COMP 431 - Problem Set 7

Joe Puccio

April 23, 2015

Collaborators: Fred Landis, Max Daum, Spencer Byers.

1.

The 17 paths and their corresponding costs are:

$$ABCDEF : 11$$

$$ABCEF : 8$$

$$ABCF : 10$$

$$ABDCEF : 10$$

$$ABDCF : 12$$

$$ABDECF : 11$$

$$ABDEF : 7$$

$$ACBDEF : 13$$

$$ACDEF : 11$$

$$ACEF : 8$$

$$ACF : 10$$

$$ADBCEF : 9$$

$$ADBCF : 11$$

$$ADCEF : 7$$

$$ADCF : 9$$

$$ADECF : 8$$

$$ADEF : 4$$

2.

a) X's distance table is as follows:

D^x	W	Y
W	1	*
Y	*	4
A	6	10

Note: the entries with asterisks actually depend on the full topology of the network, for instance there could

be a small link connecting Y and W with weight 1 and so we do not know the minimum distances.

b) An example of a new cost for $c(X, W)$ that would induce a broadcast by X of its new routing table is 6, that is, a change of $c(X, W) = 1 \rightarrow 6$.

c) An example of a new cost for $c(X, W$ that would not induce a broadcast by X of its new routing table is 2, that is, a change of $c(X, W) = 1 \rightarrow 2$.

3.

Assuming (we were told on Piazza to make this assumption) that, when the A-E link fails, router A sets its routing table entry for E to ∞ regardless of what else is in its distance table for E. Also assuming that the routing table changes are not sent on a change-basis, but rather a time-basis (sent with some schedule):

a)

D^A	
E	1
B	1

D^B	
E	2
A	1

A notices that E link went down

D^A	
E	∞
B	1

D^B	
E	2
A	1

B sends its entry for E before A can send the update

D^A	
E	3
B	1

D^B	
E	2
A	1

A sends its entry for E, thus incrementing B's entry

D^A	
E	3
B	1

D^B	
E	4
A	1

B sends its entry for E, thus incrementing A's entry, etc.

b) The probability that a count to infinity loop occurs, given that A and B are sending out routing updates at random with the same frequency, is 0.5 or 50%.

c) The probability of this loop forming, with A broadcasting within 1 second of A-E failing and B broadcasting every 60 seconds is $\frac{1}{60}$, or 1.66%.

4.

The following tables are produced:

D^x	Y	Z
Y	2	8
Z	3	7

D^y	X	Z
X	2	4
Z	5	1

D^z	X	Y
X	7	3
Y	9	1

No changes are sent because no changes are made to any of the minimum routes (that is, no changes are made to the routing tables).

5.

a)

Destination Range (decimal)	Link Interface
225.0.0.0/8	0
226.0.0.0/16	1
225.0.0.0/8	2
0.0.0.0/0	3

Destination Range (binary)	Link Interface
11100000	0
11100001 00000000	1
11100001	2
otherwise	3

b)

Destination address	Link Interface Sent To
11001000 10010001 01010001 01010101	3
11100001 00000000 11000011 00111100	1
11100001 10000000 00010001 01110111	2

For each of these destination addresses, the router will compare the destination address to the destination ranges in its routing table and send the packets to the interface that matches the address with the longest matching prefix.

6. One of the many address spaces that satisfy these constraints:

223.1.17.0/26 (for subnet 3)

223.1.17.64/26 (for subnet 2)

223.1.17.128/25 (for subnet 1)