CS305 · Computer Network

Homework 2

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1 Q1

1.1 a

Interface	range of destination host addr	number of addr
0	11100100 ~ 11111011	24
1	11100000 ~ 11100011	4
2	11111100 ~ 11111111	4
3	00000000 ~ 11011111	224

Table 1: Q1(a)

1.2 b

When datagram reaches the router, CA of the router will look up the forwarding table and forward the datagram to the corresponding link by longest prefix matching.
11001000 does not match any prefix, so it will be forwarded to link 3.
11100001 matches the longest prefix 111000, so it will be forwarded to link 1.
11110000 matches the longest prefix 111, so it will be forwarded to link 0.

2 Q2

Suppose there are n-bit for host.
As requested IP addresses for 4 organization, we have

$$\begin{aligned} 2^{n_1} &\geq 200 \rightarrow n_1 \geq 8 \\ 2^{n_2} &\geq 96 \rightarrow n_2 \geq 7 \\ 2^{n_3} &\geq 62 \rightarrow n_3 \geq 6 \\ 2^{n_4} &\geq 60 \rightarrow n_4 \geq 6 \end{aligned}$$

Then the prefixes are

Organization	CIDR
1	128.119.40.0/24
2	128.119.41.0/25
3	128.119.41.128/26
4	128.119.41.192/26

Table 2: Q2

3 Q3

3.1 a

The addresses of the interfaces of the three hosts in the home network are:

192.168.2.129
192.168.2.130
192.168.2.131

3.2 b

The NAT translation table is

WAN	LAN
24.34.114.232, 4001	192.168.2.200, 3000
24.34.114.232, 5001	192.168.2.200, 3000
24.34.114.232, 4002	192.168.2.201, 3001
24.34.114.232, 5002	192.168.2.201, 3001

Table 3: Q3(b)

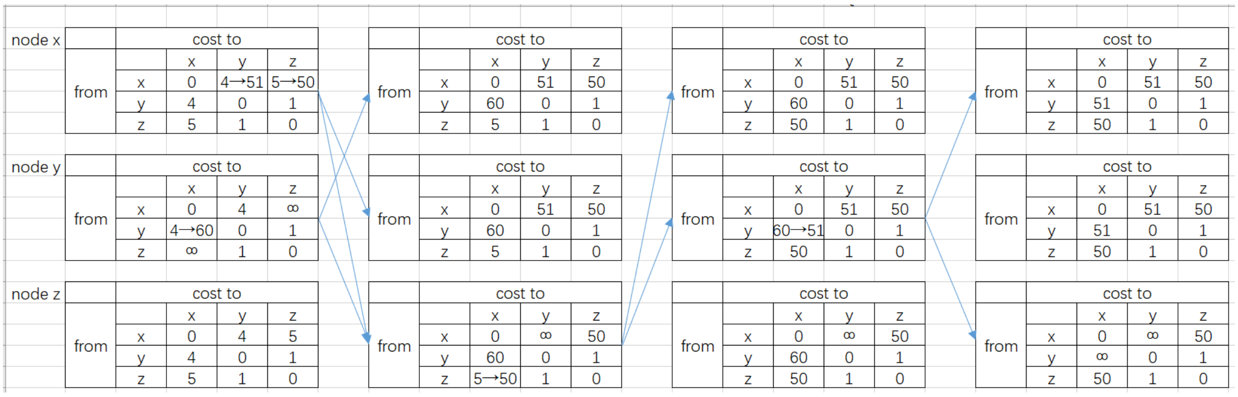
4 Q4

Step	N′	D(y), p(y)	D(z), p(z)	D(u), p(u)	D(v), p(v)	D(w), p(w)	D(t), p(t)
0	x	6, x	8, x	∞	3, x	6, x	∞
1	xv	6, x	8, x	6, v		6, x	7, v
2	xvy		8, x	6, v		6, x	7, v
3	xvyu		8, x			6, x	7, v
4	xvyuw		8, x				7, v
5	xvyuwt		8, x				
6	xvyuwtz						

Table 4: Q4

5 Q5

5.1 a



node x

from \ cost to	x	y	z
x	0	4→51	5→50
y	4	0	1
z	5	1	0

from \ cost to	x	y	z
x	0	51	50
y	60	0	1
z	5	1	0

from \ cost to	x	y	z
x	0	51	50
y	60	0	1
z	50	1	0

from \ cost to	x	y	z
x	0	51	50
y	51	0	1
z	50	1	0

node y

from \ cost to	x	y	z
x	0	4	∞
y	4→60	0	1
z	∞	1	0

from \ cost to	x	y	z
x	0	51	50
y	60	0	1
z	5	1	0

from \ cost to	x	y	z
x	0	51	50
y	60→51	0	1
z	50	1	0

from \ cost to	x	y	z
x	0	51	50
y	51	0	1
z	50	1	0

node z

from \ cost to	x	y	z
x	0	4	5
y	4	0	1
z	5	1	0

from \ cost to	x	y	z
x	0	∞	50
y	60	0	1
z	5→50	1	0

from \ cost to	x	y	z
x	0	∞	50
y	60	0	1
z	50	1	0

from \ cost to	x	y	z
x	0	∞	50
y	∞	0	1
z	50	1	0

Figure 1: Q5(a)

5.2 b

Before the oscillation, we have

$$\begin{aligned}
D_x(y) &= c(x,y) + D_y(y) = 4 \quad & D_x(z) &= c(x,y) + D_y(z) = 5\\
D_y(x) &= c(y,x) + D_x(x) = 4 \quad & D_y(z) &= c(y,z) + D_z(z) = 1\\
D_z(x) &= c(z,y) + D_y(x) = 5 \quad & D_z(y) &= c(z,y) + D_y(y) = 1
\end{aligned}$$

After the oscillation, $c(x,y) = c(y,x) = 60$ instead of 4. Then we have

- First update

$$\begin{aligned}
D_x(y) &= \min\{c(x,y) + D_y(y), c(x,z) + D_z(y)\} = \min\{60+0, 50+1\} = 51 && (c(x,z) + D_z(y))\\
D_x(z) &= \min\{c(x,z) + D_z(z), c(x,y) + D_y(z)\} = \min\{50+0, 60+1\} = 50 && (c(x,z) + D_z(z))\\
D_y(x) &= \min\{c(y,x) + D_x(x), c(y,z) + D_z(x)\} = \min\{60+0, 1+\infty\} = 60 && (c(y,x) + D_x(x))\\
D_y(z) &= \min\{c(y,x) + D_x(z), c(y,z) + D_z(z)\} = \min\{60+50, 1+0\} = 1 && (c(y,z) + D_z(z))\\
D_z(x) &= \min\{c(z,x) + D_x(x), c(z,y) + D_y(x)\} = \min\{50+0, 1+60\} = 50 && (c(z,x) + D_x(x))\\
D_z(y) &= \min\{c(z,x) + D_x(y), c(z,y) + D_y(y)\} = \min\{50+51, 1+0\} = 1 && (c(z,y) + D_y(y))
\end{aligned}$$

Then there would be message transmission with poisoned reverse: (from → to: distance vectors)

$$\begin{aligned}
x &\to y : D_x(x) = 0, D_x(y) = 51, D_x(z) = 50\\
x &\to z : D_x(x) = 0, D_x(y) = \infty, D_x(z) = 50\\
y &\to x : D_y(x) = 60, D_y(y) = 0, D_y(z) = 1\\
y &\to z : D_y(x) = 60, D_y(y) = 0, D_y(z) = 1\\
z &\to x : D_z(x) = 5, D_z(y) = 1, D_z(z) = 0\\
z &\to y : D_z(x) = 5, D_z(y) = 1, D_z(z) = 0
\end{aligned}$$

- Second update

$$
\begin{aligned}
D_x(y) &= \min\{c(x,y)+D_y(y), c(x,z)+D_z(y)\} = \min\{60+0, 50+1\} = 51 && (c(x,z)+D_z(y)) \\
D_x(z) &= \min\{c(x,z)+D_z(z), c(x,y)+D_y(z)\} = \min\{50+0, 60+1\} = 50 && (c(x,z)+D_z(z)) \\
D_y(x) &= \min\{c(y,x)+D_x(x), c(y,z)+D_z(x)\} = \min\{60+0, 1+50\} = 51 && (c(y,z)+D_z(x)) \\
D_y(z) &= \min\{c(y,x)+D_x(z), c(y,z)+D_z(z)\} = \min\{60+50, 1+0\} = 1 && (c(y,z)+D_z(z)) \\
D_z(x) &= \min\{c(z,x)+D_x(x), c(z,y)+D_y(x)\} = \min\{50+0, 1+60\} = 50 && (c(z,x)+D_x(x)) \\
D_z(y) &= \min\{c(z,x)+D_x(y), c(z,y)+D_y(y)\} = \min\{50+51, 1+0\} = 1 && (c(z,y)+D_y(y))
\end{aligned}
$$

Then there would be message transmission with poisoned reverse: (from → to: distance vectors)

$$
\begin{aligned}
x \longrightarrow y &: D_x(x) = 0, D_x(y) = 51, D_x(z) = 50 \\
x \longrightarrow z &: D_x(x) = 0, D_x(y) = \infty, D_x(z) = 50 \\
y \longrightarrow x &: D_y(x) = 60, D_y(y) = 0, D_y(z) = 1 \\
y \longrightarrow z &: D_y(x) = 60, D_y(y) = 0, D_y(z) = 1 \\
z \longrightarrow x &: D_z(x) = 50, D_z(y) = 1, D_z(z) = 0 \\
z \longrightarrow y &: D_z(x) = 50, D_z(y) = 1, D_z(z) = 0
\end{aligned}
$$

- Third update

$$
\begin{aligned}
D_x(y) &= \min\{c(x,y)+D_y(y), c(x,z)+D_z(y)\} = \min\{60+0, 50+1\} = 51 && (c(x,z)+D_z(y)) \\
D_x(z) &= \min\{c(x,z)+D_z(z), c(x,y)+D_y(z)\} = \min\{50+0, 60+1\} = 50 && (c(x,z)+D_z(z)) \\
D_y(x) &= \min\{c(y,x)+D_x(x), c(y,z)+D_z(x)\} = \min\{60+0, 1+50\} = 51 && (c(y,z)+D_z(x)) \\
D_y(z) &= \min\{c(y,x)+D_x(z), c(y,z)+D_z(z)\} = \min\{60+50, 1+0\} = 1 && (c(y,z)+D_z(z)) \\
D_z(x) &= \min\{c(z,x)+D_x(x), c(z,y)+D_y(x)\} = \min\{50+0, 1+\infty\} = 50 && (c(z,x)+D_x(x)) \\
D_z(y) &= \min\{c(z,x)+D_x(y), c(z,y)+D_y(y)\} = \min\{50+51, 1+0\} = 1 && (c(z,y)+D_y(y))
\end{aligned}
$$

Then there would be message transmission with poisoned reverse: (from → to: distance vectors)

$$
\begin{aligned}
x \longrightarrow y &: D_x(x) = 0, D_x(y) = 51, D_x(z) = 50 \\
x \longrightarrow z &: D_x(x) = 0, D_x(y) = \infty, D_x(z) = 50 \\
y \longrightarrow x &: D_y(x) = 51, D_y(y) = 0, D_y(z) = 1 \\
y \longrightarrow z &: D_y(x) = \infty, D_y(y) = 0, D_y(z) = 1 \\
z \longrightarrow x &: D_z(x) = 50, D_z(y) = 1, D_z(z) = 0 \\
z \longrightarrow y &: D_z(x) = 50, D_z(y) = 1, D_z(z) = 0
\end{aligned}
$$

After all, the system is stable.