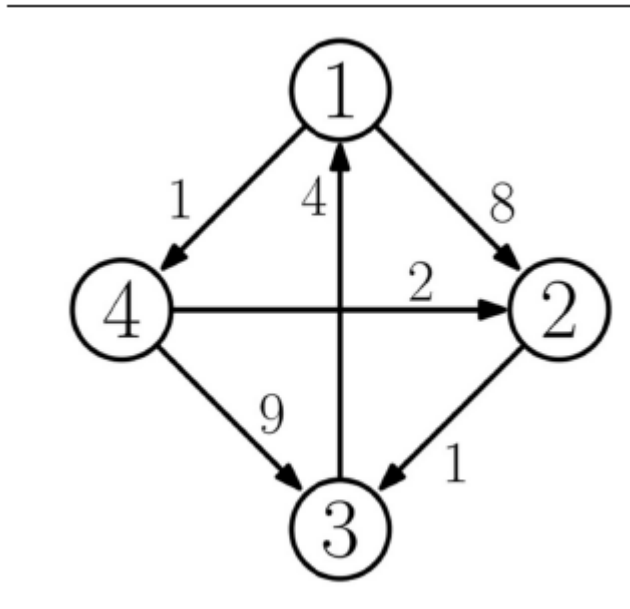


1. (30+20=50 points) Apply Floyd Warshall Algorithm to find the all-pair shortest path from the following graph (show all the steps of your work). Mention the shortest path for each vertex to every other vertex. Also, find the transitive closure of the graph (show all the steps of your work).



$D(0)$

	1	2	3	4			1	2	3	4
1	0	8	$\infty$	1		1	NIL	1	NIL	1
2	$\infty$	0	1	$\infty$		2	NIL	NIL	2	NIL
3	4	$\infty$	0	$\infty$		3	3	NIL	NIL	NIL
4	$\infty$	2	9	0		4	NIL	4	4	NIL

$\pi(0)$

$D(1) \min(d^{(0)}_{ij}, d^{(0)}_{i1} + d^{(0)}_{1j})$

	1	2	3	4			1	2	3	4
1	0	8	$\infty$	1		1	NIL	1	NIL	1
2	$\infty$	0	1	$\infty$		2	NIL	NIL	2	NIL
3	4	12	0	5		3	3	1	NIL	1
4	$\infty$	2	9	0		4	NIL	4	4	NIL

$\pi(1)$

$D(2) \min(d^{(1)}_{ij}, d^{(1)}_{i2} + d^{(1)}_{2j})$

	1	2	3	4			1	2	3	4
1	0	8	9	1		1	NIL	1	2	1
2	$\infty$	0	1	$\infty$		2	NIL	NIL	2	NIL
3	4	12	0	5		3	3	1	NIL	1
4	$\infty$	2	3	0		4	NIL	4	2	NIL

$\pi(2)$

$$D(3) \quad \min (d^{(2)}ij, d^{(2)}i3+d^{(2)}3j)$$

$$\pi(3)$$

	1	2	3	4			1	2	3	4
1	0	8	9	1		1	NIL	1	2	1
2	5	0	1	6		2	3	NIL	2	3
3	4	12	0	5		3	3	1	NIL	1
4	7	2	3	0		4	3	4	2	NIL

$$D(4) \quad \min (d^{(3)}ij, d^{(3)}i4+d^{(3)}4j)$$

$$\pi(4)$$

	1	2	3	4			1	2	3	4
1	0	3	4	1		1	NIL	4	4	1
2	5	0	1	6		2	3	NIL	2	3
3	4	7	0	5		3	3	4	NIL	1
4	7	2	3	0		4	3	4	2	NIL

The shortest path between every 2 points:

	1	2	3	4
1	0(NIL)	3(1-4-2)	4(1-4-2-3)	1(1-4)
2	5(2-3-1)	0(NIL)	1(2-3)	6(2-3-1-4)
3	4(3-1)	7(3-1-4-2)	0(NIL)	5(3-1-4)
4	7(4-2-3-1)	2(4-2)	3(4-2-3)	0(NIL)

The transitive closure of the graph:

T(0)

	1	2	3	4
1	1	1	0	1
2	0	1	1	0
3	1	0	1	0
4	0	1	1	1

T(1)

	1	2	3	4
1	1	1	0	1
2	0	1	1	1
3	1	1	1	1
4	0	1	1	1

T(2)

	1	2	3	4
1	1	1	1	1
2	0	1	1	1
3	1	1	1	1
4	0	1	1	1

T(3)

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

T(4)

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