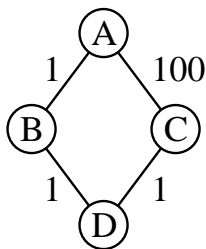


## HW #5 Solutions



1. Consider the small 4-node network above with weighted edges. Assume that the nodes communicate on a round-by-round basis, where a node can communicate once to each of its neighbors within a single round, but only one node can send a message in a given round.

- (a) Run the Belman-Ford Algorithm (i.e., Distance Vector Protocol) without Poison Reverse/Split Horizon implemented to compute the shortest paths trees to all nodes.

Answer:

We have the initial configuration:

A	B	C	B	A	D	C	A	D	D	B	C
B	1	$\infty$	A	1	$\infty$	A	100	$\infty$	A	$\infty$	$\infty$
C	$\infty$	100	C	$\infty$	$\infty$	B	$\infty$	$\infty$	B	1	$\infty$
D	$\infty$	$\infty$	D	$\infty$	1	D	$\infty$	1	C	$\infty$	1

with:

$$S_A = \begin{bmatrix} 1 & B \\ 100 & C \\ \infty & D \end{bmatrix} \quad S_B = \begin{bmatrix} 1 & A \\ \infty & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ \infty & B \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} \infty & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 1, A sends to B and C (A,D remain the same):

B	A	D	C	A	D
A	1	$\infty$	A	100	$\infty$
C	101	$\infty$	B	101	$\infty$
D	$\infty$	1	D	$\infty$	1

$$S_B = \begin{bmatrix} 1 & A \\ 101 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 101 & C \\ 1 & D \end{bmatrix}$$

Round 2, B sends to A and D (B,C remain the same):

A	B	C	D	B	C
B	1	$\infty$	A	2	$\infty$
C	102	100	B	1	$\infty$
D	2	$\infty$	C	102	1

$$S_A = \begin{bmatrix} 1 & B \\ 100 & C \\ 2 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 3, C sends to A and D (B,C remain the same):

A	B	C	D	B	C
B	1	201	A	2	101
C	102	100	B	1	102
D	2	101	C	102	1

$$S_A = \begin{bmatrix} 1 & B \\ 100 & C \\ 2 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 4, D sends to B and C (A,D remain the same):

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	1	3	A	100	3
C	101	2	B	101	2
D	$\infty$	1	D	$\infty$	1

$$S_B = \begin{bmatrix} 1 & A \\ 101 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 101 & C \\ 1 & D \end{bmatrix}$$

Round 5, A sends to B and C (A,D remain the same):

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	1	3	A	100	3
C	101	2	B	101	2
D	3	1	D	102	1

$$S_B = \begin{bmatrix} 1 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

Round 6, B sends to A and D (B,C remain the same):

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	1	201	A	2	$\infty$
C	3	100	B	1	$\infty$
D	2	101	C	3	1

$$S_A = \begin{bmatrix} 1 & B \\ 3 & C \\ 2 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 7, C sends to A and D (B,C remain the same):

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	1	102	A	2	4
C	3	100	B	1	3
D	2	101	C	3	1

$$S_A = \begin{bmatrix} 1 & B \\ 3 & C \\ 2 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

D DOES NOT send to B or C because its shortest path vector ( $S_D$ ) remained the same.

Round 8, A sends to B and C (A,D remain the same):

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	1	3	A	100	3
C	4	2	B	101	2
D	3	1	D	102	1

$$S_B = \begin{bmatrix} 1 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

Finally:

$$S_A = \begin{bmatrix} 1 & B \\ 3 & C \\ 2 & D \end{bmatrix} \quad S_B = \begin{bmatrix} 1 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

- (b) Assume that the weight of edge ( $A, B$ ) suddenly changes to 200. Perform the first five rounds of the algorithm after the change. Indicate how many rounds take place in total until convergence.

Answer:

We have from the previous part that:

<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	1	102	A	1	3	A	100	3	A	2	4
C	3	100	C	4	2	B	101	2	B	1	3
D	2	101	D	3	1	D	102	1	C	3	1

after the change in the weight of the link we get:

<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	200	3	A	100	3	A	2	4
C	202	100	C	203	2	B	101	2	B	1	3
D	201	101	D	202	1	D	102	1	C	3	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix}^* \quad S_B = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}^* \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

\*Changed after the weight change.

Round 1, A sends to B and C (A,D remain the same):

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	200	3	A	100	3
C	300	2	B	202	2
D	301	1	D	201	1

$$S_B = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

Round 2, B sends to A and D (B,C remain the same):

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	4	4
C	202	100	B	1	3
D	201	101	C	3	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 4 & A \\ 1 & B \\ 1 & C \end{bmatrix}^*$$

C DOES NOT send to A or D because it's shortest path vector remained the same.

Round 3, D sends to B and C (A,D remain the same):

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	200	5	A	100	5
C	300	2	B	202	2
D	301	1	D	201	1

$$S_B = \begin{bmatrix} 5 & A \\ 2 & C \\ 1 & D \end{bmatrix}^* \quad S_C = \begin{bmatrix} 5 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$$

A DOES NOT send to B or C because it's shortest path vector remained the same.

Round 4, B sends to A and D (B,C remain the same):

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	6	4
C	202	100	B	1	3
D	201	101	C	3	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 4 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 5, C sends to A and D (B,C remain the same):

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	6	6
C	202	100	B	1	3
D	201	101	C	3	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 6 & A \\ 1 & B \\ 1 & C \end{bmatrix}^*$$

Round 6, D sends to B and C (A,D remain the same):

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	200	7	A	100	7
C	300	2	B	202	2
D	301	1	D	201	1

$$S_B = \begin{bmatrix} 7 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 7 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

From now on only B, C and D change their shortest path vectors in each round we skip A.

In Round 7 B will send to D and A and  $S_D = \begin{bmatrix} 8 & A \\ 1 & B \\ 1 & C \end{bmatrix}^*$

In Round 8 C will send to D and A and  $S_D = \begin{bmatrix} 8 & A \\ 1 & B \\ 1 & C \end{bmatrix}$

In Round 9 D will send to B and C and  $S_B = \begin{bmatrix} 9 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$   $S_C = \begin{bmatrix} 9 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$

This will continue until we get :

A	B	C	B	A	D	C	A	D	D	B	C
B	200	102	A	200	102	A	100	102	A	103	101
C	202	100	C	300	2	B	202	2	B	1	3
D	201	101	D	301	1	D	201	1	C	3	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_B = \begin{bmatrix} 102 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 101 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

To reach 6 for D we needed 6 rounds and from then on we needed 3 rounds for each increment of 2 until we reach 103. So we needed a total of  $((103 - 6) \cdot 3)/2 + 6 \simeq 152$  rounds.

- (c) Run the Belman-Ford Algorithm on the original graph (where  $(A, B)$  has weight 1) with Poison Reverse/Split Horizon implemented to compute the shortest paths trees to all nodes.

Answer:

We have the initial configuration:

A	B	C	B	A	D	C	A	D	D	B	C
B	1	$\infty$	A	1	$\infty$	A	100	$\infty$	A	$\infty$	$\infty$
C	$\infty$	100	C	$\infty$	$\infty$	B	$\infty$	$\infty$	B	1	$\infty$
D	$\infty$	$\infty$	D	$\infty$	1	D	$\infty$	1	C	$\infty$	1

with:

$$S_A = \begin{bmatrix} 1 & B \\ 100 & C \\ \infty & D \end{bmatrix} \quad S_B = \begin{bmatrix} 1 & A \\ \infty & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 100 & C \\ \infty & D \end{bmatrix} \quad S_D = \begin{bmatrix} \infty & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 1, A sends to B and C (A,D remain the same). A sends to B  $[\infty, 100, \infty]$  and to C  $[1, \infty, \infty]$

B	A	D	C	A	D
A	1	$\infty$	A	100	$\infty$
C	101	$\infty$	B	101	$\infty$
D	$\infty$	1	D	$\infty$	1

$$S_B = \begin{bmatrix} 1 & A \\ 101 & C \\ 1 & D \end{bmatrix}^* \quad S_C = \begin{bmatrix} 100 & A \\ 101 & C \\ 1 & D \end{bmatrix}^*$$

Round 2, B sends to A and D (B,C remain the same): B sends to A  $[\infty, \infty, 1]$  and to D  $[1, 101, \infty]$

A	B	C	D	B	C		
B	1	$\infty$	A	2	$\infty$	$S_A = \begin{bmatrix} 1 & B \\ 100 & C \\ 2 & D \end{bmatrix}^*$	$S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}^*$
C	$\infty$	100	B	1	$\infty$		
D	2	$\infty$	C	102	1		

Round 3, C sends to A and D (B,C remain the same): C sends to A  $[\infty, \infty, 1]$  and to D  $[100, 101, \infty]$

A	B	C	D	B	C		
B	1	$\infty$	A	2	101	$S_A = \begin{bmatrix} 1 & B \\ 100 & C \\ 2 & D \end{bmatrix}$	$S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$
C	$\infty$	100	B	1	102		
D	2	101	C	102	1		

Round 4, D sends to B and C (A,D remain the same): D sends to B  $[\infty, \infty, 1]$  and to C  $[2, 1, \infty]$

B	A	D	C	A	D		
A	1	$\infty$	A	1	3	$S_B = \begin{bmatrix} 1 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$	$S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$
C	101	2	B	101	2		
D	$\infty$	1	D	$\infty$	1		

Round 5, A sends to B and C (A,D remain the same): A sends to B  $[\infty, 100, \infty]$  and to C  $[1, \infty, 2]$

B	A	D	C	A	D		
A	1	$\infty$	A	100	3	$S_B = \begin{bmatrix} 1 & A \\ 2 & C \\ 1 & D \end{bmatrix}$	$S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}$
C	101	2	B	101	2		
D	$\infty$	1	D	102	1		

Round 6, B sends to A and D (B,C remain the same): B sends to A  $[\infty, 2, 1]$  and to D  $[1, \infty, \infty]$

A	B	C	D	B	C		
B	1	$\infty$	A	2	101	$S_A = \begin{bmatrix} 1 & B \\ 3 & C \\ 2 & D \end{bmatrix}^*$	$S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$
C	3	100	B	1	102		
D	2	101	C	$\infty$	1		

Round 7, C sends to A and D (B,C remain the same): C sends to A  $[3, 2, 1]$  and to D  $[\infty, \infty, \infty]$

A	B	C	D	B	C		
B	1	102	A	2	$\infty$	$S_A = \begin{bmatrix} 1 & B \\ 3 & C \\ 2 & D \end{bmatrix}$	$S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$
C	3	100	B	1	$\infty$		
D	2	101	C	$\infty$	1		

D DOES NOT send to B or C because its minimum distance matrix remained the same.

Round 8, A sends to B and C (A,D remain the same): A sends to B  $[\infty, \infty, \infty]$  and to C  $[1, 3, 2]$

B	A	D	C	A	D		
A	1	$\infty$	A	100	3	$S_B = \begin{bmatrix} 1 & A \\ 2 & C \\ 1 & D \end{bmatrix}$	$S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}$
C	$\infty$	2	B	101	2		
D	$\infty$	1	D	102	1		

Finally:

$$S_A = \begin{bmatrix} 1 & B \\ 3 & C \\ 2 & D \end{bmatrix} \quad S_B = \begin{bmatrix} 1 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

- (d) Assume again that the weight of edge  $(A, B)$  suddenly changes to 200. Perform all rounds of the algorithm until messages cease to be sent.

Answer:

We have from the previous part that:

<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	1	102	A	1	$\infty$	A	100	3	A	2	$\infty$
C	3	100	C	$\infty$	2	B	101	2	B	1	$\infty$
D	2	101	D	$\infty$	1	D	102	1	C	$\infty$	1

after the change in the weight of the link we get:

<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	200	$\infty$	A	100	3	A	2	$\infty$
C	202	100	C	$\infty$	2	B	101	2	B	1	$\infty$
D	201	101	D	$\infty$	1	D	102	1	C	$\infty$	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix}^* \quad S_B = \begin{bmatrix} 200 & A \\ 2 & C \\ 1 & D \end{bmatrix}^* \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 1, A sends to B and C (A,D remain the same): A sends to B [102, 100, 101] and to C [ $\infty$ ,  $\infty$ ,  $\infty$ ]

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	200	$\infty$	A	100	3
C	300	2	B	$\infty$	2
D	301	1	D	$\infty$	1

$$S_B = \begin{bmatrix} 200 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

Round 2, B sends to A and D (B,C remain the same): B sends to A [ $\infty$ , 2, 1] and to D [200,  $\infty$ ,  $\infty$ ]

<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	201	$\infty$
C	202	100	B	1	$\infty$
D	201	101	C	$\infty$	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 201 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

C DOES NOT send to A or D because it's shortest path vector remained the same.

Round 3, D sends to B and C (A,D remain the same): D sends to B [ $\infty$ ,  $\infty$ , 1] and to C [201, 1,  $\infty$ ]

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	200	$\infty$	A	100	202
C	300	2	B	$\infty$	2
D	301	1	D	$\infty$	1

$$S_B = \begin{bmatrix} 200 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

Round 4, A sends to B and C (A,D remain the same): A sends to B [102, 100, 101] and to C [ $\infty$ ,  $\infty$ ,  $\infty$ ]

<b>B</b>	<b>A</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>D</b>
A	200	$\infty$	A	100	202
C	300	2	B	$\infty$	2
D	301	1	D	$\infty$	1

$$S_B = \begin{bmatrix} 200 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

B DOES NOT send to A or D because it's shortest path vector remained the same.

Round 5, C sends to A and D (B,C remain the same): C sends to A [ $\infty$ , 2, 1] and to D [100,  $\infty$ ,  $\infty$ ]

A	B	C	D	B	C		
B	200	102	A	201	101	$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix}$	$S_D = \begin{bmatrix} 101 & A \\ 1 & B \\ 1 & C \end{bmatrix}$
C	202	100	B	1	$\infty$		
D	201	101	C	$\infty$	1		

Round 6, D sends to B and C (A,D remain the same): D sends to B  $[101, \infty, 1]$  and to C  $[\infty, 1, \infty]$

B	A	D	C	A	D		
A	200	102	A	100	$\infty$	$S_B = \begin{bmatrix} 102 & A \\ 2 & C \\ 1 & D \end{bmatrix}$	$S_C = \begin{bmatrix} 100 & A \\ 2 & C \\ 1 & D \end{bmatrix}$
C	300	2	B	$\infty$	2		
D	301	1	D	$\infty$	1		

A DOES NOT send to B or C because it's shortest path vector remained the same.

Round 7, B sends to A and D (B,C remain the same): B sends to A  $[102, 2, 1]$  and to D  $[\infty, \infty, \infty]$

A	B	C	D	B	C		
B	200	102	A	$\infty$	101	$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix}$	$S_D = \begin{bmatrix} 101 & A \\ 1 & B \\ 1 & C \end{bmatrix}$
C	202	100	B	1	$\infty$		
D	201	101	C	$\infty$	1		

Finally:

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_B = \begin{bmatrix} 102 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 101 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

- (e) Assume an additional edge  $(B, C)$  with weight 3 is added to the original graph. Modify the routing tables from part 1c to include this edge when Poison Reverse/Split Horizon is implemented (you need not draw all the steps, just the final tables).

Answer:

A	B	C	B	A	C	D	C	A	B	D	D	B	C
B	1	102	A	1	$\infty$	$\infty$	A	100	$\infty$	3	A	2	$\infty$
C	3	100	C	$\infty$	3	2	B	101	3	2	B	1	$\infty$
D	2	101	D	$\infty$	$\infty$	1	D	102	$\infty$	1	C	$\infty$	1

Since the shortest path vectors of nodes B and C remain the same they will not communicate with their neighbors

- (f) Suppose the weight of  $(A, B)$  once again shifts to 200. Perform the first 5 iterations of the algorithm. Explain why Poison Reverse did not prevent the count to infinity problem.

Answer:

We have from the previous part:

A	B	C	B	A	C	D	C	A	B	D	D	B	C
B	1	102	A	1	$\infty$	$\infty$	A	100	$\infty$	3	A	2	$\infty$
C	3	100	C	$\infty$	3	2	B	101	3	2	B	1	$\infty$
D	2	101	D	$\infty$	$\infty$	1	D	102	$\infty$	1	C	$\infty$	1

with the change of the weight we get:

<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>D</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	200	$\infty$	$\infty$	A	100	$\infty$	3	A	2	$\infty$
C	202	100	C	$\infty$	3	2	B	101	3	2	B	1	$\infty$
D	201	101	D	$\infty$	$\infty$	1	D	102	$\infty$	1	C	$\infty$	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix}^* \quad S_B = \begin{bmatrix} 200 & A \\ 2 & C \\ 1 & D \end{bmatrix}^* \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 2 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

Round 1, A sends to B and to C (A,D remain the same): A sends to B [102, 100, 101] and to C [ $\infty$ ,  $\infty$ ,  $\infty$ ]

<b>B</b>	<b>A</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>D</b>
A	200	$\infty$	$\infty$	A	100	$\infty$	3
C	300	3	2	B	$\infty$	3	2
D	301	$\infty$	1	D	$\infty$	$\infty$	1

$$S_B = \begin{bmatrix} 200 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix}$$

Round 2, B sends to A, C and D (B, remain the same): B sends to A [200, 2, 1], to C [ $\infty$ , 2, 1] and to D [200,  $\infty$ ,  $\infty$ ]

<b>A</b>	<b>B</b>	<b>C</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>D</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	100	203	3	A	201	$\infty$
C	202	100	B	$\infty$	3	2	B	1	$\infty$
D	201	101	D	$\infty$	4	1	C	$\infty$	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 3 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_D = \begin{bmatrix} 201 & A \\ 1 & B \\ 1 & C \end{bmatrix}$$

C DOES NOT send to A or D because it's shortest path vector remained the same.

Round 3, D sends to B and C (A,D remain the same): D sends to B [ $\infty$ ,  $\infty$ , 1] and to C [201, 1,  $\infty$ ]

<b>B</b>	<b>A</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>D</b>
A	200	$\infty$	$\infty$	A	100	203	202
C	300	3	2	B	$\infty$	3	2
D	301	$\infty$	1	D	$\infty$	4	1

$$S_B = \begin{bmatrix} 200 & A \\ 2 & C \\ 1 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 100 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$$

A DOES NOT send to B or C because it's shortest path vector remained the same.

B DOES NOT send to A or C or D because it's shortest path vector remained the same.

Round 4, C sends to A, B and D (C, remain the same): C sends to A [ $\infty$ , 2, 1], to B [100, 2, 1] and to D [100,  $\infty$ ,  $\infty$ ]

<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>A</b>	<b>C</b>	<b>D</b>	<b>D</b>	<b>B</b>	<b>C</b>
B	200	102	A	200	103	$\infty$	A	201	101
C	202	100	B	300	3	2	B	1	$\infty$
D	201	101	D	301	4	1	C	$\infty$	1

$$S_A = \begin{bmatrix} 102 & B \\ 100 & C \\ 101 & D \end{bmatrix} \quad S_C = \begin{bmatrix} 103 & A \\ 2 & C \\ 1 & D \end{bmatrix}^* \quad S_D = \begin{bmatrix} 101 & A \\ 1 & B \\ 1 & C \end{bmatrix}^*$$

Round 5, D sends to B and C (A,D remain the same): D sends to B [101,  $\infty$ , 1] and to C [101, 1,  $\infty$ ]

<b>B</b>	<b>A</b>	<b>C</b>	<b>D</b>	<b>C</b>	<b>A</b>	<b>B</b>	<b>D</b>		
A	200	103	102	A	100	203	202	$S_B =$	$\begin{bmatrix} 102 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$
C	300	3	2	B	$\infty$	3	2		$S_C =$
D	301	4	1	D	$\infty$	4	1		$\begin{bmatrix} 100 & A \\ 2 & C \\ 1 & D \end{bmatrix}^*$

We have still the count to infinity problem because as we see poisson reverse fails to detect loops of length greater than 2.

(g) Did Poison Reverse help at all in part 1f? Explain your answer.

Answer:

Poisson Reverse helped us reduce the number of steps, determine and prevent loops of length 2 but not for loops of length 3 or more (it needs modifications for that).

2. Draw the trie structure that maps addresses to the interface corresponding to the longest matching prefix in the table below:

prefix	interface
0	2
1	2
01	1
111	1
011	3
0110	1
1011	3

Answer:

