CSE 473 – Introduction to Computer Networks	*Roch Guérin*
Quiz 4 – (10 points)	
Your Name:	*11/06/2017*

1. **[5 points]** Consider an Internet Service Provider (ISP) that owns the following three prefixes: 145.5.128.0/18, 145.5.192.0/18, and 145.4.0.0/16.
What is the smallest set of new prefixes the ISP needs to acquire so that it owns a single block of consecutive addresses? What are those prefixes and what is the final address block? New prefixes must not overlap with each other nor with the prefixes the ISP already owns. Justify your answer.

Given the presence of a block of type 145.4.0.0/16 and prefixes of type 145.5..0/18, it is easy to see that the final block the ISP should target is of the form 145.4.0.0/15.*

In order to get this block, the ISP first needs to acquire the missing parts of the prefix 145.5.0.0/16. The two sub-prefixes the ISP currently owns in the 145.5.0.0/16 prefix, i.e., 145.5.128.0/18 and 145.5.192.0/18, need to be supplemented to complete the full 145.5.0.0/16 prefix. In these two /18 prefixes, only the first two bits of the third byte are relevant. These bits are of the form 10 (128) and 11 (192), so that we only need two other prefixes whose third byte would start with 01 and 00, i.e., 145.5.64.0/18 and 145.5.0.0/18, respectively, or in short 145.5.0.0/17.

Once 145.5.0.0/17 has been added, the ISP owns all addresses in 145.5.0.0/16, which, together with its existing 145.4.0.0/16 prefix, means that it owns all the addresses in the prefix block 145.4.0.0/15.

2. **[5 points]** Router A is connected to routers B, C, and D with point-to-point links with cost 1, 2, and 3, respectively. The routers use a distance vector routing protocol and the <u>current</u> distance vectors at the four routers include 7 destinations and are of the form:
A: [5 , 6 , 3 , 4 , 10 , 7 , 11] ; B: [4 , 2 , 3 , 5 , 8 , 6 , 11] ; C: [4 , 4 , 1 , 2 , 9 , 5 , 10] ;
D: [2 , 4 , 1 , 3 , 7 , 4 , 8].
Identify the possible next hop(s) at A for each one of the 7 destinations, and also identify from which routers, router A <u>cannot</u> have yet received their current distance vector (recall that in a distance vector protocol, shortest path computations and updates are asynchronous).

The second entry in the distance vector at router B together with the cost of 1 of link A-B, yields a distance of 2+1=3 from A to that destination through B, which is smaller than the current distance of 6 in A's distance vector. Hence, A cannot have yet received the latest distance vector from B.

Additionally, computing minimum distances from A to the seven destinations through either C or D gives:

Through C: 2 + [4 , 4 , 1 , 2 , 9 , 5 , 10] = [6 , 6 , 3 , 4 , 11 , 7 , 12];

Through D: 3 + [2 , 4 , 1 , 3 , 7 , 4 , 8] = [5 , 7 , 4 , 7 , 10 , 7 , 11];

which when compared to the distance vector at A yields the following next hops for each destination:

[5 (D), 6 (C) , 3 (C) , 4 (C), 10 (D), 7 (C,D), 11 (D)]

Note that B may be another next hop depending on what its previous distance vector may have been.