Routing

1) Describe the difference between Link State Routing and Distance Vector Routing in your own words. Discuss the steps a node using an approach that implements Link State Routing such as OSPF has to go through in order to establish a routing table in comparison to the steps that a Distance Vector Routing approach such as RIP has to go through.

   Link State Routing: i) A node would broadcast information about its own connections to its neighbours, ii) periodically, it may run an algorithm such as Dijkstra's Shortest Path to establish a routing table that includes routes to all nodes that it received information about in broadcasts.

   Distance Vector Routing: A node would periodically exchange routing tables or updated information of routing tables with neighbouring nodes. When a node receives an update from a neighbouring node, it will analyse this information for updates to its own routing table.

2) Link State Routing

   Consider the network shown in Figure 1. The nodes are routers in a network, the edges are links between the routers and the numbers on the edges indicate initial latency measurements (in msec) on that link (the measurements performed by two routers connected to the same link are identical.) The network uses measured latency as its metric.

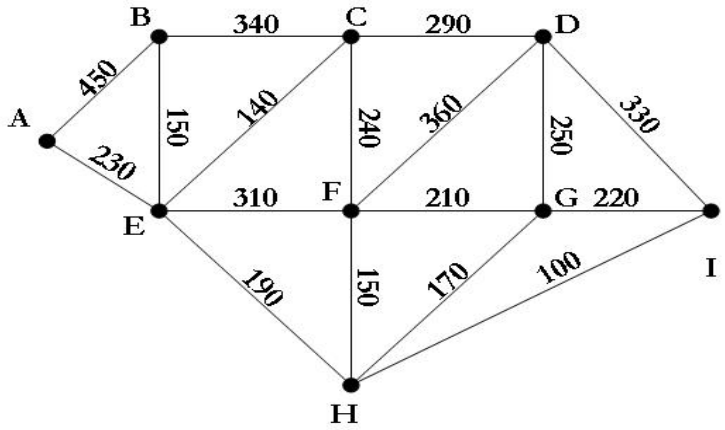

Figure 1

   a) Use Dijkstra's algorithm for finding the shortest path between A and I. A correct answer must include the complete list of routers in the shortest path between A and I, the length of that path and a list that shows the chronological order in which routers were marked permanent by Dijkstra's algorithm.

      Path: A, E, H, I
      Length: 520
      Chronological order: A, E, C, B, H, I, F, G, D

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b) Show the routing tables of the following three routers A, F, and I. Each entry in these tables has the form [destination, distance, link].

Routing table for A:

A	0	0
B	380	E
C	370	E
D	660	C
E	230	A
F	540	E
G	590	H
H	420	E
I	520	H

Routing table for I:

A	520	E
B	440	E
C	430	E
D	320	I
E	290	H
F	160	H
G	130	I
H	100	I
I	0	0

Routing table for F:

A	540	E
B	460	E
C	240	F
D	360	F
E	310	F
F	0	0
G	210	F
H	150	F
I	250	H

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3) Distance Vector Routing

Router	Latency
E	390
F	260
G	270
I	380

a) Router H in the network of exercise 1) updates its neighbours using distance vectors with the information shown in the table above. Show the progression of the routing information in the network for the times t= 0, 1, 2, … and the influence on the distance of the path from router A to router I.

Time Update
t0 H
t1 E, F, G, I
t2 A, B, C, D

Route from A to I over E-H: 1000
Route from A to I: A-E-F-G-I
Length: 970

b) Explain the exchange of routing information in Distance Vector Routing in your own words and contrast it with the approach taken in Link State Routing.

An answer to this question should explain the exchange of complete routing tables or updates to routing tables between neighbouring nodes in Distance Vector Routing and that information in routing tables progresses through the network based on these exchanges until all nodes converge on a common view of the network. Given the volatile nature of nodes and connections, changes in the connectivity may trigger updates being propagated and the view of the network of individual routers may constantly change.
In contrast to this, Link State Routing is based on periodical or irregular broadcasts of connectivity information by individual routers. These broadcasts are gathered by individual routers and used for a shortest-path analysis, for example based on Djikstra's Shortest Path algorithm. The broadcasts of connectivity information may be triggered at regular intervals or whenever a change occurs. In contrast to Distance Vector Routing, these broadcasts should be delivered to all routers in the topology, eliminating the progression to convergence exhibited by Distance Vector approaches; at the expense of causing broadcasts throughout a topology i.e. introducing increased network traffic in exchange for reduced latency in distributing routing information.

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