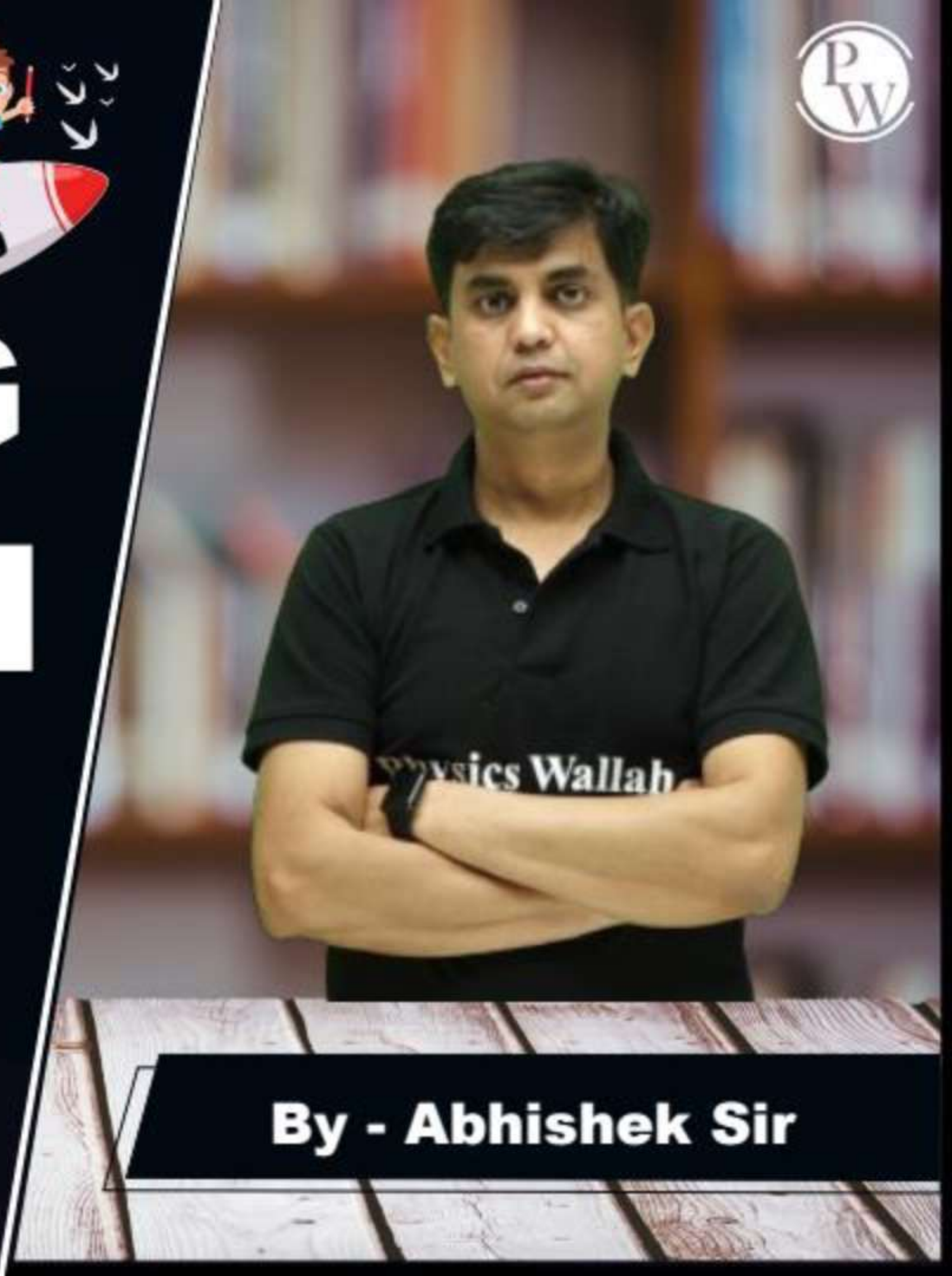
CS & IT ENGINEERING

Computer Network

Switching & Routing

Lecture No. - 05



By - Abhishek Sir

Recap of Previous Lecture

Topic Distance Vector Routing

Topics to be Covered

Topic Distance Vector Routing

ABOUT ME

Hello, I'm Abhishek

- GATE CS AIR - 96
- M.Tech (CS) - IIT Kharagpur
- 12 years of GATE CS teaching experience

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#Q. For the network given in the figure below, the routing tables of the four nodes A, E, D and G are shown. Suppose that F has estimated its delay to its neighbors, A, E, D and G as 8, 10, 12 and 6 msecs respectively and updates its routing table using distance vector routing technique.

[GATE-2007]

F→A: 8 F→D: 12 F→E: 10 F→G: 6

Routing Table of A	
A	0
B	40
C	14
D	17
E	21
F	9
G	24

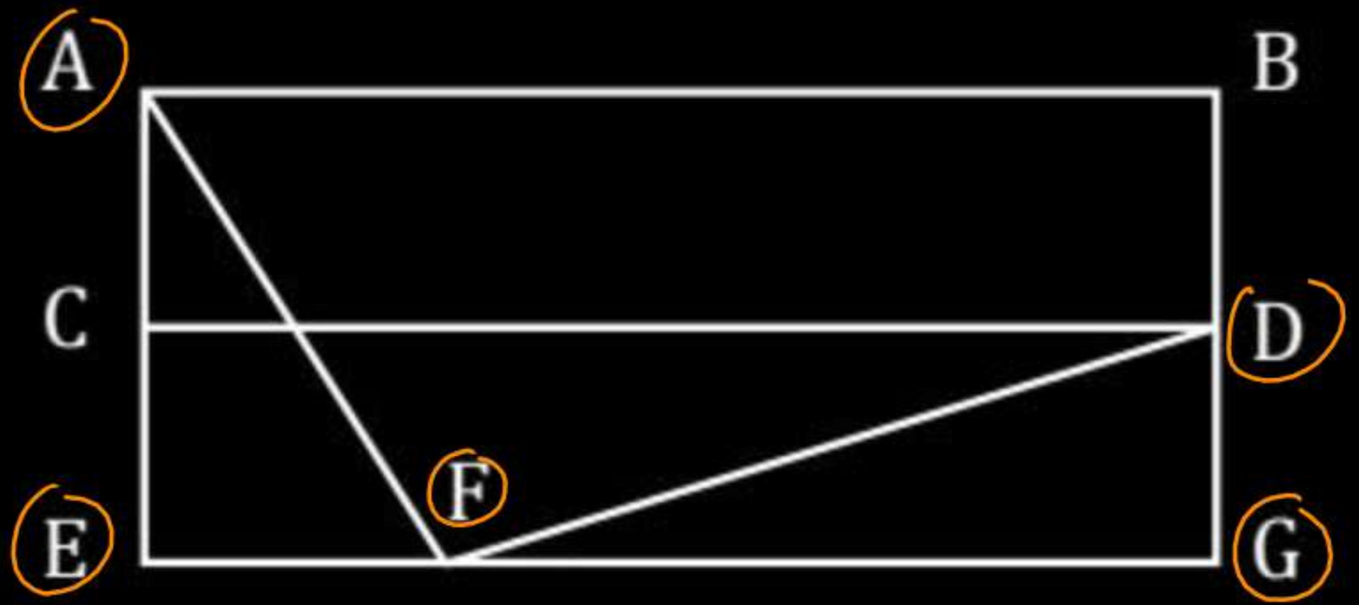
Routing Table of D	
A	20
B	8
C	30
D	0
E	14
F	7
G	22

Routing Table of E	
A	24
B	27
C	7
D	20
E	0
F	11
G	22

Routing Table of G	
A	21
B	24
C	22
D	19
E	22
F	10
G	0

Routing Table of F

Node	Cost	Via
A	8	A
B	20	D
C	17	E
D	12	D
E	10	E
F	0	F
G	6	G



Ans : A

A

A	8
B	20
C	17
D	12
E	10
F	0
G	6

B

A	21
B	8
C	7
D	19
E	14
F	0
G	22

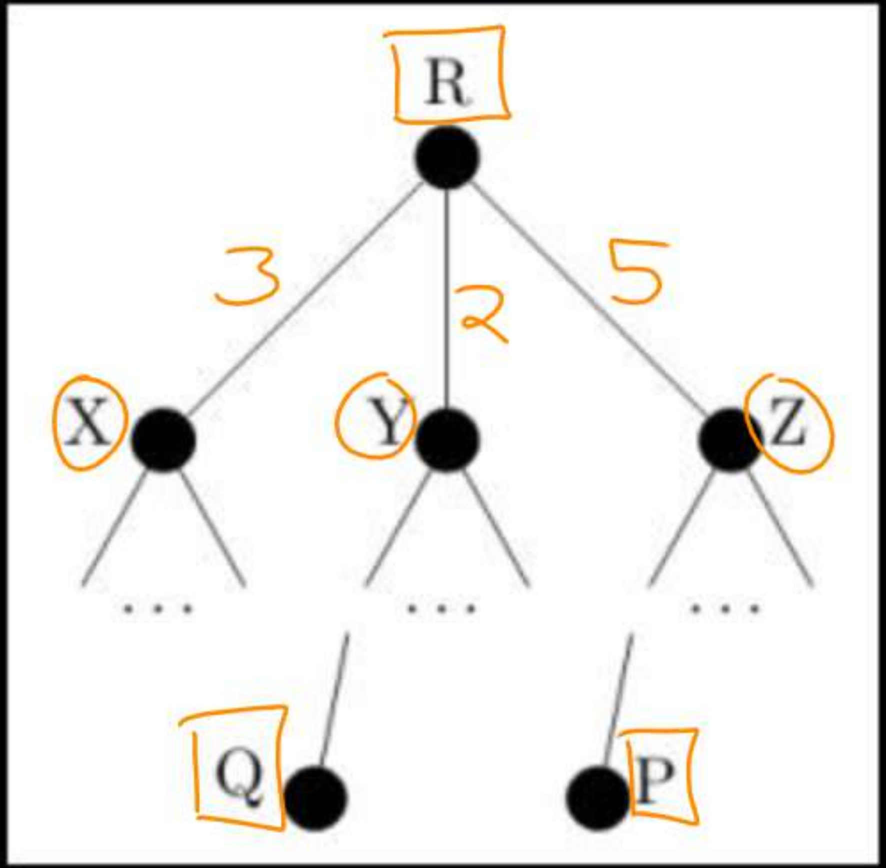
C

A	8
B	20
C	17
D	12
E	10
F	16
G	6

D

A	8
B	8
C	7
D	12
E	10
F	0
G	6

#Q. Consider a computer network using the distance vector routing algorithm in its network layer. The partial topology of the network is shown below.



The objective is to find the shortest-cost path from the router R to routers P and Q. Assume that R does not initially know the shortest routes to P and Q. Assume that R has three neighbouring routers denoted as X, Y and Z.

MSQ

During one iteration, R measures its distance to its neighbours X, Y, and Z as 3, 2 and 5, respectively. Router R gets routing vectors from its neighbours that indicate that the distance to router P from routers X, Y and Z are 7, 6 and 5, respectively. The routing vector also indicates that the distance to router Q from routers X, Y and Z are 4, 6 and 8 respectively. Which of the following statement(s) is/are correct with respect to the new routing table of R, after updation during this iteration?

[GATE-2021]

(A) The distance from R to P will be stored as 10

(B) The distance from R to Q will be stored as 7

(C) The next hop router for a packet from R to P is Y

(D) The next hop router for a packet from R to Q is Z

Ans: B & C

$C(R, X) = 3,$ $\boxed{X : D_X(P) = 7 \text{ and } D_X(Q) = 4}$

$C(R, Y) = 2,$ $\boxed{Y : D_Y(P) = 6 \text{ and } D_Y(Q) = 6}$

$C(R, Z) = 5,$ $\boxed{Z : D_Z(P) = 5 \text{ and } D_Z(Q) = 8}$

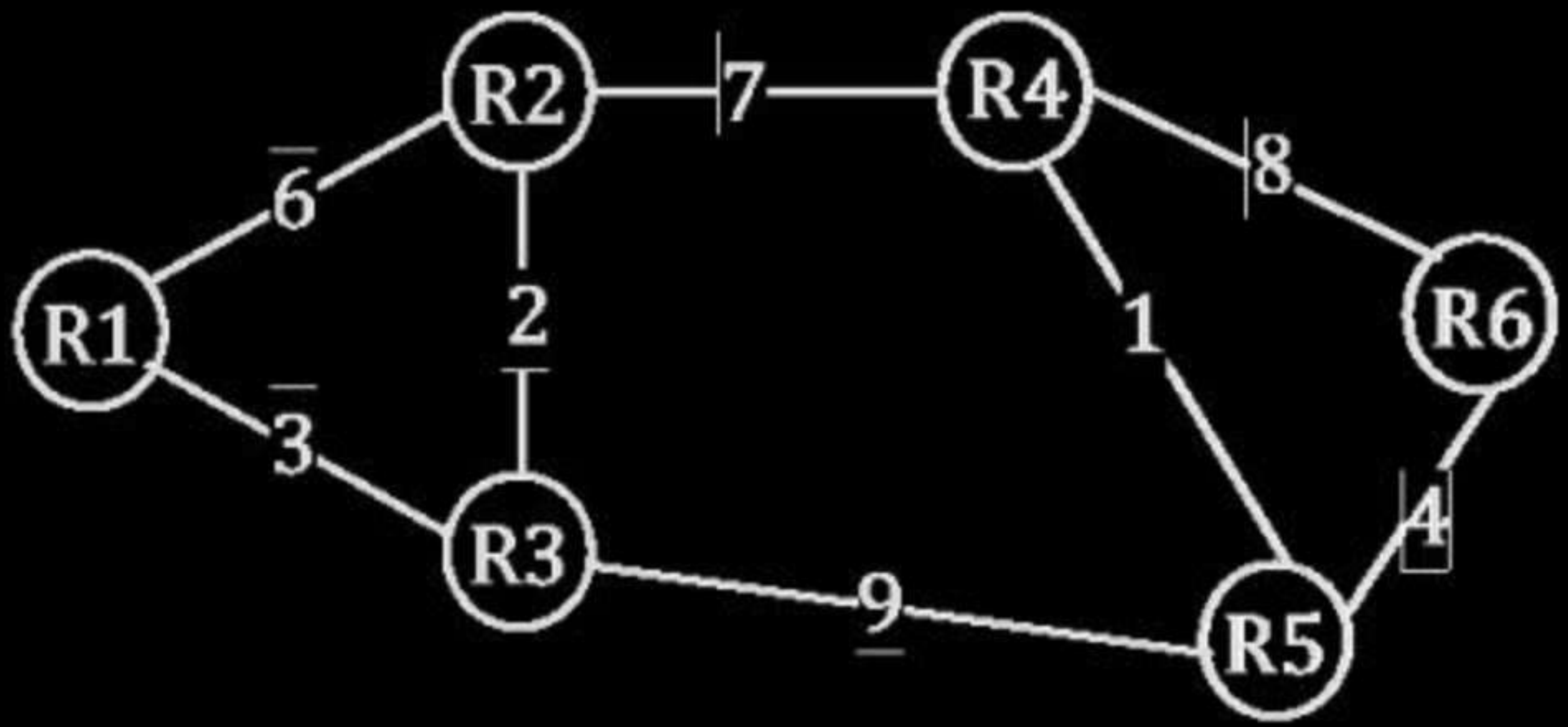
$\boxed{R} : D_R(P) = ?$ and $D_R(Q) = ?$

$$D_R(P) = \min[\{C(R, X) + D_X(P)\}, \{C(R, Y) + D_Y(P)\}, \{C(R, Z) + D_Z(P)\}]$$
$$= 8 \text{ (Via Y)} = \min[(3+7), (2+6), (5+5)]$$

$$D_R(Q) = \min[\{C(R, X) + D_X(Q)\}, \{C(R, Y) + D_Y(Q)\}, \{C(R, Z) + D_Z(Q)\}]$$
$$= 7 \text{ (Via X)} = \min[(3+4), (2+6), (5+8)]$$

Statement for linked question

Consider a network with 6 routers R1 to R6 connected with links having weights as shown in the following diagram:



#Q. All the routers use the distance vector based routing algorithm to update their routing tables. Each router starts with its routing table initialized to contain an entry for each neighbor with the weight of the respective connecting link. After all the routing tables stabilize, how many links in the network will never be used for carrying any data?

[GATE-2010]

(A) 4

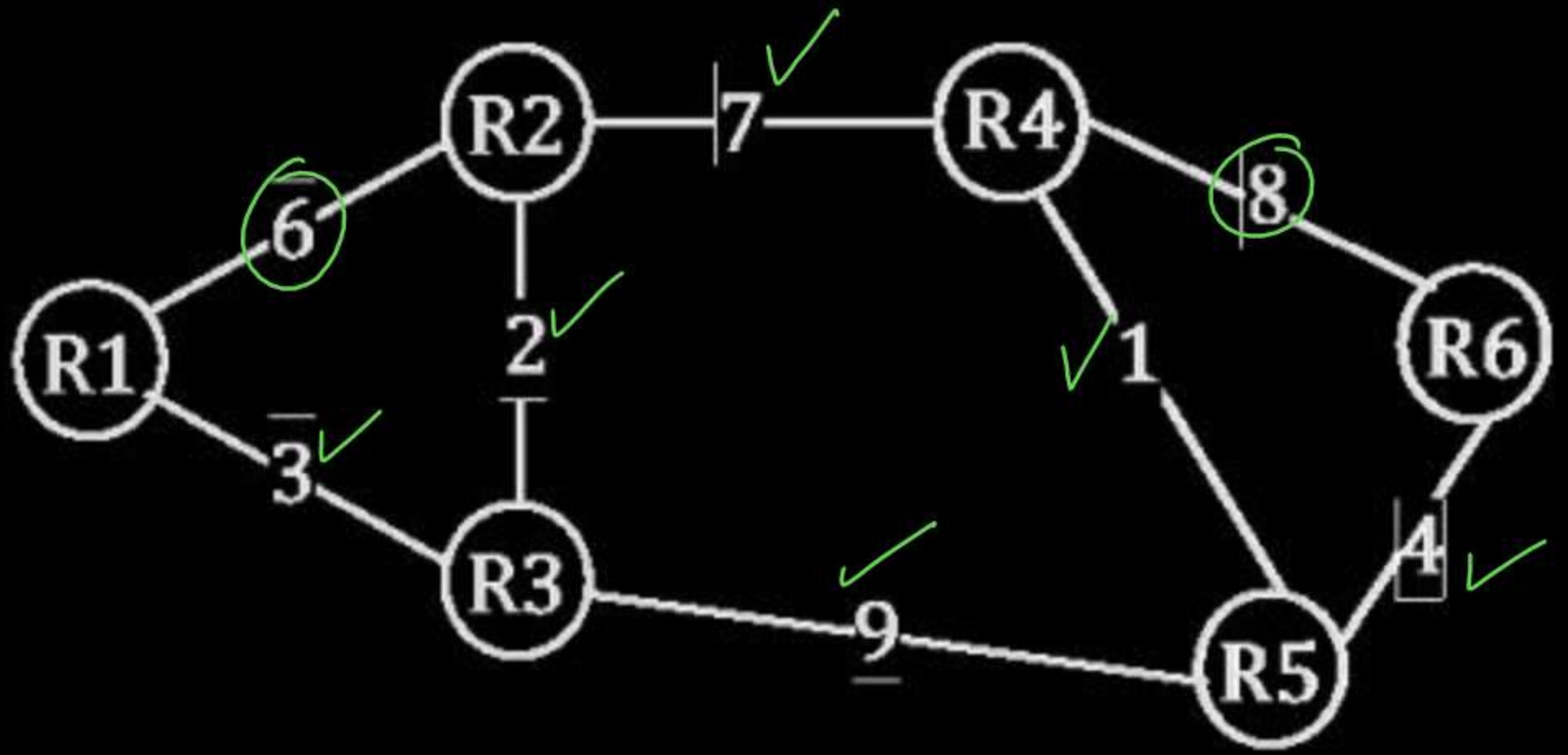
(B) 3

(C) 2

(D) 1

$\boxed{\text{Ans: C}}$

Unused Link: [R_1-R_2], [R_4-R_6]



#Q. Suppose the weights of all unused links in the previous question are changed to 2 and the distance vector algorithm is used again until all routing tables stabilize. How many links will now remain unused?

[GATE-2010]

(A) 0

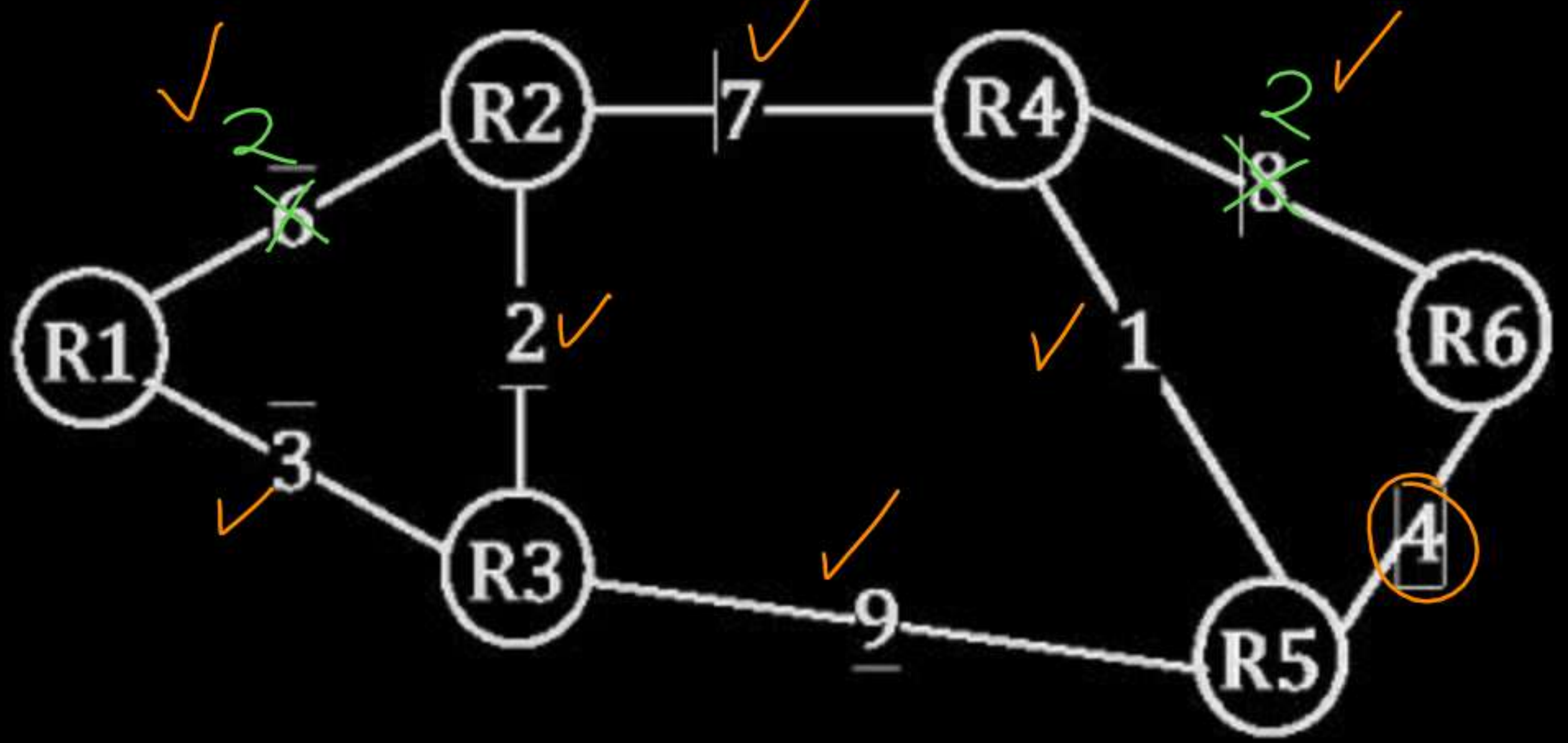
(B) 1

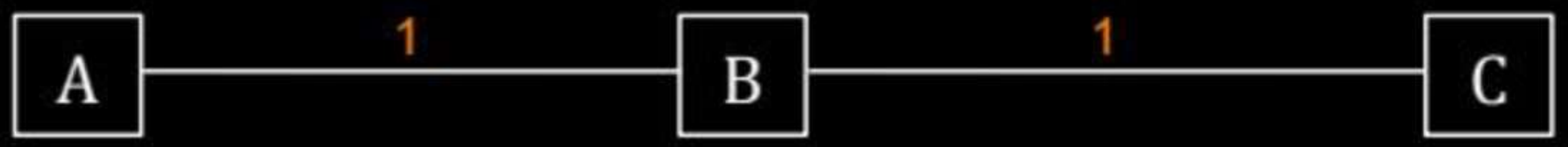
(C) 2

(D) 3

$\boxed{\text{Ans: B}}$

Unused link : $R_5 - R_6$



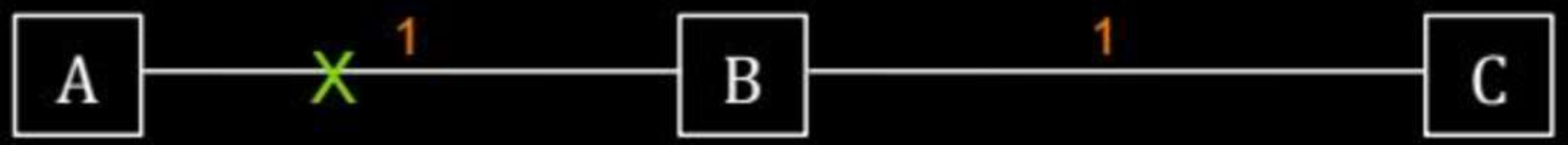


Node	Cost	Via
A	0	A
B	1	B
C	2	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

CASE I :-



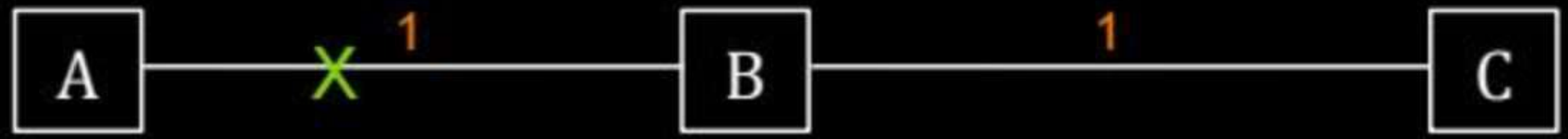
Node	Cost	Via
A	0	A
B	∞	
C	∞	

Node	Cost	Via
A	∞	
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

A	∞
B	0
C	1

CASE I :-



Node	Cost	Via
A	0	A
B	∞	
C	∞	

Node	Cost	Via
A	∞	
B	0	B
C	1	C

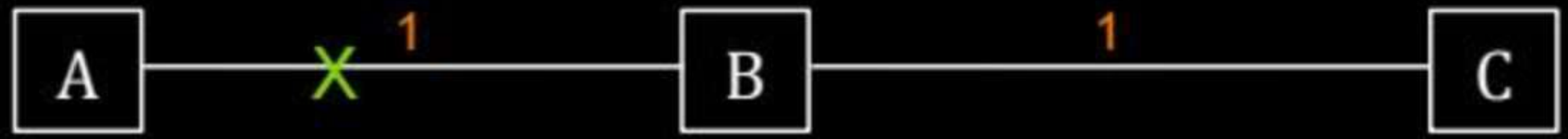
Node	Cost	Via
A	∞	
B	1	B
C	0	C

A	∞
B	1
C	0

Topic : Distance Vector Routing

→ Problem : May suffer with "Count to infinity" problem
[Link to infinity problem]

CASE II :-



Node	Cost	Via
A	0	A
B	∞	
C	∞	

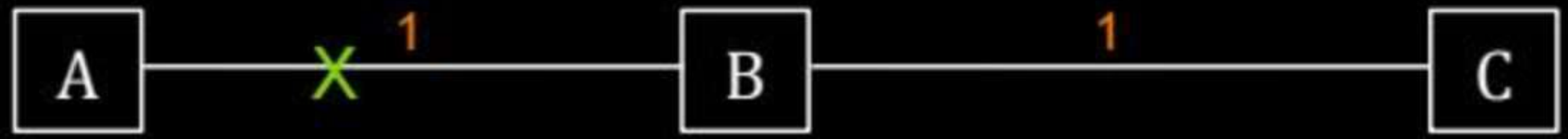
Node	Cost	Via
A	∞	
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

A	∞
B	0
C	1

A	2
B	1
C	0

CASE II :-



Node	Cost	Via
A	0	A
B	∞	
C	∞	

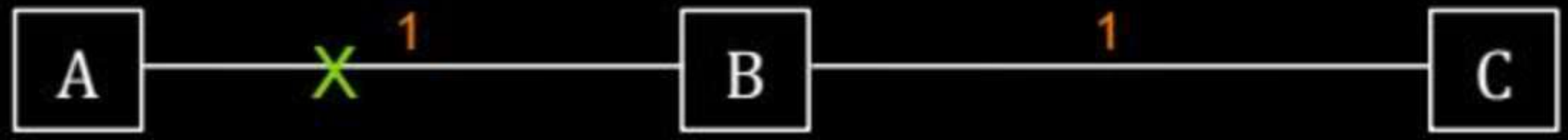
Node	Cost	Via
A	3	C
B	0	B
C	1	C

Node	Cost	Via
A	∞	
B	1	B
C	0	C

A	3
B	0
C	1

A	∞
B	1
C	0

CASE II :-



Node	Cost	Via
A	0	A
B	∞	
C	∞	

Node	Cost	Via
A	∞	
B	0	B
C	1	C

Node	Cost	Via
A	4	B
B	1	B
C	0	C

A	∞
B	0
C	1

A	4
B	1
C	0

[MCQ]

#Q. Count to infinity is a problem associated with :

[GATE-2005]

(A) Link state routing protocol

(B) Distance vector routing protocol

(C) DNS while resolving host name

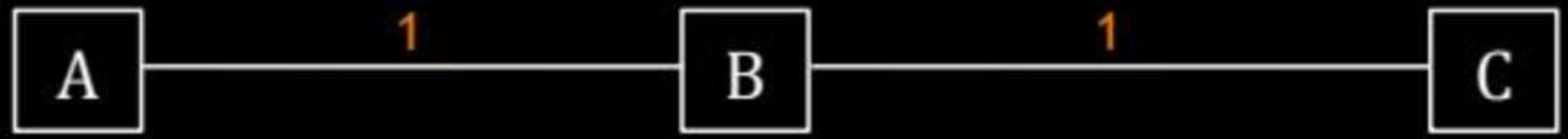
(D) TCP for congestion control

$\boxed{\text{Ans : B}}$

Topic : Distance Vector Routing

→ Problem : May suffer with "Count to infinity" problem
[Link to infinity problem, occur due to routing loop in DVR]

Solution 1 : Advertise routing path in 'Distance Vector'
[Send 'Next Hop' (via) with distance vector]



Node	Cost	Via
A	0	A
B	1	B
C	2	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

Node	Cost	Via
A	0	A
B	1	B
C	2	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

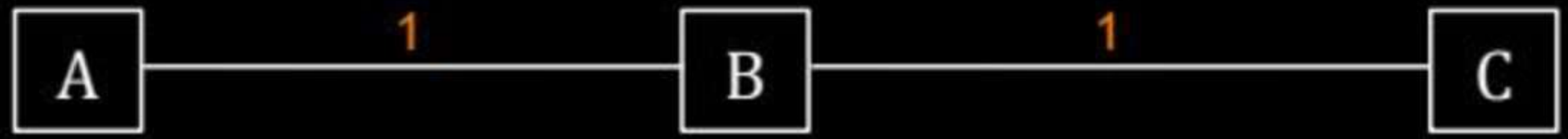
Node	Cost	Via
A	1	A
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

Topic : Distance Vector Routing

→ Problem : May suffer with "Count to infinity" problem
[Link to infinity problem, occur due to routing loop in DVR]

Solution 2 : "Split horizon hack"
[Do not advertise the distance to a neighbor,
if the neighbor is the Next Hop for corresponding entry]



Node	Cost	Via
A	0	A
B	1	B
C	2	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

A	0

B	0
C	1

A	1
B	0

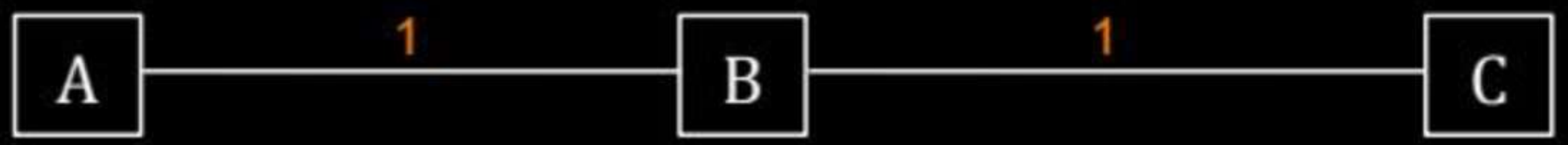
C	0

Topic : Distance Vector Routing

→ Problem : May suffer with "Count to infinity" problem
[Link to infinity problem, occur due to routing loop in DVR]

Solution 3 : "Poison reverse"
[Advertise infinite distance to a neighbor,
if the neighbor is the Next Hop for corresponding entry]

[split horizon with poison revers]



Node	Cost	Via
A	0	A
B	1	B
C	2	B

Node	Cost	Via
A	1	A
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

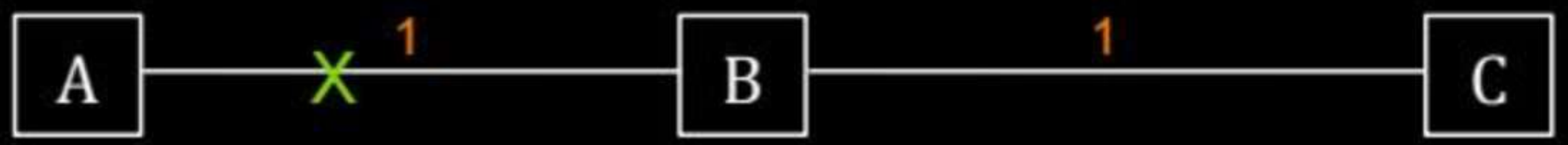
A	0
B	∞
C	∞

A	∞
B	0
C	1

A	1
B	0
C	∞

A	∞
B	∞
C	0

CASE III :-



Node	Cost	Via
A	0	A
B	∞	
C	∞	

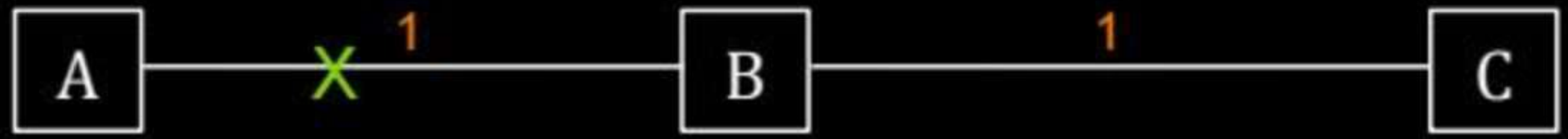
Node	Cost	Via
A	∞	
B	0	B
C	1	C

Node	Cost	Via
A	2	B
B	1	B
C	0	C

A	∞
B	0
C	∞

A	∞
B	∞
C	0

CASE III :-



Node	Cost	Via
A	0	A
B	∞	
C	∞	

Node	Cost	Via
A	∞	
B	0	B
C	1	C

Node	Cost	Via
A	∞	
B	1	B
C	0	C

Topic : Distance Vector Routing

→ Problem : May suffer with "Count to infinity" problem
[Link to infinity problem, occur due to routing loop in DVR]

Solution 1 : Advertise routing path in 'Distance Vector'
[Send 'Next Hop' (via) with distance vector]

Solution 2 : "Split horizon hack"
[Do not advertise the distance to a neighbor,
if the neighbor is the Next Hop for corresponding entry]

Solution 3 : "Poison reverse"
[Advertise infinite distance to a neighbor,
if the neighbor is the Next Hop for corresponding entry]

[MCQ]

#Q. Two popular routing algorithms are Distance Vector (DV) and Link State (LS) routing. Which of the following are true?

(S1) Count to infinity is a problem only with DV and not LS routing TRUE

(S2) In LS, the shortest path algorithm is run only at one node FALSE

(S3) In DV, the shortest path algorithm is run only at one node FALSE

(S4) DV requires lesser number of network messages than LS TRUE

[GATE-2008]

IISC

(A) S1, S2 and S4 only

(B) S1, S3 and S4 only

(C) S2 and S3 only

(D) S1 and S4 only

Ans: D

[MCQ]

#Q. Consider the following three statements about link state and distance vector routing protocols, for a large network with 500 network nodes and 4000 links.

[S1] The computational overhead in link state protocols is higher than in distance vector protocols. TRUE

[S2] A distance vector protocol (with split horizon) avoids persistent routing loops, but not a link state protocol. FALSE

[S3] After a topology change, a link state protocol will converge faster than a distance vector protocol. TRUE

Which one of the following is correct about S1, S2, and S3 ?

[GATE-2014, Set-1, 1-Mark]

(A) S1, S2, and S3 are all true

(B) S1, S2, and S3 are all false

(C) S1 and S2 are true but S3 is false

(D) S1 and S3 are true, but S2 is false

Ans: D

Statement for Linked Answer Questions.

Consider a network with five nodes, N1 to N5, as shown below. The network uses a Distance Vector Routing protocol. Once the routes have stabilized, the distance vectors at different nodes are as following.

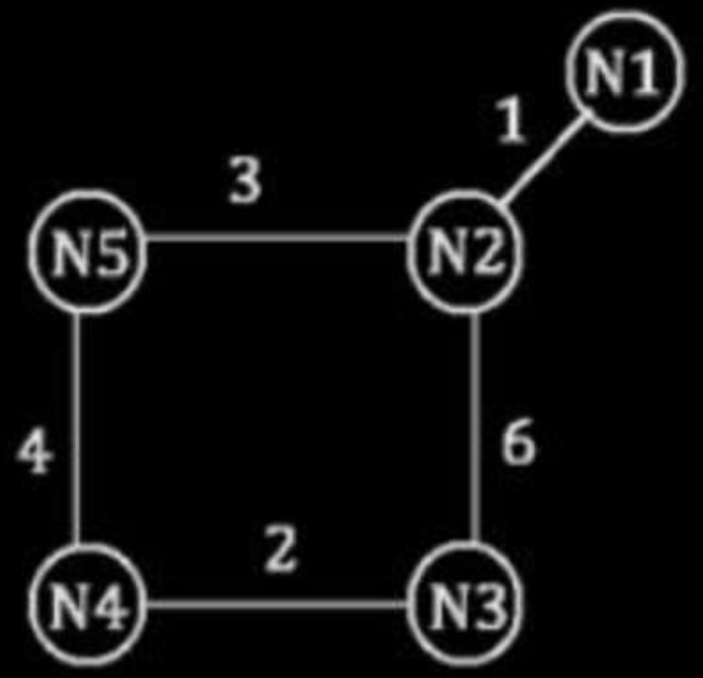
Nl : (0, 1, 7, 8, 4)

N2 : (1, 0, 6, 7, 3)

N3 : (7, 6, 0, 2, 6)

N4 : (8, 7, 2, 0, 4)

N5 : (4, 3, 6, 4, 0)



Each distance vector is the distance of the best known path at that instance to nodes, N1 to N5, where the distance to itself is 0. Also, all links are symmetric and the cost is identical in both directions. In each round, all nodes exchange their distance vectors with their respective neighbors. Then all nodes update their distance vectors. In between two rounds, any change in cost of a link will cause the two incident nodes to change only that entry in their distance vectors.

[MCQ]

#Q. The cost of link N2-N3 reduces to 2 (in both directions). After the next round of updates, what will be the new distance vector at node, N3?

[GATE-2011]

IIT-M

H.W.

(A) (3, 2, 0, 2, 5)

(B) (3, 2, 0, 2, 6)

(C) (7, 2, 0, 2, 5)

(D) (7, 2, 0, 2, 6)

[MCQ]

#Q. Consider the same data as given in previous question. After the update in the previous question, the link N1-N2 goes down. N2 will reflect this change immediately in its distance vector as cost, infinite. After the NEXT ROUND of update, what will be cost to N1 in the distance vector of N3?

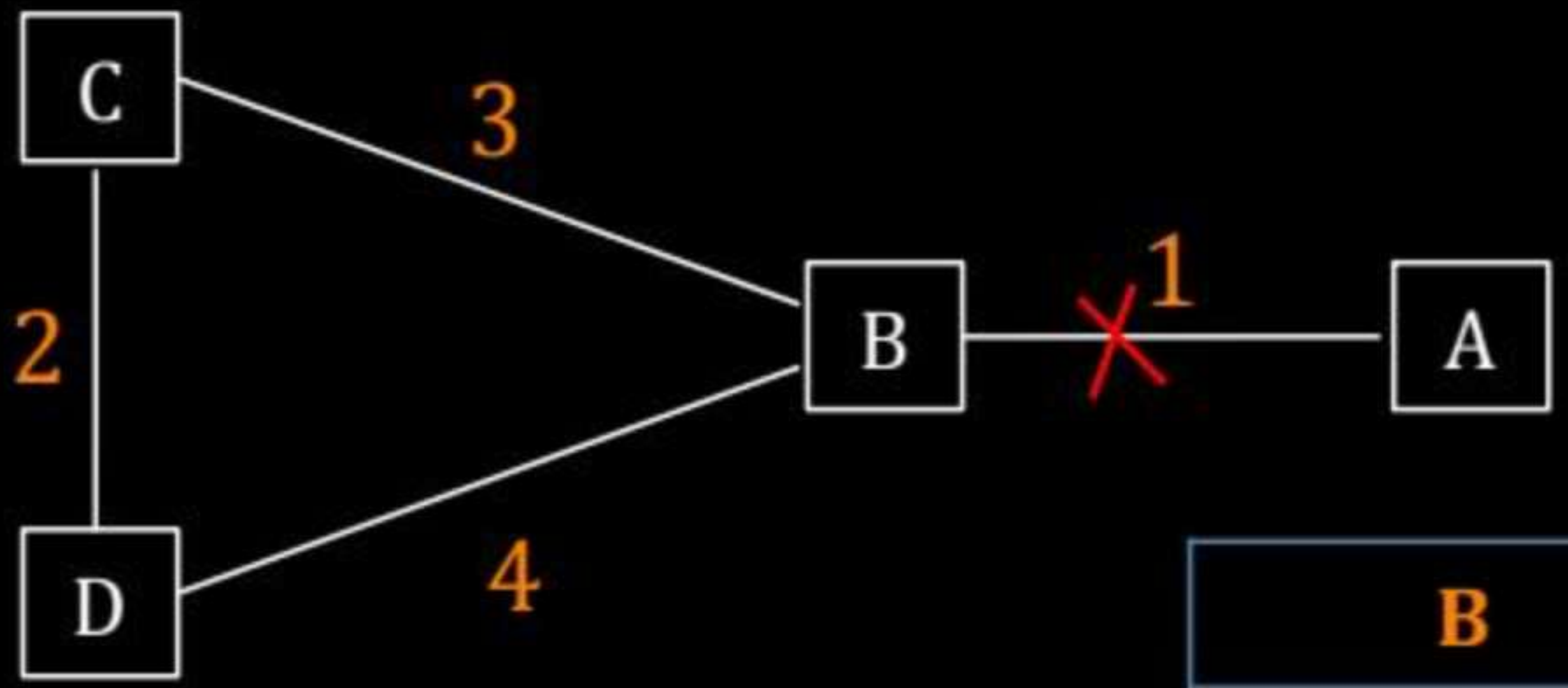
$\underbrace{\text{[GATE-2011]}}_{\text{H.W}}$

(A) 3

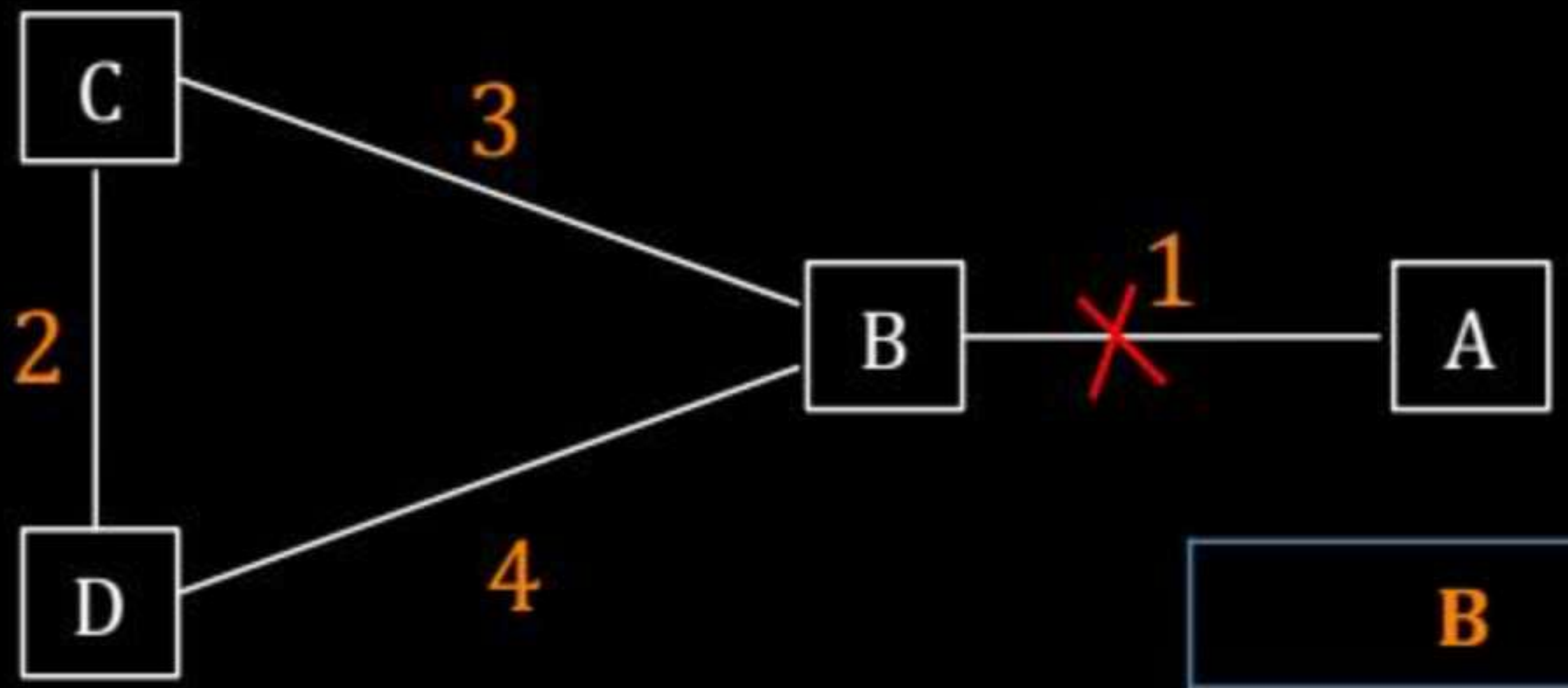
(B) 9

(C) 10

(D) Infinite



B	C	D
A = 1, Via A	A = 4, Via B	A = 5, Via B
$\boxed{A = \infty}$	A = 4, Via B	A = 5, Via B
A = ∞	A = 7, Via D	A = 6, Via C
A = 10, via D	A = ∞	A = ∞



B	C	D
A = 1, Via A	A = 4, Via B	A = 5, Via B
A = ∞	A = 4, Via B	A = 5, Via B
A = ∞	A = 7, Via D	A = 6, Via C
A = 10, Via C	A = ∞	A = ∞
A = ∞	A = ∞	A = 14, Via B
A = ∞	A = 16, Via D	A = ∞

2 mins Summary

Topic Distance Vector Routing

THANK - YOU