UIT2403 – Data Communication and Networking

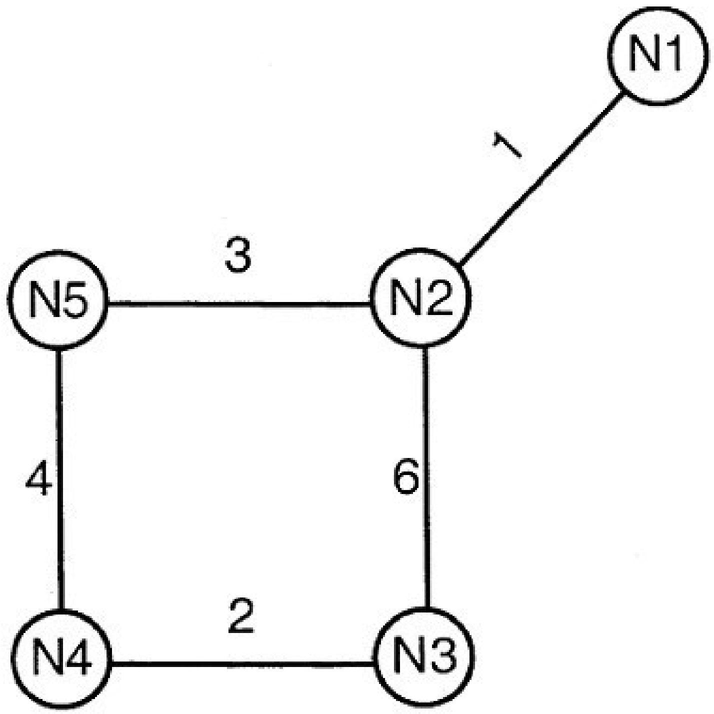
UNIT III: NETWORK LAYER AND INTERNETWORKING

Tutorial – III

Routing Algorithms

Date: 16.05.2024

1. Consider a network with five nodes, N1 to N5, as shown below.



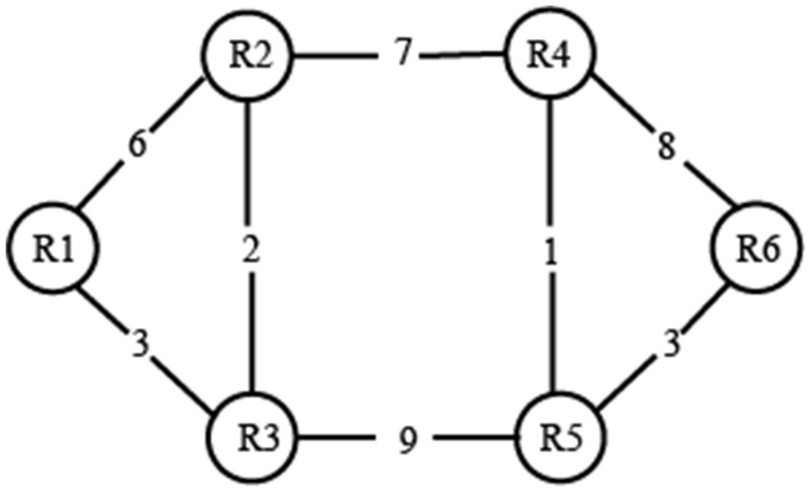
The network uses a Distance Vector Routing protocol. Once the routes have stabilized, the distance vectors at different nodes are as follows.

- **N1**: (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 the 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. 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.

2. Consider the same data as given in the 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?

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



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?

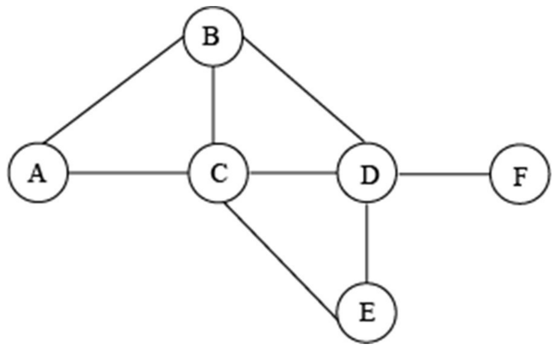
4. Suppose the weights of all unused links in the previous question are changed to 2 and the distance vector algorithm is used again until all routing tables stabilize. How many links will now remain unused?

5. Consider a simple graph with unit edge costs as shown below. Each node in the graph represents a router. Each node maintains a routing table indicating the next hop router to be used to relay a packet to its destination and the cost of the path to the destination through that router.

   Initially, the routing table is empty. The routing table is synchronously updated as follows. In each updating interval, three tasks are performed.

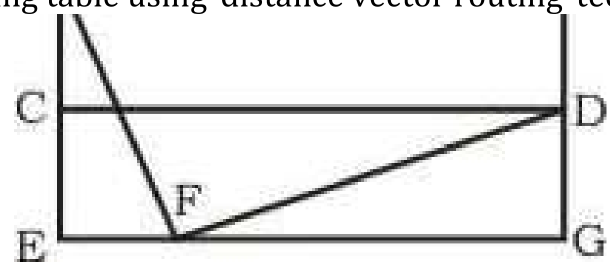
   i. A node determines whether its neighbors in the graph are accessible. If so, it sets the tentative cost to each accessible neighbor as 1. Otherwise, the cost is set to ∞.
   ii. From each accessible neighbor, it gets the costs to relay to other nodes via that neighbor (as the next hop).

iii. Each node updates it routing table based on the information received in the previous two steps by choosing the minimum cost.



For the graph given above, determine the possible routing tables for A, B, C and D nodes after they have stabilized.

6. 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.

7. 

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

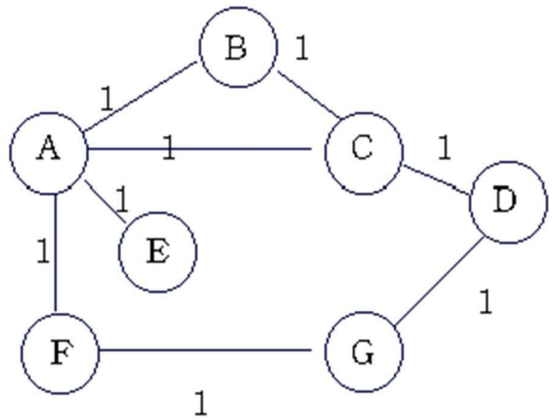
A	24
B	27
C	7
D	20
E	0
F	11
G	22

Routing Table of G

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

Determine the updated routing table at the node F.

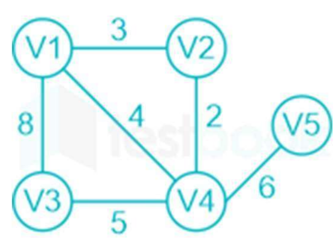
7. Consider the following network graph.



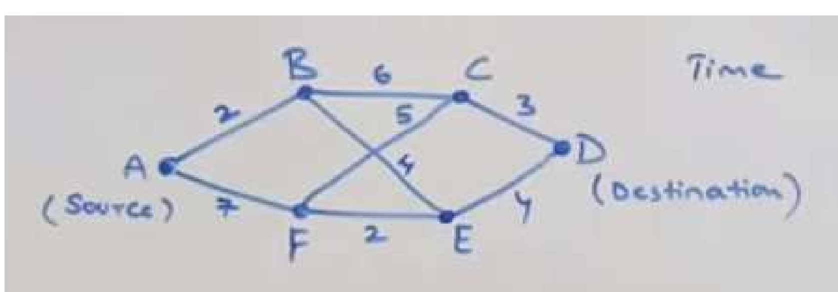
Apply Distance Vector Routing to determine the following:

i. Initial distances stored at each node.
ii. Final distances stored at each node.

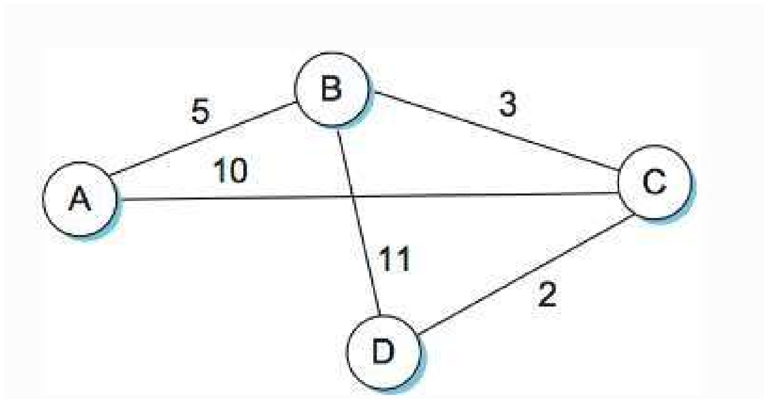
8. In the following diagram, if link V1-V4 is removed, then how does the routing table for distance vector routing protocol vary for the node V1?



9. Consider the following network graph. Apply Dijkstra's algorithm to find the shortest path from the source to destination.



10. Consider the network depicted in the following graph.



Apply Dijkstra's algorithm to trace the steps for building the routing table for node D.

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