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CS 3800
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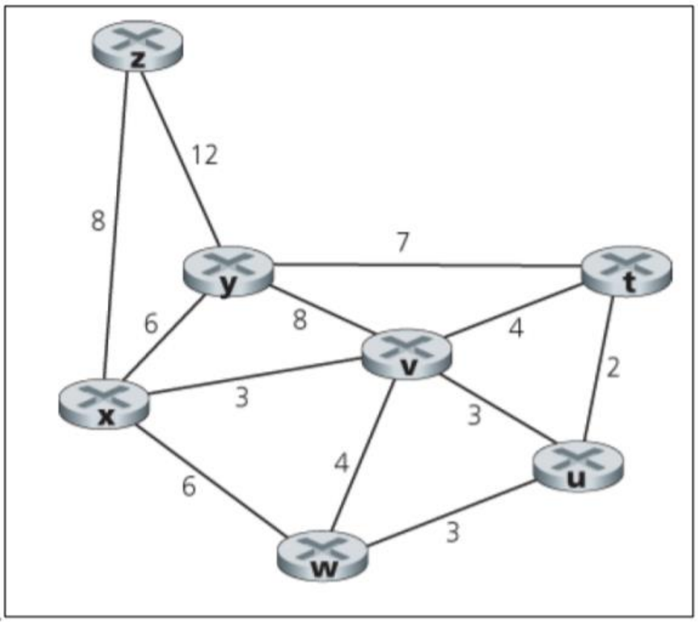
Assignment #4

1. . (Ch 5: P4) [6pts] Consider the network shown below. Using Dijkstra's algorithm, and showing your work using a table (similar to the one in the lecture and textbook), do the following:



a. Compute the shortest path from t to all network nodes.

Step	N'	D(u), p(u)	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	t	2, t	4, t	∞	∞	7, t	∞
1	tu	2, t	4, t	5, u	∞	7, t	∞
2	tuv	2, t	4, t	5, u	7, v	7, t	∞
3	tuvw	2, t	4, t	5, u	7, v	7, t	∞
4	tuvwx	2, t	4, t	5, u	7, v	7, t	15, x
5	tuvwxy	2, t	4, t	5, u	7, v	7, t	15, x
6	tuvwxyz	2, t	4, t	5, u	7, v	7, t	15, x

b. Compute the shortest path from u to all network nodes.

Step	N'	D(t), p(t)	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	u	2, u	3, u	3, u	∞	∞	∞
1	ut	2, u	3, u	3, u	∞	9, t	∞
2	utv	2, u	3, u	3, u	6, v	9, t	∞
3	utvw	2, u	3, u	3, u	6, v	9, t	∞
4	utvwx	2, u	3, u	3, u	6, v	9, t	14, x
5	utvwxy	2, u	3, u	3, u	6, v	9, t	14, x
6	utvwxyz	2, u	3, u	3, u	6, v	9, t	14, x

c. Compute the shortest path from v to all network nodes.

Step	N'	D(t), p(t)	D(u), p(u)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	v	4, v	3, v	4, v	3, v	8, v	∞
1	vx	4, v	3, v	4, v	3, v	8, v	11, x
2	vxu	4, v	3, v	4, v	3, v	8, v	11, x
3	vxut	4, v	3, v	4, v	3, v	8, v	11, x
4	vxutw	4, v	3, v	4, v	3, v	8, v	11, x
5	vxutwy	4, v	3, v	4, v	3, v	8, v	11, x
6	vxutwyz	4, v	3, v	4, v	3, v	8, v	11, x

d. Compute the shortest path from x to all network nodes.

Step	N'	D(t), p(t)	D(u), p(u)	D(v), p(v)	D(w), p(w)	D(y), p(y)	D(z), p(z)
0	x	∞	∞	3, x	6, x	6, x	8, x
1	xy	7, v	6, v	3, x	6, x	6, x	8, x
2	xvu	7, v	6, v	3, x	6, x	6, x	8, x
3	xvuw	7, v	6, v	3, x	6, x	6, x	8, x
4	xvuwy	7, v	6, v	3, x	6, x	6, x	8, x
5	xvuwyt	7, v	6, v	3, x	6, x	6, x	8, x
6	xvuwytz	7, v	6, v	3, x	6, x	6, x	8, x

e. Using the routes generated above, compute the forwarding table for t, u, v and x.

Forwarding table for t

Destination	Cost	Next Hop
t	0	-
u	2	u
v	4	x
w	5	w
x	7	z
y	7	y
z	15	z

Forwarding table for u

Destination	Cost	Next Hop
t	2	t
u	0	-
v	3	x
w	3	w
x	6	z
y	9	y
z	14	z

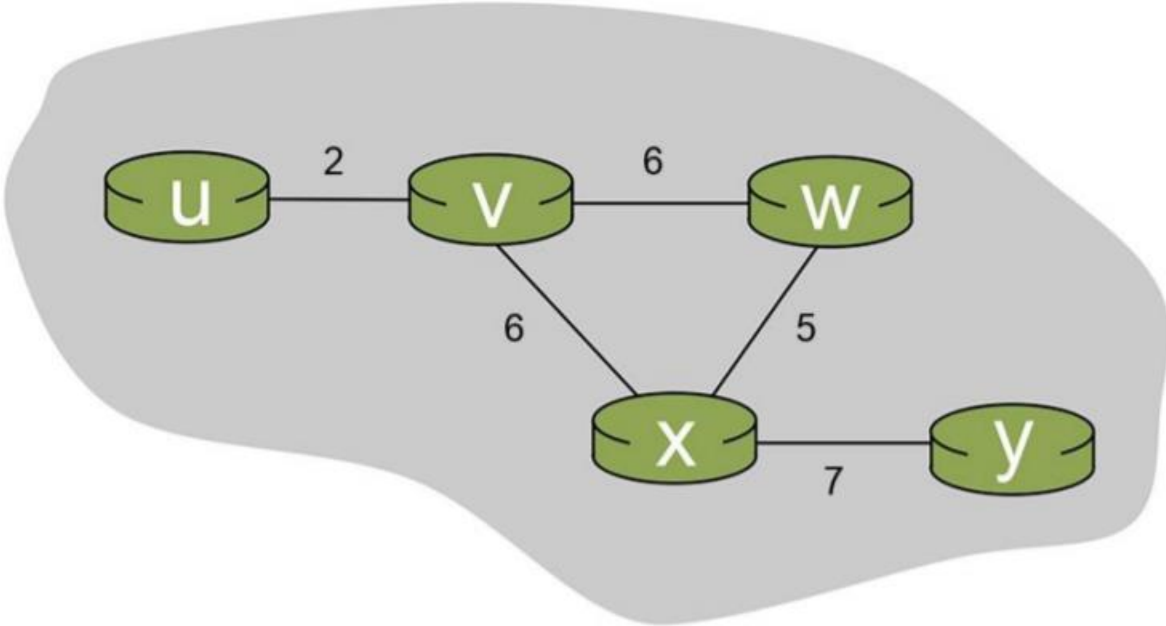
Forwarding table for v

Destination	Cost	Next Hop
t	4	t
u	3	u
v	0	-
w	4	w
x	3	z
y	8	y
z	11	z

Forwarding table for x

Destination	Cost	Next Hop
t	7	t
u	6	u
v	3	v
w	6	w
x	0	-
y	6	y
z	8	z

2. [5pts] Consider the network shown below. Compute the all pairs shortest paths between the nodes using the DVR algorithms. Provide calculations.



U	U	V	W	X	Y
U	0	2	∞	∞	∞
V	∞	∞	∞	∞	∞

V	U	V	W	X	Y
U	∞	∞	∞	∞	∞
V	2	0	6	6	∞
W	∞	∞	∞	∞	∞
X	∞	∞	∞	∞	∞

W	U	V	W	X	Y
V	∞	∞	∞	∞	∞
W	∞	6	0	5	∞
X	∞	∞	∞	∞	∞

X	U	V	W	X	Y
V	∞	∞	∞	∞	∞
W	∞	∞	∞	∞	∞
X	∞	6	5	0	7
Y	∞	∞	∞	∞	∞

Y	U	V	W	X	Y
X	∞	∞	∞	∞	∞
Y	∞	∞	∞	7	0

U	U	V	W	X	Y
U	0	2	8	8	15
V	2	0	6	6	∞

V	U	V	W	X	Y
U	0	2	∞	∞	∞
V	2	0	6	6	13
W	∞	6	0	5	∞
X	∞	6	5	0	7

W	U	V	W	X	Y
V	2	0	6	6	∞
W	8	6	0	5	12
X	∞	6	5	0	7

X	U	V	W	X	Y
V	2	0	6	6	∞
W	∞	6	0	5	∞
X	8	6	5	0	7
Y	∞	∞	∞	7	0

Y	U	V	W	X	Y
X	∞	6	5	0	7
Y	∞	13	12	7	0

U	U	V	W	X	Y
U	0	2	8	8	15
V	2	0	6	6	13

V	U	V	W	X	Y
U	0	2	8	8	∞
V	2	0	6	6	13
W	8	6	0	5	12
X	∞	6	5	0	7

W	U	V	W	X	Y
V	2	0	6	6	13
W	8	6	0	5	12
X	8	6	5	0	7

X	U	V	W	X	Y
V	2	0	6	6	13
W	8	6	0	5	12
X	8	6	5	0	7
Y	15	13	12	7	0

Y	U	V	W	X	Y
X	8	6	5	0	7
Y	15	13	12	7	0

3. (Ch 6: P18) [Extra credit 4pts] Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 325 bit times (A bit time is the time need to transmit a bit). Suppose CSMA/CD and Ethernet packets are used for this broadcast channel. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not? If the answer is yes, then A incorrectly believes that its frame was successfully transmitted without a collision. Hint: Suppose at time t=0 bits, A begins transmitting a frame. In the worst case, A transmits a minimum-sized frame of 512 + 64 bit times. So A would finish transmitting the frame at t= 512 + 64 bit times. Thus, the answer is no, if B's signal reaches A before bit time t=512+64 bits. In the worst case, when does B's signal reach A?

   Speed of the Ethernet bus = 10 Mbps
   Propagation delay between node A and node B = 325 times
   At t = 0 node A transmits the frame
   At t = 576, node A completes transmitting the frame
   Worst case: node B begins its transmission at time just before the first bit of node A arrives at node B (before time propagation delay). So, node B begins its transmission at time t = 324.
   As propagation delay is 325 times, at time t 324 + 325 = 649, the first bit of node B arrives at node A.
   Node A finishes its transmission before detecting that transmission by node B started.
   Node A believes incorrectly that the frame sent by node A is transmitted successfully without collision.