 36 + 0 + 24 = 60$

$M[2,4] = \min(42, 60) = 42$

Step ⇒ 5 M[1,4] = A.B.C.D

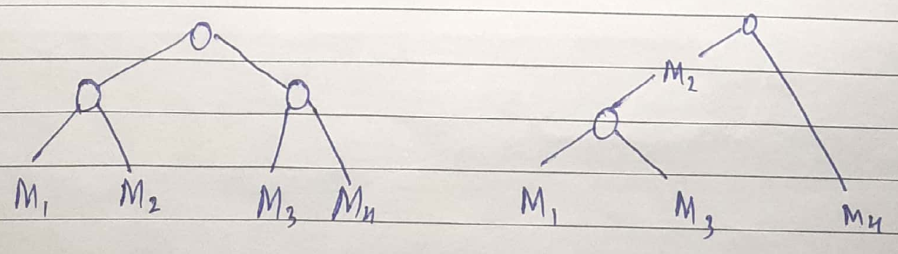
A.(B.C.D)	(A.B).(C.D)	(A.B.C).D
$M[1,1] + M[2,4] + 2 \times 4 \times 2$	$M[1,2] + M[3,4] + 2 \times 3 \times 2$	$M[1,3] + M[4,4] + 2 \times 3 \times 2$
$= 58$	$= 54$	$= 54$

M[1,4] = 54

∴ Minimum Number of Multiplication required = 54

The Sequence is

1.) $(M_1 . M_2) . (M_3 . M_4) = 54$ 2.) $(M_1 . M_2 . M_3) . M_4 = 54$



Q5.> in Longest Common Sequence (LCS),
if $(x[i] == y[j]$, $c[i][j] = 1 + c[i-1][j-1]$;
Otherwise $c[i][j] = \max^m(c[i][j-1], c[i-1][j])$

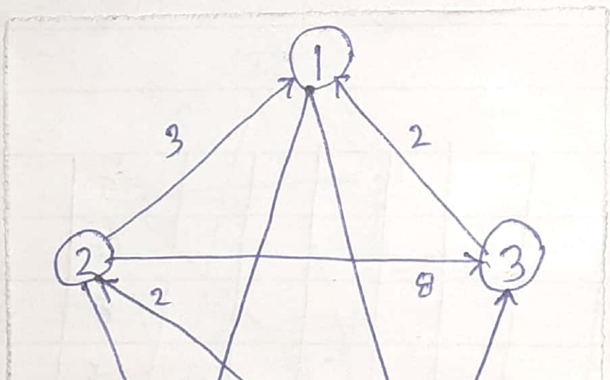
j →
↓ i

		P	R	E	P	A	R	A	T	I	O	N
	0	0	0	0	0	0	0	0	0	0	0	0
P	0	1	1	1	1	1	1	1	1	1	1	1
R	0	1	2	2	2	2	2	2	2	2	2	2
O	0	1	2	2	2	2	2	2	2	2	3	3
P	0	1	2	2	3	3	3	3	3	3	3	3
E	0	1	2	3	3	3	3	3	3	3	3	3
R	0	1	2	3	3	3	4	4	4	4	4	4
T	0	1	2	3	3	3	4	4	5	5	5	5
I	0	1	2	3	3	3	4	4	5	6	6	6
E	0	1	2	3	3	3	4	4	5	6	6	6
S	0	1	2	3	3	3	4	4	5	6	6	6

∴ Value of LCS = 6

Sequence = PRERTI

Q6.> To find the all pairs of shortest path using Floyd Warshall in a given graph is given below :-



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$$A^k[i,j] = \min\{A^{k-1}[i,j],\ A^{k-1}[i,k] + A^{k-1}[k,j]\}$$

$$D_0 = \begin{array}{cc} & \begin{matrix}1 & 2 & 3 & 4 & 5\end{matrix} \\ \begin{matrix}1\\2\\3\\4\\5\end{matrix} & \begin{bmatrix} 0 & 3 & 8 & \infty & -4 \\ \infty & 0 & \infty & 1 & 7 \\ \infty & 2 & 0 & \infty & \infty \\ 2 & \infty & -5 & 0 & \infty \\ \infty & \infty & \infty & 2 & 0 \end{bmatrix}\end{array}$$

$$D_1 = \begin{array}{cc} & \begin{matrix}1 & 2 & 3 & 4 & 5\end{matrix} \\ \begin{matrix}1\\2\\3\\4\\5\end{matrix} & \begin{bmatrix} 0 & 3 & 8 & \infty & -4 \\ \infty & 0 & \infty & 1 & 7 \\ \infty & 2 & 0 & \infty & \infty \\ 2 & 5 & -5 & 0 & -2 \\ \infty & \infty & \infty & 2 & 0 \end{bmatrix}\end{array}$$

$$D_2 = \begin{array}{cc} & \begin{matrix}1 & 2 & 3 & 4 & 5\end{matrix} \\ \begin{matrix}1\\2\\3\\4\\5\end{matrix} & \begin{bmatrix} 0 & 3 & 8 & 4 & -4 \\ \infty & 0 & \infty & 1 & 7 \\ \infty & 2 & 0 & 3 & 9 \\ 2 & 5 & -5 & 0 & -2 \\ \infty & \infty & \infty & 2 & 0 \end{bmatrix}\end{array}$$

$$D_3 = \begin{array}{cc} & \begin{matrix}1 & 2 & 3 & 4 & 5\end{matrix} \\ \begin{matrix}1\\2\\3\\4\\5\end{matrix} & \begin{bmatrix} 0 & 3 & 8 & 4 & -4 \\ \infty & 0 & \infty & 1 & 7 \\ \infty & 2 & 0 & 3 & 9 \\ 2 & -3 & -5 & 0 & -2 \\ \infty & \infty & \infty & 2 & 0 \end{bmatrix}\end{array}$$

$$D_4 = \begin{array}{cc} & \begin{matrix}1 & 2 & 3 & 4 & 5\end{matrix} \\ \begin{matrix}1\\2\\3\\4\\5\end{matrix} & \begin{bmatrix} 0 & 1 & -1 & 4 & -4 \\ 3 & 0 & -4 & 1 & -1 \\ 5 & 0 & 0 & 3 & 1 \\ 2 & -3 & -5 & 0 & -2 \\ 4 & -1 & -3 & 2 & 0 \end{bmatrix}\end{array}$$

$$D_5 = \begin{array}{cc} & \begin{matrix}1 & 2 & 3 & 4 & 5\end{matrix} \\ \begin{matrix}1\\2\\3\\4\\5\end{matrix} & \begin{bmatrix} 0 & -5 & -7 & -2 & -4 \\ 3 & 0 & -4 & 1 & -1 \\ 5 & 0 & 0 & 3 & 1 \\ 2 & -3 & -5 & 0 & -2 \\ 4 & -1 & -3 & 2 & 0 \end{bmatrix}\end{array}$$

$\therefore$ D_5 is having all pairs of shortest path using Floyd Warshall Algorithm.

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