SYSC 4602 Assignment 4

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1. Tabulating the distance vectors from B, D, and E, while taking into account C's distance from each of them gives the distance table:

	B	D	E
A	11	19	12
B	6	15	11
D	18	3	14
E	12	12	5
F	8	13	9

Picking the minimum values from each row gives the new vector table:

	Distance, Next Hop
A	11, B
B	6, B
D	3, D
E	5, E
F	8, B

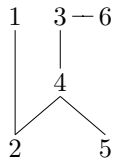
2. (a) Running the Dijkstra algorithm from Node 4 gives the following results:

Step	Visited Set	Node Distance				
		1	2	3	5	6
0	{4}	5	1	2	3	∞
1	{4, 1}	5	1	2	3	∞
2	{4, 1, 2}	4	1	2	3	∞
3	{4, 1, 2, 3}	4	1	2	3	3
4	{4, 1, 2, 3, 5}	4	1	2	3	3
5	{4, 1, 2, 3, 5, 6}	4	1	2	3	3

The shortest paths from Node 4 to other nodes are:

Destination	Path
1	$4 \rightarrow 2 \rightarrow 1$
2	$4 \rightarrow 2$
3	$4 \rightarrow 3$
5	$4 \rightarrow 5$
6	$4 \rightarrow 3 \rightarrow 6$

The spanning tree for Node 4 is:



(b) The routing table for node 4 is:

Destination	Distance, Next Hop
1	4, 2
2	1, 2
3	3, 2
5	3, 5
6	3, 3

3. (a) The IP addresses for the six computers in the EE department, from right to left, are 111.111.1.1, 111.111.1.2, 111.111.1.3, 111.111.1.4, 111.111.1.5, 111.111.1.6. The subnet mask is 111.111.1.0/24. The IP addresses for the six computers in the CS department, from right to left, are 111.111.2.1, 111.111.2.2, 111.111.2.3, 111.111.2.4, 111.111.2.5, 111.111.2.6. The subnet mask is 111.111.2.0/24. The IP addresses of the router interface are 111.111.1.0 and 111.111.2.0, with the first one being for the subnet of the EE department, and the second one for the subnet of the CS department. Suppose that the EE department is associated with VLAN ID 01, and the CS department with VLAN ID 10.

(b) The steps taken to transfer an IP datagram from an EE host on the left switch to an EE host on the right switch are:

- Suppose that the host "A" in EE with IP address 111.111.1.1 would like to send an IP datagram to a host "B" in EE with IP address 111.111.1.6.
- Host A first encapsulates the IP datagram with destination 111.111.1.6 into a frame, whose destination MAC address is equal to the MAC address of the router's interface card that connects to port 1 of the switch.
- Once the router receives the frame, it passes it up to the IP layer, which determines that the IP datagram should be forwarded to subnet 111.111.1.0/24 via sub-interface 111.111.1.0.

- The route then encapsulates the IP datagrame into a frame, with 802.1q tag VLAN ID 01, and sends it to port 1.
- Once the right switch receives the frame on port 1, it will broadcast a who-is request to locate the IP of host B across its own ports and through the trunk line.
- When host B replies across the trunk link, the right switch will forward the frame through the trunk link to host B.

(c) The steps taken to transfer an IP datagram from an EE host on the left switch to a CS host on the right switch are nearly identical, except that at the third step, the IP datagram should be forwarded to subnet 111.111.2.0/24 via sub-interface 111.111.2.0, and the VLAN ID in step 4 is 10.

4. It is sufficient to add one new table entry: 29.18.0.0/22 for the new block. If an incoming packet's destination matches both 29.18.0.0/17 and 29.18.0.0/22, then the more specific rule (/22) will apply.

5. Designing the variable-length addressing scheme for this company requires working from the most-specific tier (Department) towards the least-specific tier (AS Number), and then assigning the subnets from AS Number down. For example:

   - The smallest block size that could support the users in Legal is 126. The smallest block size that could support the users in Accounting is 510.
   - The smallest block size that could support Chicago Building 1 (the Legal and Accounting blocks combined) is 1022.
   - Following this logic, the smallest block size that could support Chicago Building 2 is 4094.
   - Finally, the smallest block size needed to fit all of AS1 is 8190.

   The subnets are then assigned by AS first, from largest to smallest. Then each AS subnet is sub-subnetted by location, then location subnets are split by department. The final addressing scheme is as follows:

AS	Location	Department	Prefix
1	Chicago Campus Building 1	Legal	000-100-100
		Accounting	000-100-0
	Chicago Campus Building 2	HQ	000-0-0
		Engineering	000-0-1000
2	Toronto	Sales	0100 0000-1
	Boston	Sales	0100 0000-0
3	Philadelphia	Operations1	001-0
		Operations2	001-100
		Sales	001-110

And the subnets and block sizes for each department are:

AS	Location	Department	Subnet	Block Size
1	Chicago 1	Legal	129.99.18.0/25	126
		Accounting	129.99.16.0/23	510
	Chicago 2	HQ	129.99.0.0/21	2046
		Engineering	129.99.8.0/24	254
2	Toronto	Sales	129.99.64.128/25	126
	Boston	Sales	129.99.64.0/25	126
3	Philadelphia	Operations1	129.99.32.0/20	4094
		Operations2	129.99.48.0/22	1022
		Sales	129.99.52.0/22	1022

(Note that block sizes are in powers of 2, minus two because all 0s and all 1s are two reserved patterns.)

6. In a way, yes, it is possible with Network Address Translation. As long as the two (or more) routers can exchange their NAT translation table information every time a new entry is added to the table. CISCO has achieved this with their HSRP protocol.
(Reference: http://www.cisco.com/c/en/us/support/docs/ip/hot-standby-router-protocol-hsrp/9234-hsrpguidetoc.html)

7. No. A pair of ports sets uniquely up a single connection, so $(1, p) \longleftrightarrow (2, q)$ is the only possible connection between the two hosts/ports. Additional TCP connections would require additional port pairs.