

# Floyd's Warshall or

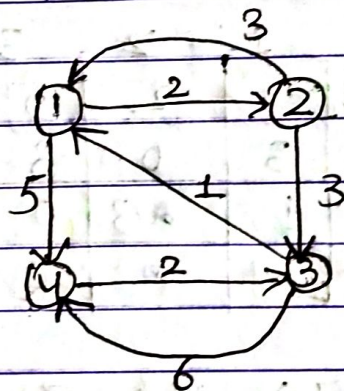
## All pair shortest path Algo

It calculates the shortest path b/w every pair of vertices and therefore it is known as all pair shortest path. works with directed as well as undirected graph. this graph may contain negative values also. In case of self loop, we must first ignore or remove all the self loop.

→ For  $n$  vertices there will be  $(n+1)$  matrix.

original matrix

$$D^0 = \begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \end{matrix} & \begin{bmatrix} 0 & 2 & \infty & 5 \\ 3 & 0 & 3 & \infty \\ 1 & \infty & 0 & 6 \\ \infty & \infty & 2 & 0 \end{bmatrix} \end{matrix}$$

$$D^1 = \begin{matrix} & \begin{matrix} 1 & 2 & 3 & 4 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \\ 4 \end{matrix} & \begin{bmatrix} 0 & 2 & \infty & 5 \\ 3 & 0 & 3 & 8 \\ 1 & 3 & 0 & 6 \\ \infty & \infty & 2 & 0 \end{bmatrix} \end{matrix}$$


So  $mai^0 [2,3] = [2,1] + [1,3] = \infty$

$D^1$  mai source

1 ki tota uski

row = column

same hoga.

$$[2,4] \geq [2,1] + [1,4]$$

$$\infty > 3 + 5 \quad \infty > 8$$

Teacher's Sign.



$$[3,2] > [3,1] + [1,2]$$

$$\infty > 1 + 2$$

$$\infty > 3$$

$$[3,4] > [3,1] + [1,4]$$

$$6 > 1 + 5$$

$$6 > 6$$

$$[4,2] > [4,1] + [1,2]$$

$$\infty > \infty + 2$$

$$\infty > \infty$$

$$[4,3] > [4,1] + [1,3]$$

$$2 > \infty + \infty$$

$$2 > \infty$$

$D^2 =$

	1	2	3	4
1	0	2	5	5
2	3	0	3	$\infty$
3	1	$\infty$ 3	0	6
4	$\infty$	$\infty$	2	0

2<sup>nd</sup> row & column  
unchange

$$[1,3] > [1,2] + [2,3]$$

$$\infty > 2 + 3$$

$$\infty > 5$$

$$[1,4] > [1,2] + [2,4]$$

$$5 > 2 + \infty$$

$$5 > \infty$$

$$[3,1] > [3,2] + [2,1]$$

$$1 > \infty + 3$$



$$[3, 4] \rightarrow [3, 2] + [2, 4]$$

8 > 10

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$$[4, 1] \rightarrow [4, 2] + [2, 1]$$

10 > 10

$$[4, 3] = [4, 2] + [2, 3]$$

8 > 2 + 3  
2 >

	1	2	3	4
1	0	2	10	5
2	3	0	3	8
3	1	10	0	6
4	3	5	2	0

$$[1, 2] \rightarrow [1, 3] + [3, 2]$$

2 > 10 + 10

$$[1, 4] \rightarrow [1, 3] + [3, 4]$$

5 > 10

$$[2, 1] \rightarrow [2, 3] + [3, 1]$$

3 > 3 + 1

$$[2, 4] \rightarrow [2, 3] + [3, 4]$$

10 > 3 + 6  
10 > 9

$$[4, 1] \rightarrow [4, 2] + [2, 1]$$

10 > 2 + 1

$$[4, 2] \rightarrow [4, 3] + [3, 2]$$

10 > 2 + 8

Teacher's Sign. \_\_\_\_\_



	1	2	3	4
0 <sub>u</sub> = 1	0	2	7	5
2	3	0	3	∞
3	1	11	0	6
4	3	5	2	0

$$[1, 2] > [1, 4] + [4, 2]$$

$$2 > 5 + \infty$$

$$2 > \infty$$

$$[1, 3] > [1, 4] + [4, 3]$$

$$\infty > 5 + 2$$

$$\infty > 7$$

$$[2, 1] > [2, 4] + [4, 1]$$

$$3 > 8 + 3$$

$$3 > 11$$

$$[2, 3] > [2, 4] + [4, 3]$$

$$3 > 8 + 2$$

$$[3, 1] > [3, 4] + [4, 1]$$

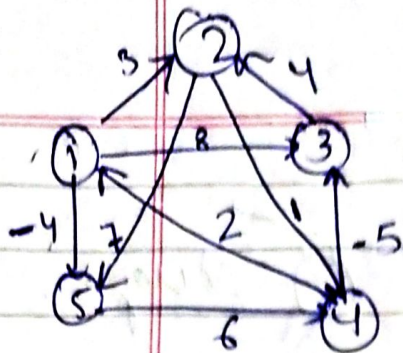
$$1 > 6 + 3$$

$$[3, 2] > [3, 4] + [4, 2]$$

$$\infty > 6 + 5$$

$$\infty > 11$$





8

	1	2	3	4	5
1	0	3	8	$\infty$	-4
2	$\infty$	0	$\infty$	1	7
3	$\infty$	4	0	$\infty$	$\infty$
4	2	$\infty$	-5	0	$\infty$
5	$\infty$	$\infty$	$\infty$	6	0

$D^1 =$

	1	2	3	4	5
1	0	3	8	$\infty$	-4
2	$\infty$	0	$\infty$	$\infty$	7
3	$\infty$	4	0	$\infty$	$\infty$
4	2	(5)	-5	0	-2
5	$\infty$	$\infty$	$\infty$	6	0

$$[2,3] = [2,1] + [1,3]$$

$$= \infty + 8$$

$$= \infty$$

$$[2,4] = [2,1] + [1,4]$$

$$= \infty$$

$D^2 =$

	1	2	3	4	5
1	0	3	8	$\infty$	-4
2	$\infty$	0	$\infty$	1	7
3	$\infty$	4	0	3	11
4	2	5	-5	0	-2
5	$\infty$	$\infty$	$\infty$	6	0

$$[2,5] = \infty$$

$$[3,2] = 3,1 + 1,2$$

$$= \infty + 3$$

$$= \infty$$

$$3,4 = 3,1$$

$D^3 =$

	1	2	3	4	5
1	0	3	8	11	-4
2	$\infty$	0	$\infty$	1	7
3	$\infty$	4	0	3	11
4	2	(-1)	-5	0	-2
5	$\infty$	$\infty$	$\infty$	6	0

$$3,5$$

$$4,1 + 1,2$$

$$= 2 + 3$$

$$= 5$$

$$4,3$$

$$2 + 8 = 10$$

$$2 + (-1) = 1$$

$$2,1 \quad 2,4$$

$$\infty \quad 1,2 \quad \infty \quad 4,1 \quad \infty \quad 4,2 \quad \infty \quad 4,5$$

$$1,3 + 3,2 \quad 8 + 4 = 12 \quad 8 + 3 = 11 \quad 1,5 \quad 5,4$$

$$8 + 4 = 12 \quad 1,3 + 3,2 \quad 8 + 3 = 11 \quad 1,5 \quad 5,4$$

$$1,3 = 1,2 + 2,3$$

$$= 3 + \infty$$

$$= \infty$$

$$4,1 \quad 4,3 \quad 5 + \infty \quad 5 + 7 = 12 \quad 5,3 \quad 1,5 \quad 2,1 \quad 2 + 2,5$$

$$5 + \infty \quad 5 + \infty \quad 5 + 7 = 12 \quad 5,3 \quad 1,5 \quad 2,1 \quad 2 + 2,5$$

$$5 + \infty \quad 5 + \infty \quad 5 + 7 = 12 \quad 5,3 \quad 1,5 \quad 2,1 \quad 2 + 2,5$$

$$3,5 = 4 + 7 = 11 \quad 2 + 1 \quad 3,1 = 3,2 + 2,1$$

$$= 4 + \infty$$



$$D_u = \begin{array}{c|ccccc} & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 0 & 3 & 8 & 11 & -4 \\ 2 & 3 & 0 & -4 & 1 & -1 \\ 3 & -2 & 2 & 0 & 3 & -2 \\ 4 & 2 & -1 & -5 & 0 & -2 \\ 5 & 8 & 5 & 1 & 6 & 0 \end{array}$$

classmate

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$$D_s = \begin{array}{c|ccccc} & 1 & 2 & 3 & 4 & 5 \\ \hline 1 & 0 & 1 & -3 & 2 & -4 \\ 2 & 3 & 0 & 0 & 1 & -1 \\ 3 & -2 & 2 & 0 & 3 & -2 \\ 4 & 2 & -1 & -5 & 0 & -2 \\ 5 & 8 & 5 & 1 & 6 & 0 \end{array}$$

13  
14 + 43  
4 + -5  
15  
11 + (-2)  
21  
24 + 41  
1 + 2

12  
18 + 52    32  
4 + 5    -2 + 5  
34

23  
24 + 43  
1 + (-5)

13  
-4 + 1    -2 + 6

25  
1 + (-2)

14  
4 + 6    4 + 1  
-2 + 8

31  
34 + 43

21  
-1 + 8    42  
-2 + 5

3 + (-5)

23  
43  
-2 + 1

32  
3 + (-1)

-1 + 1

35  
3 + (-2)

24  
31  
-2 + 8

51  
54 + 41  
6 + 2

-1 + 6

52  
6 + (-1)

53