CS305 HW2

Question1

Consider a datagram network using **8-bit host addresses**. Suppose a router uses **longest prefix matching** and has the following forwarding table

Prefix	Match
00	0
01	1
10	1
110	2
111	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

prefix	range	match
00	00000000-00111111	0
01	01000000-10111111	1
10	10000000-10111111	1
110	11000000-11011111	2
111	11100000-11111111	3

interface	range	number of addresses
0	00000000-00111111	64
1	01000000-10111111 10000000-10111111	128
2	11000000-11011111	32
3	11100000-11111111	32

Question2

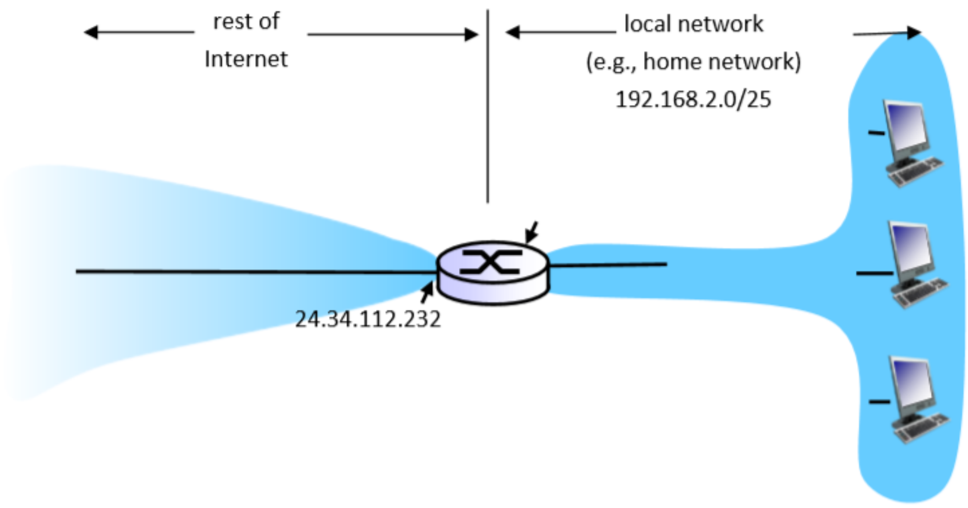
Consider a router that interconnects three subnets: **Subnet 1, Subnet 2, and Subnet 3.** Suppose all interfaces in these three subnets are required to have the **prefix 222.1.16/24**. Also suppose that Subnet 1 is required to support **at least 60 interfaces**, **Subnet 2 is to support at least 90 interfaces**, and Subnet 3 is to **support at least 12 interfaces**. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints, please show the calculation procedure.

222.1.16/24 $\rightarrow$ 11011110-00000001-00010000-xxxxxxxx

Subnet	nexwork addresses	network allow	support
1	222.1.16.64/26	11011110-00000001-00010000-01xxxxxx	64
2	222.1.16.128/25	11011110-00000001-00010000-1xxxxxxx	128
3	222.1.16.0/28	11011110-00000001-00010000-0000xxxx	16

Question3

Consider the network setup in the figure below. Suppose that the ISP instead assigns **the router the address 24.34.112.232** and that the network address of the home network is **192.168.2.0/25.**



a. Assign addresses to all interfaces in the home network.

host	address
PC1	192.168.2.2
PC2	192.168.2.3
PC3	192.168.2.4

b. Suppose each host has two ongoing TCP connections, all to port 80 at host 128.119.40.87. Provide the six corresponding entries in the NAT translation table.

WAN side addr	LAN side addr
24.34.112.232:1111	192.168.2.2:2333
24.34.112.232:1112	192.168.2.2:5555
24.34.112.232:1113	192.168.2.3:2333
24.34.112.232:1114	192.168.2.3:5555
24.34.112.232:1115	192.168.2.4:2333
24.34.112.232:1116	192.168.2.4:5555

Question4

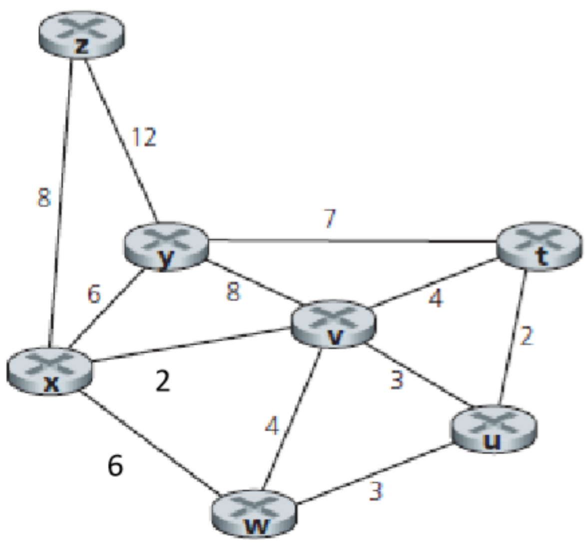
What is the **difference** between a **forwarding table** that we encountered in destinationbased forwarding in Section 4.1 and OpenFlow's **flow table** that we encountered in Section 4.4?

TABLE	CONTENT	FUNCTION	DEFINE
Local forwarding table	Only contain **<Destionation Address Range, Link Interface>** pair	Destination-based forwarding	Hardware defined
Open flow forwarding table	**simple packet-handling rules** - **Pattern**: match values in packet header fields - **Action**: drop, forward, modify, matched, send packet to controller... - **Priority**: dismbiguate overlapping patterns - **Counters**: #bytes and #packets	**Router**: forward out a link **Switch**: forward and flood **Firewall**: permit or deny **NAT**: rewrite address and port	Software defined

---

Question5

Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes. **Show how the algorithm works and show the final forwarding table in x.**



Process of Dijkstra's algotrithm

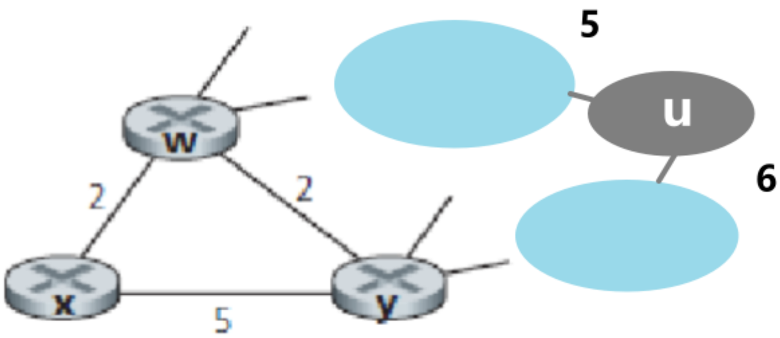
Step	N'	D(Y)	D(Z)	D(W)	D(V)	D(U)	D(T)
0	x	6,x	8,x	6,x	**2,x**	∞	∞
1	xv	6,x	8,x	6,x	---	**5,v**	6,v
2	xvu	**6,x**	8,x	6,x	---	---	6,v
3	xvuy	---	8,x	**6,x**	---	---	6,v
4	xvuyw	---	8,x	---	---	---	**6,v**
5	xvuywt	---	**8,x**	---	---	---	---
6	xvuywtz	---	---	---	---	---	---

Final forwardng table

destination	link
y	(x,y)
z	(x,z)
u	(x,v)
v	(x,v)
w	(x,w)
t	(x,v)

Question6

Consider the network fragment shown below. **x has only two attached neighbors, w and y.** w has a minimum-cost path to destination u (not shown) of 5, and y has a minimum-cost path to u of 6. The complete paths from w and y to u (and between w and y) are not shown. All link costs in the network have strictly positive integer values.



a. Give x’s distance vector for destinations w, y, and u.

$$d_x(w) = min\{c(x,y) + d_y(w), c(x,w) + d_w(w)\} = min\{7,2\} = 2$$
$$d_x(y) = min\{c(x,y) + d_y(y), c(x,w) + d_w(y)\} = min\{5,4\} = 4$$
$$d_x(u) = min\{c(x,w) + d_w(u), c(x,y) + d_y(u)\} = min\{7,11\} = 7$$

b. Give a link-cost change for either c(x,w) or c(x,y) such that x will inform its neighbors of a new minimum-cost path to u as a result of executing the distance-vector algorithm.

$$c(x,w) = 2 \rightarrow c(x,w) = 5$$

c. Give a link-cost change for either c(x,w) or c(x,y) such that x will not inform its neighbors of a new minimum-cost path to u as a result of executing the distance-vector algorithm.

$$c(x,y) = 5 \rightarrow c(x,y) = 6$$