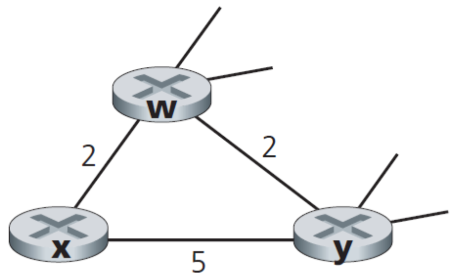
ENSC-371 – Summer 2017 Assignment#5: **Ch5**-P7, P8, P14, **Ch6**-P5, P6, P7, P8, P15 Due Date 06 Aug2017

*Note: Provide Detailed solutions and not just final answers. Final Answers only will get a mark of zero.*

## Problem-1:[10] Chapter-5

P7. 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*.

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. 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.

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**Problem-2:[10]**

P8. Consider the three-node topology shown in Figure 5.6. Rather than having the link costs shown in Figure 5.6, the link costs are $c(x,y) = 3$, $c(y,z) = 6$, $c(z,x) = 4$. Compute the distance tables after the initialization step and after each iteration of a synchronous version of the distance-vector algorithm (as we did in our earlier discussion of Figure 5.6).

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## Problem-3:[10]

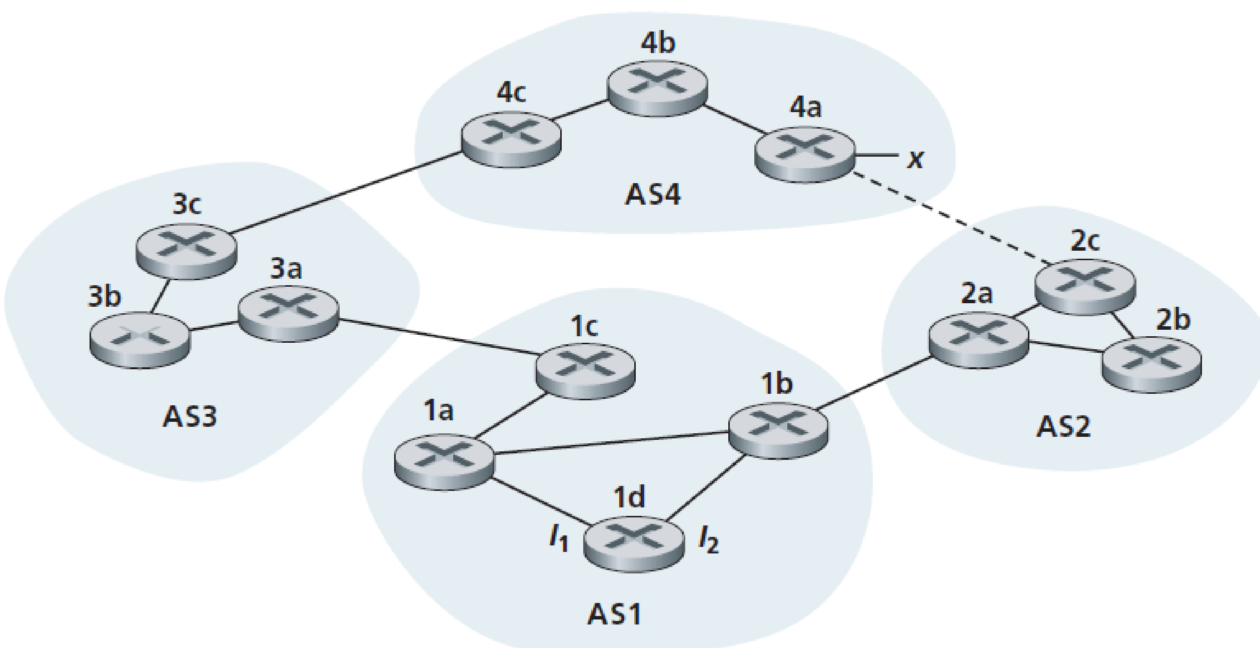
P14. Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is *no* physical link between AS2 and AS4.

a. Router 3c learns about prefix *x* from which routing protocol: OSPF, RIP, eBGP, or iBGP?

b. Router 3a learns about *x* from which routing protocol?

c. Router 1c learns about *x* from which routing protocol?

d. Router 1d learns about *x* from which routing protocol?



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**Problem-4:[10] Chapter6:**

P5. Consider the generator, G = 1001, and suppose that D has the value 11000111010. What is the value of R?

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**Problem-5:[10]**

P6. Rework the previous problem, but suppose that D has the value

a. 01101010101.

b. 11111010101.

c. 10001100001.

*Note: Provide Detailed solutions and not just final answers. Final Answers only will get a mark of zero.*

**Problem-6:[10]**

P7. In this problem, we explore some of the properties of the CRC. For the generator G (= 1001) given in Section 6.2.3, answer the following questions.

a. Why can it detect any single bit error in data D?

b. Can the above G detect any odd number of bit errors? Why?

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## Problem-7:[10]

P8. In Section 6.3, we provided an outline of the derivation of the efficiency of slotted ALOHA. In this problem we'll complete the derivation.

a. Recall that when there are $N$ active nodes, the efficiency of slotted ALOHA is $Np(1 - p)^{N-1}$. Find the value of $p$ that maximizes this expression.

b. Using the value of $p$ found in (a), find the efficiency of slotted ALOHA by letting $N$ approach infinity. *Hint*: $(1 - 1/N)^N$ approaches $1/e$ as $N$ approaches infinity.

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## Problem-8:[10]

P15. Consider Figure 6.33. Now we replace the router between subnets 1 and 2 with a switch S1, and label the router between subnets 2 and 3 as R1.

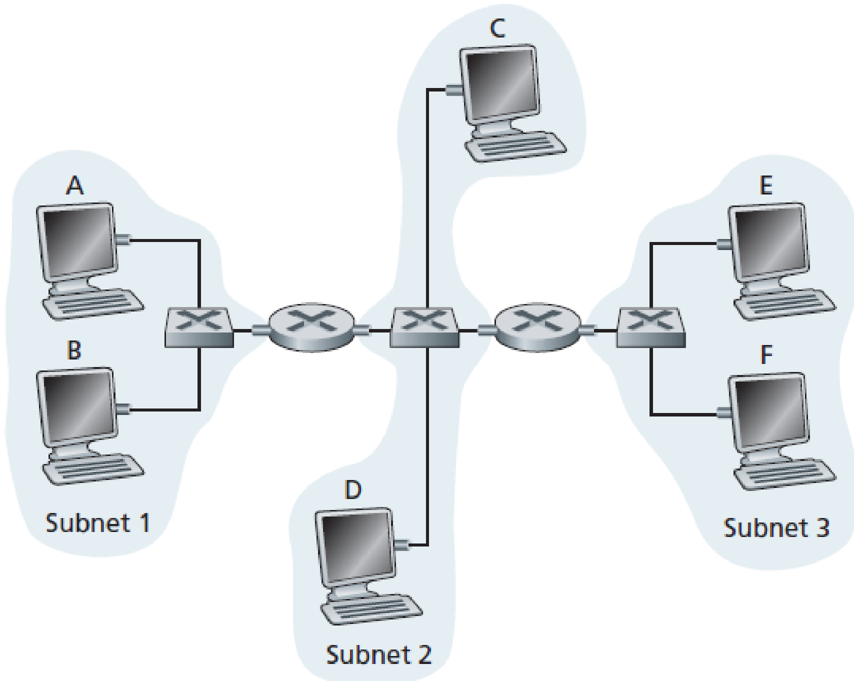


**Figure 6.33** ♦ Three subnets, interconnected by routers

a. Consider sending an IP datagram from Host E to Host F. Will Host E ask router R1 to help forward the datagram? Why? In the Ethernet frame containing the IP datagram, what are the source and destination IP and MAC addresses?

b. Suppose E would like to send an IP datagram to B, and assume that E's ARP cache does not contain B's MAC address. Will E perform an ARP query to find B's MAC address? Why? In the Ethernet frame (containing the IP datagram destined to B) that is delivered to router R1, what are the source and destination IP and MAC addresses?

c. Suppose Host A would like to send an IP datagram to Host B, and neither A's ARP cache contains B's MAC address nor does B's ARP cache contain A's MAC address. Further suppose that the switch S1's forwarding table contains entries for Host B and router R1 only. Thus, A will broadcast an ARP request message. What actions will switch S1 perform once it receives the ARP request message? Will router R1 also receive this ARP request message? If so, will R1 forward the message to Subnet 3? Once Host B receives this ARP request message, it will send back to Host A an ARP response message. But will it send an ARP query message to ask for A's MAC address? Why? What will switch S1 do once it receives an ARP response message from Host B?

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