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Assignment: 5
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Big Pictures
P1.
a). Datagram network is preferred, since virtual circuit network is a connection-oriented network through router, whereas datagram network is a connection-less network. Because of this, when a router fails, in datagram network, another router can be used immediately.

b). Virtual circuit network is preferred, since only routers on the fixed path from source node to destination node need to reserve capacity for the connection.

c). Datagram network has more control traffic overhead, because to route datagrams through the network, it needs various packet headers, whereas in virtual circuit network, routing has to be done only once.

Distance Vector and Link State
P28.
Node z has two neighbors, x and v.

	u	v	x	y	z
u	0	1	∞	2	∞
v	1	0	3	∞	6
x	∞	3	0	3	2
y	2	∞	3	0	∞
z	∞	6	2	∞	0

Update row z with row x and row v.

(row z) = (∞, 6, 2, ∞, 0)
(row v) + 6 = (7, 6, 9, ∞, 12)
(row x) + 2 = (∞, 5, 2, 5, 4)
Therefore, row z is updated to (7, 5, 2, 5, 0).

Similarly, update other rows.

	u	v	x	y	z
u	0	1	4	2	7
v	1	0	3	3	5
x	4	3	0	3	2
y	2	3	3	0	5
z	7	5	2	5	0

Repeat the above steps.

	u	v	x	y	z
u	0	1	4	2	**6**
v	1	0	3	3	5
x	4	3	0	3	2
y	2	3	3	0	5
z	**6**	5	2	5	0

Only row z and row u change, after this, the algorithm converges.

P29.
Suppose the longest path of the network contains n nodes, then after n-1 iterations, the synchronous distance vector algorithm converges. Because the algorithm begins with the destination node, and at each iteration, it propagates to all its neighbors.

This is assuming no circle exists in the network. If circle of n nodes exists, the number of iterations required for the algorithm to converge is obviously < n.

P30.

a). $d_x(w)$ = 2, $d_x(y)$ = 4, $d_x(u) = 7$

b). x to u through w has cost 2 + 5 = 7, x to u through y has cost 4 + 6 = 10.

When c(x, w) changes within (0, 5], the least cost path still goes through w, in this case, x will inform its neighbors since the cost changes. When c(x, w) is > 5, the least cost path goes through y instead, and x will inform its neighbors too since the path itself changes.

When c(x, y) changes within (0, 1), the least cost path goes through y instead, therefore x will inform its neighbors. When c(x, y) >= 1, the least cost path remains to go through w, and x will not inform its neighbors.

c). Any change of cost on c(x, y) >= 1 doesn't cause x to inform its neighbors of a new minimum-cost path to u.

P32.

No. If originally there was no counting-to-infinity problem, then decreasing the cost of a link doesn't cause the problem to occur, since it doesn't create loops.

Connecting two nodes which don't have a link doesn't cause the problem to occur either, since it's effectively the same as decreasing the cost from infinity to some finite value.

P34.

a).
When the distance vector routing is stabilized, w routes to x via y, y routes to x directly, and z routes to x via w then y. Thus,

w informs y: $D_w(x) = \infty$
w informs z: $D_w(x) = 5$
y informs w: $D_y(x) = 4$
y informs z: $D_y(x) = 4$
z informs w: $D_z(x) = \infty$
z informs y: $D_z(x) = 6$

b). Guess yes. I don't know how to derive the number of iterations needed.

c). Cut the link between y and z.

Internet Routing
P37.
a). eBGP
b). iBGP
c). eBGP
d). iBGP

P38.
a). I1. Since there is no physical link between AS2 and AS4, the path goes through router 1d – 1a – 1c.
b). I2, because from I2, the NEXT-HOP router is closer to x than that from I1.
c). I1, because from I1, the AS-PATH attribute of the path is smaller than that from I2.

P39.

The BGP mechanism that C might use is to advertise the route to D only via its east coast peering point. This way B would hand over A-to-D traffic at the east coast peering point.

P40.

Topology view at X is as follows, since X doesn't receive any advertisement that contains both A and C.

W – A – B – X – C – Y

Topology view at W is as follows, since W doesn't receive any advertisement that contains both B and C.

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W – A –  B – X
       \__ C _ Y
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P41.

BitTorrent. Suppose peer A, B and C are in networks W, X, Y respectively. Peer B can receive data from peer A and send to peer C, thus the network path is W – X – Y.

Forwarding

P10.

a).

11100000 00	0
11100000 01000000	1
1110000	2
11100001 1	3
otherwise	3

b).

Match to otherwise	-> 3
Match to 1110000	-> 2
Match to 11100001 1	-> 3