⑤ What are the collapsing rules? Solve by considering the instance: weights are, W: {10, 15, 6, 9}, profits {2, 5, 8, 1}. The knapsack capacity is 25.

2 5 8 1

10 15 6 9

Purging Rule (Dominance Rule):-

If S^{i+1} contains (P_j, W_j) and (P_k, W_k) such that $P_j <= P_k$ and $W_j >= W_k$, then (P_j, W_j) can be eliminated. (remove object with less profit and more weight).

Initially $S^0 = \{(0,0)\}$ i.e. $P=0, W=0$.

$S_1^0 = \{(0+2, 0+10)\} = \{(2,10)\}$

$S^1 = \{S^0 \cup S_1^0\} = \{(0,0), (2,10)\}$

$S_1^1 = \{(0+5, 0+15), (2+5, 10+15)\} = \{(5,15), (7,25)\}$

$S^2 = \{S^1 \cup S_1^1\} = \{(0,0), (2,10), (5,15), (7,25)\}$

$S_1^2 = \{(0+8, 0+6), (2+8, 10+6), (5+8, 15+6), (7+8, 25+6)\}$

$= \{(8,6), (10,16), (13,21), (15,31)\}$

$S^3 = \{S^2 \cup S_1^2\} = \{(0,0), (2,10), (5,15), (7,25), (8,6),$
$(10,16), (13,21), (15,31)\}$

exceeding knapsack capacity.

tuple (15,31) eliminated due to exceeding knapsack capacity.

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↳ By applying Purging rule $(7,25), (8,6) \longrightarrow (7,25)$ is eliminated.

$\therefore S^3 = \{(0,0), (2,10), (5,15), (8,6), (10,16), (13,21)\}$

By applying Purging rule on $(5,15), (8,6)$

↳ $(5,15)$ is eliminated

$S^3 = \{(0,0), (2,10), (8,6), (10,16), (13,21)\}$

By applying Purging rule on $(2,10), (8,6)$

↳ $(2,10)$ is eliminated

$S^3 = \{(0,0), (8,6), (10,16), (13,21)\}$

$S_1^3 = \{(0+1, 0+9), (8+1, 6+9), (10+1, 16+9), (13+1, 21+9)\}$

$= \{(1,9), (9,15), (11,25), (14,30)\}$

$S^4 = \{S^3 \cup S_1^3\}$

$= \{(0,0), (1,9), (8,6), (9,15), (10,16), (11,25), (13,21), (14,30)\}$

By applying Purging rule on $(1,9), (8,6) \Rightarrow (1,9)$ is eliminated.

$S^4 = \{(0,0), (8,6), (9,15), (10,16), (11,25), (13,21), (14,30)\}$

By applying Purging rule on $(11,25), (13,21)$

$\Rightarrow (11,25)$ is eliminated.

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$S^4 = \{(0,0), (8,6), (9,15), (10,16), (13,21), (14,30)\}$

$(14,30)$ → exceeding knapsack capacity

$\therefore S^4 = \{(0,0), (8,6), (9,15), (10,16), (13,21)\}$

The last tuple in S^4 is $(13,21)$ $\quad (13,21) \in S^3$ so $x_4 = 0$

$(13,21) \notin S^2 \Rightarrow x_3 = 1$

$(13,21)$ came from $(5,15)$. $\quad (5,15) \in S^2$

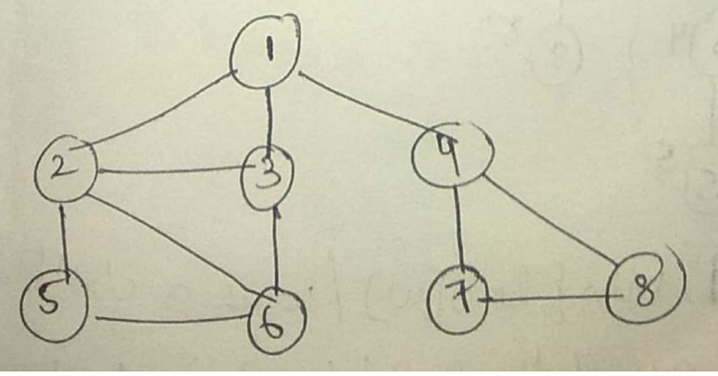
$(5,15) \notin S^1 \Rightarrow x_2 = 1$

$(5,15)$ came from $(0,0)$ $\quad (0,0) \in S^1$ and $(0,0) \in S^0$

$\Rightarrow x_1 = 0$

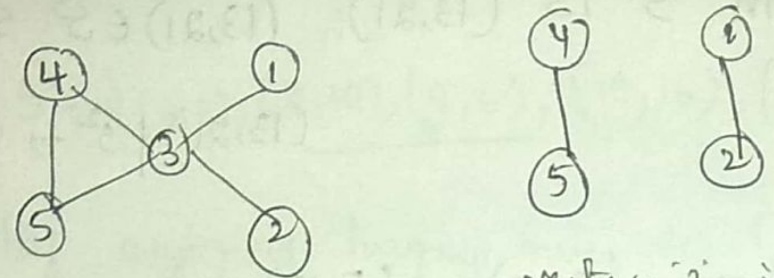
$\therefore$ optimal solution is $(x_1, x_2, x_3, x_4) = (0,1,1,0)$.

(6) Define biconnected component, articulation point. With the help of algorithm identify the articulation point & draw the biconnected components of the given graph.



Articulation point:- A vertex 'v' in a connected graph 'G' is an articulation point iff, the deletion of vertex 'v' together with all edges incident to 'v' disconnects the graph into two or more non empty components.

Ex:

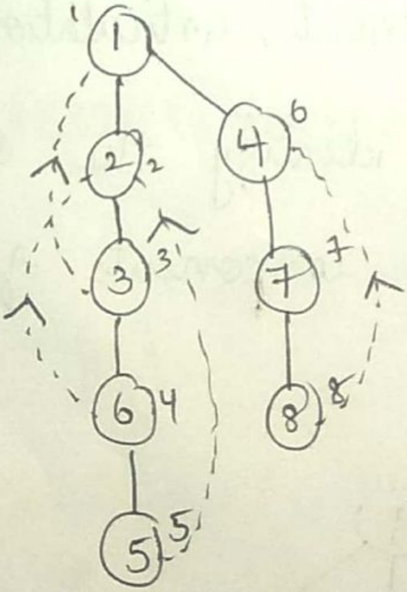


vertex '3' is an articulation point

→ Two Biconnected components can have atmost one common vertex and that vertex is an articulation point.

→ A maximal biconnected subgraph of given graph is called as biconnected component.

step ① & ②



low[u] = min{ dfn[u], min{ low[w] / w is a child of 'u'}, min{dfn[v] / (u,v) is back edge}}

u —— w

vertex	8	7	4	5	6	3	2	1
dfn	8	7	6	5	4	3	2	1
low	6	6	6	2	2	1	1	1

$low[8] = \min\{dfn[8], \min\{\underbrace{-}_{\text{no child}}\}, \min\{\underbrace{dfn[4]}_{6}\}\}$ (8-4) → backedge

$= \min\{8, -, 6\}$

$= \boxed{6}$

$low[7] = \min\{dfn[7], \min\{\underbrace{low[8]}_{6}\}, \min\{-\}\}$

$= \min\{7, 6, -\}$

$= \boxed{6}$

$low[4] = \min\{dfn[4], \min\{\underbrace{low[7]}_{6}\}, \min\{-\}\}$

$= \min\{6, 6, -\}$

$= \boxed{6}$

$low[5] = \min\{dfn[5], \min\{-\}, \min\{\underbrace{dfn[2]}_{2}\}\}$

$= \min\{5, -, 2\}$

$= \boxed{2}$

$low[6] = \min\{dfn[6], \min\{\underbrace{low[5]}_{2}\}, \min\{\underbrace{dfn[2]}_{2}\}\}$

$= \min\{4, 2, 2\} = \boxed{2}$

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$$low[3] = \min\{dfn[3], \min\{\underbrace{low[6]}_{2}\}, \min\{\underbrace{dfn[1]}_{1}\}\}$$

$$= \min\{3, 2, 1\}$$

$$= \boxed{1}$$

$$low[2] = \min\{dfn[2], \min\{\underbrace{low[3]}_{1}\}, \min\{-\}\}$$

$$= \min\{2, 1, -\}$$

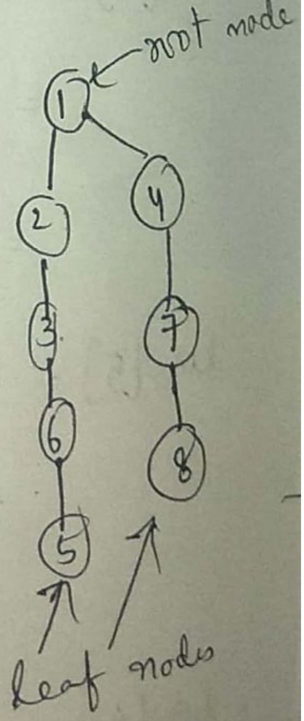
$$= \boxed{1}$$

$$low[1] = \min\{dfn[1], \min\{\underbrace{low[2]}_{1}\}, \min\{-\}\}$$

$$= \min\{1, 1, -\}$$

$$= \boxed{1}$$

<u>finding an articulation point</u>



vertex	1	2	3	4	5	6	7	8
dfn	1	2	3	6	5	4	7	8
low	1	1	1	6	2	2	6	6

* Leaf nodes are not articulation points.

* The root node of DFS tree is an articulation point if it has atleast 2 children.

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∴ '1' is articulation point

∴ 5, 8 are not articulation points

vertex 2:

$low[3] \geq dfn[2]$

$1 \geq 2$ (false)

∴ 2 Not an articulation point.

vertex 4:

$low[7] \geq dfn[4]$

$6 \geq 6$ (true)

∴ 4 is articulation point

vertex 3:

$low[6] \geq dfn[3]$

$2 \geq 3$ (false)

∴ 3 is not an articulation point

vertex 6:

$low[5] \geq dfn[6]$

$2 \geq 4$ (false

∴ 6 is not an articulation point

vertex 7:

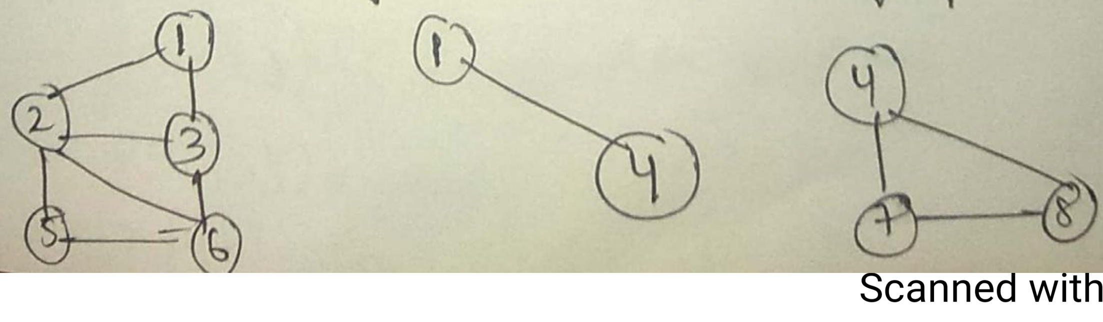
$low[8] \geq dfn[7]$

$6 \geq 7$ (false)

∴ 7 is not an articulation point

∴ 1, 4 are articulation points

Biconnected components of given graph are:



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(7) Explain travelling salesperson problm using DP and solve problem.

$$
\begin{array}{c|c}
 & \begin{matrix} 1 & 2 & 3 & 4 & 5 \end{matrix} \\
\begin{matrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{matrix} &
\begin{bmatrix}
0 & 8 & 13 & 18 & 20 \\
3 & 0 & 7 & 8 & 10 \\
4 & 11 & 0 & 10 & 7 \\
6 & 6 & 7 & 0 & 11 \\
10 & 6 & 2 & 1 & 0
\end{bmatrix}
\end{array}
$$

8
7
10
11 31
10. 15
46

8
10
1. 19
7. 11
30

1

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As $g(i, \phi) = C_{i1} \quad 1 \le i \le n$

$g(2, \phi) = C_{21} = 3 \qquad g(4, \phi) = C_{41} = 6$

$g(3, \phi) = C_{31} = 4 \qquad g(5, \phi) = C_{51} = 10$

we know that

$$\boxed{g(i, S) = \min\{C_{ij} + g(j, S - \{j\})\} \quad j \in S}$$

→ for $|S| = 1$

$g(2, \{3\}) = C_{23} + g(3, \phi) = 7 + 4 = 11$

$g(2, \{4\}) = C_{24} + g(4, \phi) = 8 + 6 = 14$

$g(2, \{5\}) = C_{25} + g(5, \phi) = 10 + 10 = 20$

$g(3, \{2\}) = C_{32} + g(2, \phi) = 11 + 3 = 14$

$g(3, \{4\}) = C_{34} + g(4, \phi) = 10 + 6 = 16$

$g(3, \{5\}) = C_{35} + g(5, \phi) = 7 + 10 = 17$

$g(4, \{2\}) = C_{42} + g(2, \phi) = 6 + 3 = 9$

$g(4, \{3\}) = C_{43} + g(3, \phi) = 7 + 4 = 11$

$g(4, \{5\}) = C_{45} + g(5, \phi) = 11 + 10 = 21$

$g(5, \{2\}) = C_{52} + g(2, \phi) = 6 + 3 = 9$

$g(5, \{3\}) = C_{53} + g(3, \phi) = 2 + 4 = 6$

$g(5, \{4\}) = C_{54} + g(4, \phi) = 1 + 6 = 7$

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for $|S| = 2$ $\quad i \neq 1, 1 \notin S, i \notin S$

$g(2,\{3,4\}) = \min\{c_{23} + g(3,\{4\}), c_{24} + g(4,\{3\})\}$

$= \min\{\underset{23}{7+16}, \underset{19}{8+11}\}$

$= 19$

$g(2,\{3,5\}) = \min\{\underset{24}{7+17}, \underset{16}{10+6}\}$

$= 16$

$g(2,\{4,5\}) = \min\{\underset{29}{8+21}, \underset{17}{10+7}\}$

$= 17$

$g(3,\{2,4\}) = \min\{\underset{25}{11+14}, \underset{19}{10+9}\} = 19$ $\quad 10+7 = 17$

$g(3,\{2,5\}) = \min\{\underset{31}{11+20}, \underset{16}{7+9}\} = 16$

$g(3,\{4,5\}) = \min\{\underset{31}{10+21}, \underset{14}{7+7}\} = 14$

$g(4,\{2,3\}) = \min\{\underset{17}{6+11}, 7+14\} = 17$

$g(4,\{2,5\}) = \min\{6+20, \underset{20}{11+9}\} = 20$

$g(4,\{3,5\}) = \min\{7+17, \underset{17}{11+6}\} = 17$

$g(5,\{2,3\}) = \min\{6+11, \underset{16}{2+14}\} = 16$

$g(5,\{2,4\}) = \min\{6+14, \underset{10}{1+9}\} = 10$

$g(5,\{3,4\}) = \min\{2+16, \underset{12}{1+11}\} = 12$

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for $|S| = 3$

$$g(2,\{3,4,5\}) = \min\{C_{23} + g(3,\{4,5\}),\ C_{24} + g(4,\{3,5\}),\ C_{25} + g(5,\{3,4\})\}$$

$$= \min\{\underbrace{7+14}_{21},\ \underbrace{8+17}_{25},\ \underbrace{10+12}_{22}\}$$

$$= 21$$

$$g(3,\{2,4,5\}) = \min\{\underbrace{11+17}_{28},\ \underbrace{10+20}_{30},\ \underbrace{7+10}_{17}\} = 17$$

$$g(4,\{2,3,5\}) = \min\{\underbrace{6+16}_{22},\ \underbrace{7+16}_{23},\ \underbrace{11+16}_{27}\} = 22$$

$$g(5,\{2,3,4\}) = \min\{\underbrace{6+19}_{25},\ \underbrace{2+19}_{21},\ \underbrace{1+17}_{18}\} = 18$$

for $|S| = 4$

$$g(1,\{2,3,4,5\}) = \min\{C_{12} + g(2,\{3,4,5\}),\ C_{13} + g(3,\{2,4,5\}),\ C_{14} + g(4,\{2,3,5\}),\ C_{15} + g(5,\{2,3,4\})\}$$

$$= \min\{\underbrace{8+21}_{29},\ \underbrace{13+17}_{30},\ \underbrace{18+22}_{40},\ \underbrace{20+18}_{38}\}$$

$$= 29$$

$\therefore$ 1, 2, 3, 5, 4, 1 is the shortest path.

8
7
7
1
6
15
14
4

(4) Construct an OBST for identifiers.

$(a_1 - a_4) = (A, B, C, D)$

$p(1:4) = (0.1, 0.2, 0.4, 0.3)$
$\quad\quad\quad\quad\; 1 \quad\; 2 \quad\; 3 \quad\; 4$

$q(0:4) = (0.3, 0.2, 0.2, 0.1, 0.2)$
$\quad\quad\quad\quad\; 0 \quad\; 1 \quad\; 2 \quad\; 3 \quad\; 4$

$$\sum_{1 \le i \le n} P(i) * \text{level}(a_i) + \sum_{0 \le i \le n} q(i) * (\text{level}(E_i) - 1)$$

$$w(i,j) = P(j) + q(j) + w(i, j-1)$$

$$\text{cost}(i,j) = \min_{i < k \le j} \{\text{cost}(i, k-1) + \text{cost}(k, j)\} + w(i,j)$$

$$w(i,i) = q(i), \quad c(i,i) = r(i,i) = 0$$

The 'k' value which gives minimum cost is chosen as 'r'.

	0	1	2	3	4
j-i=0	$w(0,0)=0.3$ $c(0,0)=0$ $r(0,0)=0$	$w(1,1)=0.2$ $c(1,1)=0$ $r(1,1)=0$	$w(2,2)=0.2$ $c(2,2)=0$ $r(2,2)=0$	$w(3,3)=0.1$ $c(3,3)=0$ $r(3,3)=0$	$w(4,4)=0.2$ $c(4,4)=0$ $r(4,4)=0$
j-i=1	$w(0,1)=0.6$ $c(0,1)=0.6$ $r(0,1)=1$	$w(1,2)=0.6$ $c(1,2)=0.6$ $r(1,2)=2$	$w(2,3)=0.7$ $c(2,3)=0.7$ $r(2,3)=3$	$w(3,4)=0.6$ $c(3,4)=0.6$ $r(3,4)=4$	
j-i=2	$w(0,2)=1$ $c(0,2)=1.6$ $r(0,2)=1,2$	$w(1,3)=1.1$ $c(1,3)=1.7$ $r(1,3)=3$	$w(2,4)=1.2$ $c(2,4)=1.8$ $r(2,4)=3$	X	
j-i=3	$w(0,3)=1.5$ $c(0,3)=2.8$ $r(0,3)=2$	$w(1,4)=1.6$ $c(1,4)=2.8$ $r(1,4)=3$	X		
j-i=4	$w(0,4)=2$ $c(0,4)=4.2$ $r(0,4)=3$	X			

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$\cancel{w(0,0) = p(0) + q(0) + w(0,-1)}$

$\cancel{= 0 + 0.34 \; \_\_ \; = 0.3}$

$r(0,4) = 2$

$(0,1) \quad (2,4)$

1st row: $j - i = 0$

$w(i,j) = q(j)$

$\Rightarrow w(0,0) = q(0) = 0.3$

$w(1,1) = q(1) = 0.2 \qquad w(2,2) = q(2) = 0.2$

$w(3,3) = q(3) = 0.1 \qquad w(4,4) = q(4) = 0.2$

2nd row $j - i = 1$

$$\boxed{w(i,j) = p(j) + q(j) + w(i, j-1)}$$

* $w(0,1) = p(1) + q(1) + w(0,0)$

$= 0.1 + 0.2 + 0.3 = 0.6$

$$cost(i,j) = \min_{i<k\le j} \{cost(i,k-1) + cost(k,j)\} + w(i,j)$$

$$c(0,1) = \min_{0<k\le 1} \{cost(0,0) + cost(1,1)\} + w(0,1)$$

$k = 1$

$= \min\{0 + 0\} + 0.6 \Rightarrow 0 + 0.6 = 0.6$

$\Rightarrow r = 1$

* $w(1,2) = p(2) + q(2) + w(1,1)$

$= 0.2 + 0.2 + 0.2 = 0.6$

$\cancel{c(1,2) = \min_{1<k\le 2} \{cost(1,0) + cost(1,2),\ cost(1,1) + cost(2,2)\} + w(1,2)}$

$\cancel{k = 1/2}$

$= \underset{k=1,2}{\cancel{\min}} \{ \cancel{a} +$

$$c(1,2) = \min_{1<k\leq 2} \{c(1,1) + c(2,2)\} + w(1,2)$$

$k = 2$

$= \min\{0+0\} + 0.6 \Rightarrow 0.6 \Rightarrow r = 2$

$* \; w(2,3) = p(3) + q(3) + w(2,2)$

$= 0.4 + 0.1 + 0.2 = 0.7$

$$c(2,3) = \min_{2<k\leq 3} \{c(2,2) + c(3,3)\} + w(2,3)$$

$k = 3$

$= (0+0) + 0.7 = 0.7 \Rightarrow r = 3$

$* \; w(3,4) = p(4) + q(4) + w(3,3)$

$= 0.3 + 0.2 + 0.1 = 0.6$

$$c(3,4) = \min_{3<k\leq 4} \{c(3,3) + c(4,4)\} + w(3,4)$$

$k = 4$

$= (0+0) + 0.6 = 0.6 \Rightarrow r = 4$

$0+7$
$8+0$

<u>3rd row</u> $\boxed{j-i=2}$

$w(0,2) = p(2) + q(2) + w(0,1)$

$= 0.2 + 0.2 + 0.6 = 1$

$$c(0,2) = \min_{0<k\leq 2} \{c(0,0) + c(1,2),\; c(0,1) + c(2,2)\} + w(0,2)$$

$k = 1, 2$

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$= \min\{\underset{0.6}{0+0.6}, \underset{0.6}{0.6+0}\}+1$

$= 0.6+1 = 1.6 \Rightarrow r = 1,2$

$w(1,3) = p(3)+q(3)+w(1,2)$

$= 0.4+0.1+0.6 = 1.1$

$c(1,3) = \min\limits_{1<k\le 3}\{c(1,1)+c(2,3), c(1,2)+c(3,3)\}+w(1,3)$

$k=2,3$

$= \min\{\underset{0.7}{0+0.7}, \underset{0.6}{0.6+0}\}+1.1$

$= 0.6+1.1 = 1.7 \Rightarrow \cancel{k} = 3$

$w(2,4) = p(4)+q(4)+w(2,3)$

$= 0.3+0.2+0.7 = 1.2$

$c(2,4) = \min\limits_{2<k\le 4}\{c(2,2)+c(3,4), c(2,3)+c(4,4)\}+w(2,4)$

$k=3,4$

$= \min\{\underset{0.6}{0+0.6}, \underset{0.7}{0.7+0}\}+1.2$

$= 0.6+1.2 = 1.8 \Rightarrow r = 3$

4th row $\boxed{j-i=3}$

$w(0,3) = p(3)+q(3)+w(0,2)$

$= 0.4+0.1+1 = 1.5$

$c(\cancel{0,3}) = \cancel{\min}\{c$

$0<\cancel{k\le 3}$ $\cancel{k=1,2,3}$

$$c(0,3) = \min_{\substack{0<k\le 3 \\ k=1,2,3}} \{c(0,0)+c(1,3),\ c(0,1)+c(2,3),\ c(0,2)+c(3,3)\} + w(0,3)$$

$$= \min\{\underbrace{0+1.7}_{1.7},\ \underbrace{0.6+0.7}_{1.3}\checkmark,\ \underbrace{1.6+0}_{1.6}\} + 1.5$$

$$= 1.3+1.5 = 2.8 \Rightarrow r=2$$

$$w(1,4) = p(4)+q(4)+w(1,3)$$

$$= 0.3+0.2+1.1 = 1.6$$

$$c(1,4) = \min_{\substack{1<k\le 4 \\ k=2,3,4}} \{c(1,1)+c(2,4),\ c(1,2)+c(3,4),\ c(1,3)+c(4,4)\} + w(1,4)$$

$$= \min\{\underbrace{0+1.8}_{1.8},\ \underbrace{0.6+0.6}_{1.2}\checkmark,\ \underbrace{1.7+0}_{1.7}\} + 1.6$$

$$= 1.2+1.6 = 2.8 \Rightarrow r=3$$

5^{th} row $\quad j-i=4$

$$w(0,4) = p(4)+q(4)+w(0,3)$$

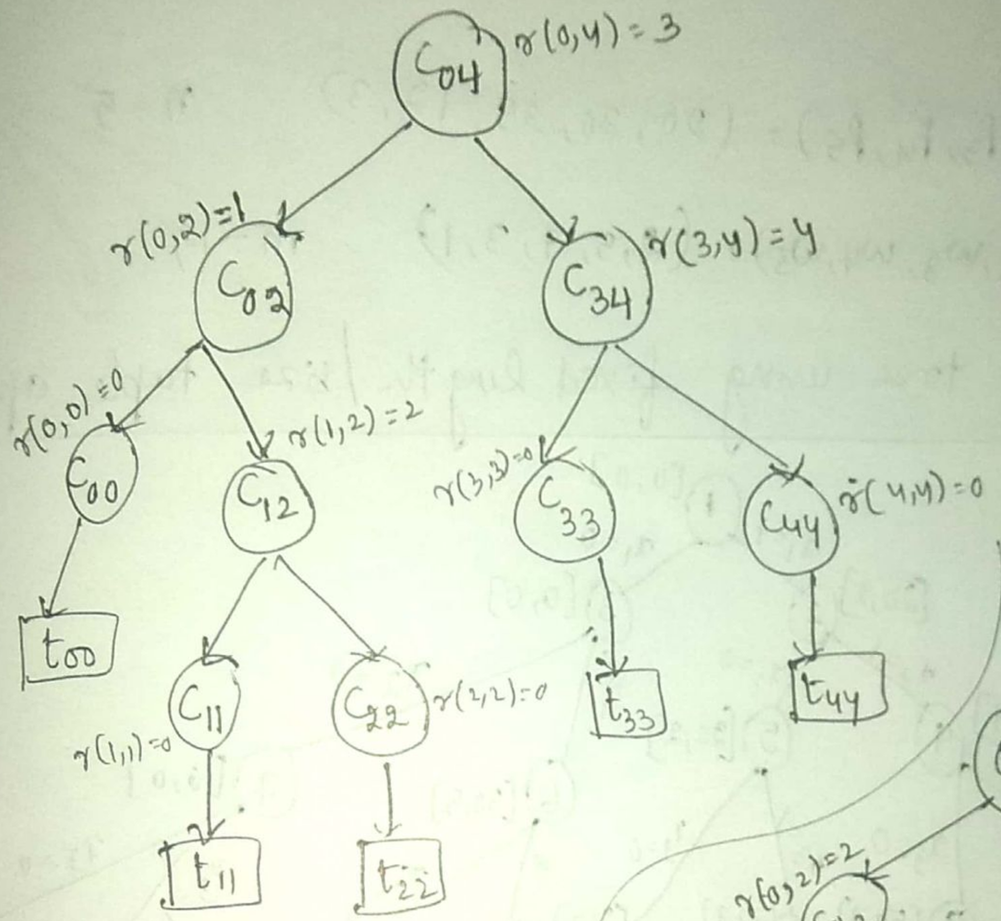
$$= 0.3+0.2+1.5 = 2$$

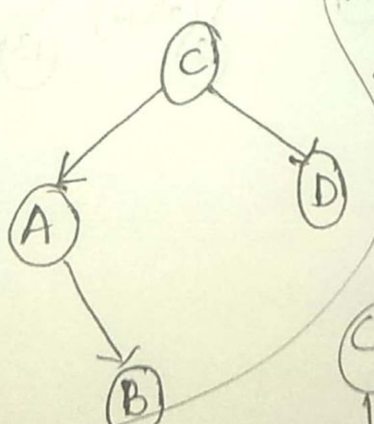
$$c(0,4) = \min_{\substack{0<k\le 4 \\ k=1,2,3,4}} \{c(0,0)+c(1,4),\ c(0,1)+c(2,4),\ c(0,2)+c(3,4),\ c(0,3)+c(4,4)\} + w(0,4)$$

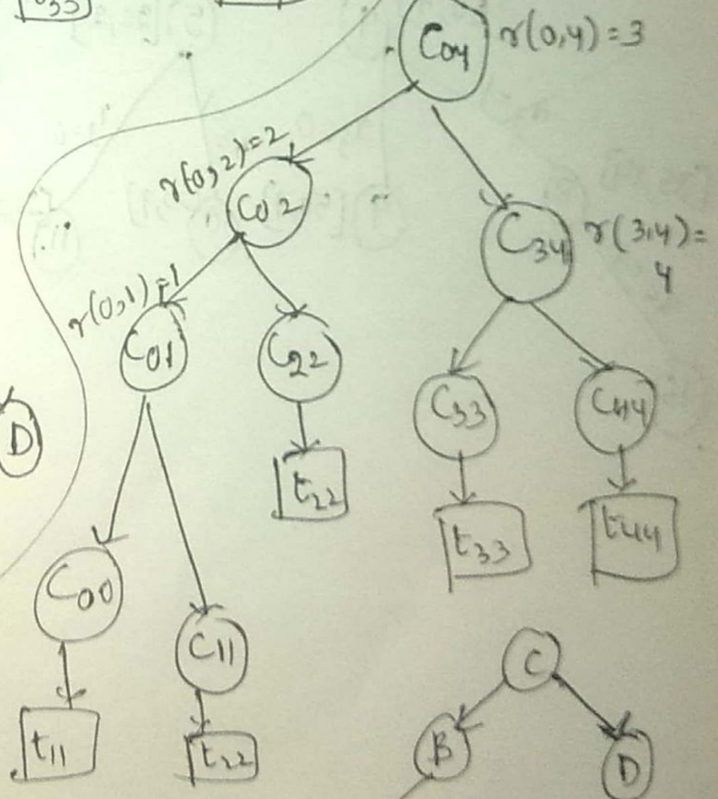
$= \min\{0+2.8,\ 0.6+1.8,\ 1.6+0.6,\ 2.8+0\} + 2$

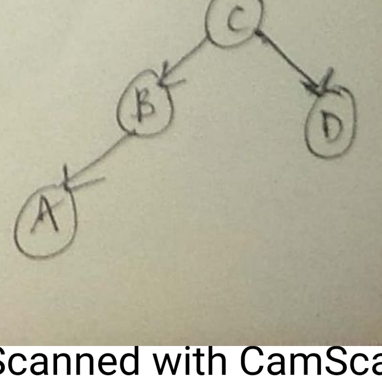
$\phantom{= \min\{}2.8 \qquad\quad 2.4 \qquad\quad 2.2 \checkmark \qquad\quad 2.8$

$= 2.2 + 2 = 4.2 \Rightarrow r = 3$

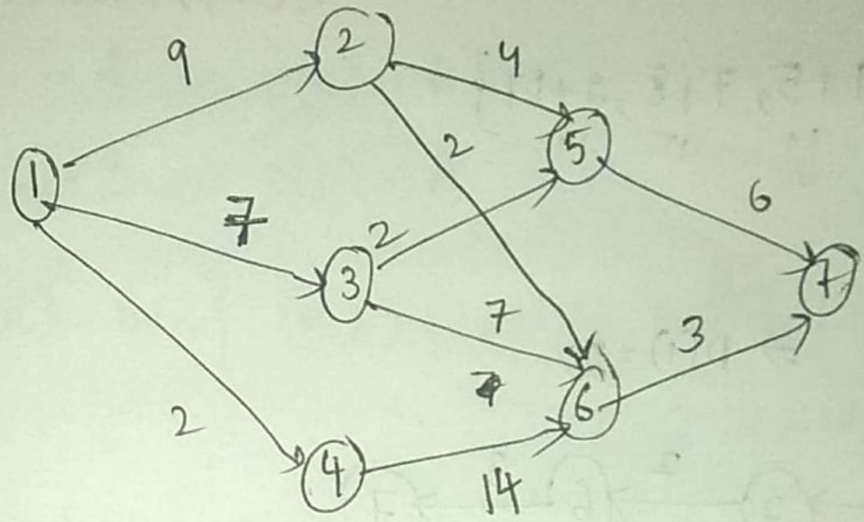








2) a) Using forward approach



$D(7)=0 \Leftarrow cost(7) = 0$

$D(5) = 7 \Leftarrow cost(5) = 6$

$D(6) = 7 \Leftarrow cost(6) = 3$

for forward approach

$cost(i,j) = \min\{c(j,l) + cost(i+1,l)\}$

$l \in V_{i+1}$

$(j,l) \in E$

$cost(4) = \min\{c(4,6) + cost(6)\}$

$= \min\{14+3\} = 17$

$cost(4) = 17 \Rightarrow D(4) = 6$

$cost(3) = \min\{c(3,6) + cost(6),\ c(3,5) + cost(5)\}$

$= \min\{\underset{10}{7+3},\ \underset{8\checkmark}{2+6}\}$

$cost(3) = 8 \Rightarrow D(3) = 5$

$cost(2) = \min\{c(2,6) + cost(6),\ c(2,5) + cost(5)\}$

$= \min\{\underset{5}{2+3},\ \underset{10}{4+6}\}$

$cost(2) = 5 \Rightarrow D(2) = 6$

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$cost(1) = \min\{c(1,2) + cost(2),\ c(1,3) + cost(3),$
$c(1,4) + cost(4)\}$

$= \min\{9+5,\ 7+8,\ 2+17\}$
$\quad\ \ 14 \checkmark \quad 15 \quad 19$

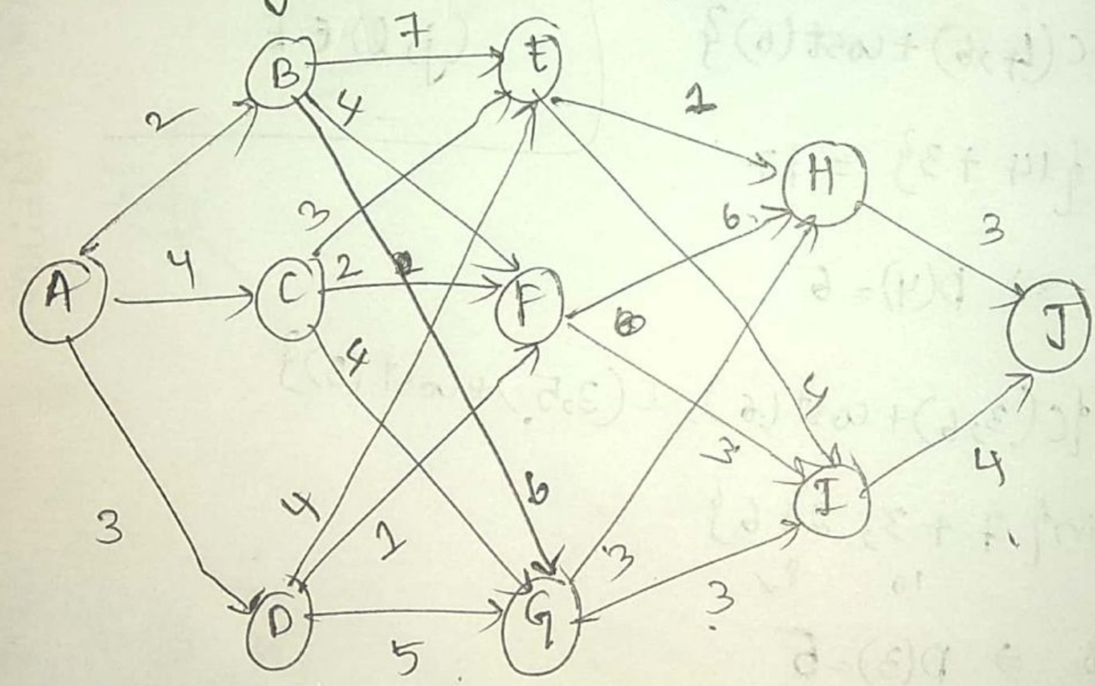
$= 14$

$cost(1) = 14 \Rightarrow D(1) = 2$

$\therefore\ 1 \xrightarrow{9} 2 \xrightarrow{2} 6 \xrightarrow{3} 7$

The cost is $9+2+3 = 14$

(b) using backward approach in



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$cost(A) = 0 \Rightarrow D(A) = 0$

$cost(B) = 2 \Rightarrow D(B) = A$

$cost(C) = 4 \Rightarrow D(C) = A$

$cost(D) = 3 \Rightarrow D(D) = A$

$cost(E) = \min\{c(B,E) + cost(B), c(C,E) + cost(C),$
$c(D,E) + cost(D)\}$

$= \min\{\underset{9}{7+2}, \underset{7}{3+4}, \underset{7}{4+3}\}$

$= 7 \Rightarrow cost(E) = 7 \Rightarrow D(E) = C$

$cost(F) = \min\{c(B,F) + cost(B), c(C,F) + cost(C),$
$c(D,F) + cost(D)\}$

$= \min\{\underset{6}{4+2}, \underset{6}{2+4}, \underset{4}{1+3}\}$

$= 4 \Rightarrow cost(F) = 4 \Rightarrow D(F) = D$

$cost(G) = \min\{c(B,G) + cost(B), c(C,G) + cost(C),$
$c(D,G) + cost(D)\}$

$= \min\{\underset{8}{6+2}, \underset{8}{4+4}, \underset{8}{5+3}\}$

$= 8 \Rightarrow cost(G) = 8 \Rightarrow D(F) = B$

$cost(H) = \min\{c(E,H) + cost(E), c(F,H) + cost(F),$
$c(G,H) + cost(G)\}$

$= \min\{\underset{8}{1+7}, \underset{10}{6+4}, \underset{11}{3+8}\} \Rightarrow cost(H) = 8 \Rightarrow D(H) = E$

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$$\text{cost}(I) = \min\{c(E,I) + \text{cost}(E),\ c(F,I) + \text{cost}(F),\ c(G,I) + \text{cost}(G)\}$$

$$= \min\{\underset{11}{4+7},\ \underset{7}{3+4},\ \underset{11}{3+8}\}$$

$$= 7 \Rightarrow \text{cost}(I) = 7 \Rightarrow D(I) = F$$

$$\text{cost}(J) = \min\{c(H,J) + \text{cost}(H),\ c(I,J) + \text{cost}(I)\}$$

$$= \min\{\underset{11}{3+8},\ \underset{11}{4+7}\}$$

$$= 11 \Rightarrow \text{cost}(J) = 11 \Rightarrow D(J) = H$$

$$A \xrightarrow{4} C \xrightarrow{3} E \xrightarrow{1} H \xrightarrow{3} J$$

The cost is 11.

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