Computer Networking Written Assignment 2

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$\boxed{Q_1}$

solution

(a) Interface 0: range: 11100100 ~ 11111011, the number of address: 24

Interface 1: range: 11100000 ~ 11100011; the number of address: 4

Interface 2: range: 11111100 ~ 11111111; the number of address: 4

Interface 3: range: 00000000 ~ 11011111; the number of address: 224

(b)

For 11001000, the first 3 bit is inconsistent with 111 (it's 110), so, the appropriate link interface is interface 3.

For 11100001, due to the longest prefix matching: Although the first 3 bits ~~is~~ are 111, but the first 6 bits are 111000, which is matched to interface 1.

So, the appropriate link interface is interface 1.

For 11110000, the first 3 bits are 111, but the first 6 bits are 111100. It's neither 111000 nor 111111, so it's belongs to the prefix match for interface 0.

So, the appropriate link interface is interface 0.

$\boxed{Q_2}$ solution For organization 1, $128 = 2^7 < 200 < 256 = 2^8$

and the ISP owns the block Ip of 128.119.40.0/23.

So. for organization 1, we can change the last 8 bits for host number.

That is: $(40)_{10} = (00101000)_2$ $(128)_{10} = (10000000)_2$

$(119)_{10} = (01110111)_2$

So. the ISP own the block Ip is:

10000000 | 01110111 | 00101000 | 00000000

"network number"

Then, for organization, if we can change the last 8 bits, we may get: 10000000 | 01110111 | 00101001 | 00000000 / XXXXXXXX

"network number"

⇓

So, all the Ip for organization 1 is: 10000000 | 01110111 | 00101001 | XXXXXXXX

That is: 128.119.41.0/24

So, the prefixes for organization 1 is 128.119.41.0/24

For organization 2, because $2^6 = 64 < 96 < 2^7 = 128$

So, we can change the last 7 bits for host number.

That is:

10000000 | 01110111 | 00101000 | 1 0000000 / XXXXXXX

"network number"

⇓

So, all the Ip for organization 2 is: 10000000 | 01110111 | 00101000 | 1XXXXXXX

That is: 128.119.40.128/25

So, the prefixes for organization 2 is 128.119.40.128/25.

For organization 3. because $2^5 = 32 < 62 < 2^6 = 64$

so, we can change the last 6 bits for host number.

That is:

$\underbrace{10000000 \mid 01110111 \mid 00101000 \mid 01}_{\text{"network number"}} \mid \begin{matrix} 000000 \\ xxxxxx \end{matrix}$

so, all the Ip for organization 3 is: 10000000 | 01110111 | 00101000 | 01 xxxxxx

That is: 128.119.40.64 /26

so, the prefixes for organization 3 is 128.119.40.64/26.

For organization 4, because $2^5 = 32 < 60 < 2^6 = 64$

so, we can change the last 6 bits for the host number.

That is:

$\underbrace{10000000 \mid 01110111 \mid 00101000 \mid 00}_{\text{"network number"}} \mid \begin{matrix} 000000 \\ xxxxxx \end{matrix}$

so. all the Ip for organization 4 is: 10000000 | 01110111 | 00101000 | 00 xxxxxx

That is: 128.119.40.0/26

so. the prefixes for organization 4 is: 128.119.40.0/26.

Q3

solution:

(a) because the network address of the home network is 192.168.2.128/25

That is seems like: $\underbrace{\underbrace{xx\cdots}_{192} \mid \underbrace{x\cdots xx}_{168} \mid \underbrace{xx\cdots x}_{2} \mid 1}_{\text{"network number"}} \begin{matrix} 0000000 \\ xxxxxxx \end{matrix}$

so. the last 7 bits can change for assigning the different host.

Therefore: the last 7 bits can be like: 0000001, 0000010, 0000011

So, based on that, the three hosts can have the Ip: (See next page)

Host1: 192.168.2.129/25

Host2: 192.168.2.130/25

Host3: 192.168.2.131/25

∴ Therefore, the addresses to the interfaces of the three hosts in the home network can be assigned as: 192.168.2.129/25, 192.168.2.130/25 and 192.168.2.131/25 respectively.

(b) So, the NAT translation table is:

NAT translation Table	
WAN	LAN
24.34.114.232, 5001	192.168.2.200, 3000
24.34.114.232, 5002	192.168.2.200, 3001
24.34.114.232, 5003	192.168.2.201, 3000
24.34.114.232, 5004	192.168.2.201, 3001

Q4

solution: The table is as follows:

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	xv	7, v	6, v		6, x	6, x	8, x
2	xvu	7, v			6, x	6, x	8, x
3	xvuw	7, v				6, x	8, x
4	xvuwy	7, v					8, x
5	xvuwyt						8, x
6.	xvuwytz						

$\boxed{Q5}$

Solution: For the answer of this question, I will draw a table like the lecture note 11 to cover all the problems:

Node x table:

cost to ...

from	x	y	z
x	0	51 ~~4~~	~~5~~ 50
y	4	0	1
z	5	1	0

detect $c(x,y) = c(3,4)$
$= 60$

cost to ...

from	x	y	z
x	0	51	50
y	60	0	1
z	5	1	0

cost to ...

from	x	y	z
x	0	51	50
y	60	0	1
z	50	1	0

cost to ...

from	x	y	z
x	0	51	50
y	51	0	1
z	50	1	0

Node y table:

cost to ...

from	x	y	z
x	0	4	∞
y	60 ~~4~~	0	1
z	∞	1	0

cost to ...

from	x	y	z
x	0	51	50
y	60	0	1
z	∞	1	0

cost to ...

from	x	y	z
x	0	51	50
y	51	0	1
z	50	1	0

cost to ...

from	x	y	z
x	0	51	50
y	51	0	1
z	50	1	0

Node z table:

cost to ...

from	x	y	z
x	0	4	5
y	4	0	1
z	5	1	0

cost to ...

from	x	y	z
x	0	∞	50
y	60	0	1
z	50	1	0

cost to ...

from	x	y	z
x	0	∞	50
y	60	0	1
z	50	1	0

cost to ...

from	x	y	z
x	0	∞	50
y	∞	0	1
z	50	1	0

t_0 (change happened) | after change happened | t_1 | time (s) | t_2 | t_3 (steady state) whole process:

1. At t_0, the change happened. So, node X and node Y will recalculate their distance vector. Because for node X,

$$D_x(y) = \min\{c(x,y) + D_y(y),\ c(x,z) + D_z(y)\}$$

$$= \min\{60 + 0,\ 50 + 1\} = 51$$

$$D_x(z) = \min\{c(x,y) + D_y(z),\ c(x,z) + D_z(z)\} = \min\{60+1,\ 50\} = 50$$

So: $D_x(y) = 51$, $D_x(z) = 50$

for node y, $D_y(x) = \min\{c(y,x) + D_x(x),\ c(y,z) + D_z(x)\} = \min\{60+0,\ 1+\infty\} = 60$

and $D_y(z) = \min\{c(y,z) + D_z(z),\ c(y,x) + D_x(z)\} = \min\{1,\ 60+\infty\} = 1$

So: $D_y(x) = 60$ and $D_y(z) = 1$

Therefore, at t_0: X will change $D_x(y)$ to 51 and $D_x(z)$ to 50.

Y will change $D_y(x)$ to 60 and $D_y(z)$ to 1 (still not changed!)

2. At t_1, Y will tell X and Z, $D_y(x) = 60$. And X will tell y, $D_x(y) = 51$ and $D_x(z) = 50$, X will also tell z $D_x(y) = \infty$ and $D_x(z) = 50$.

Then: Node Z will recalculate its distance vector to X that:

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

So: Node z will change $D_z(x)$ to 50. And node X and node Y will not change their ~~vector di~~ distance vector in this time.

3. At t_2: Node Z will tell X and Y that $D_z(x) = 50$. Then, node Y will recalculate its distance vector to X that:

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

Therefore: Node Y will change $D_y(x)$ to 51. And node X and node Z will not change their distance vector in this time.

4. At t_3, Node y will tell Node x that $D_y(x) = 51$ and tell Node z that $D_y(x) = \infty$. Then, this algorithm will keep a steady state.