

hw6

P5, P9, P10, P15, P18, P26

P5. Consider the 5-bit generator, $G = 10011$, and suppose that D has the value 1010101010. What is the value of R ?

P9. Show that the maximum efficiency of pure ALOHA is $1/(2e)$. Note: This problem is easy if you have completed the problem above!

P10. Consider two nodes, A and B , that use the slotted ALOHA protocol to contend for a channel. Suppose node A has more data to transmit than node B , and node A 's retransmission probability p_A is greater than node B 's retransmission probability, p_B .

a. Provide a formula for node A 's average throughput. What is the total efficiency of the protocol with these two nodes?

b. If $p_A = 2p_B$, is node A 's average throughput twice as large as that of node B ? Why or why not? If not, how can you choose p_A and p_B to make that happen?

c. In general, suppose there are N nodes, among which node A has retransmission probability $2p$ and all other nodes have retransmission probability p . Provide expressions to compute the average throughputs of node A and of any other node.

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 $R1$.

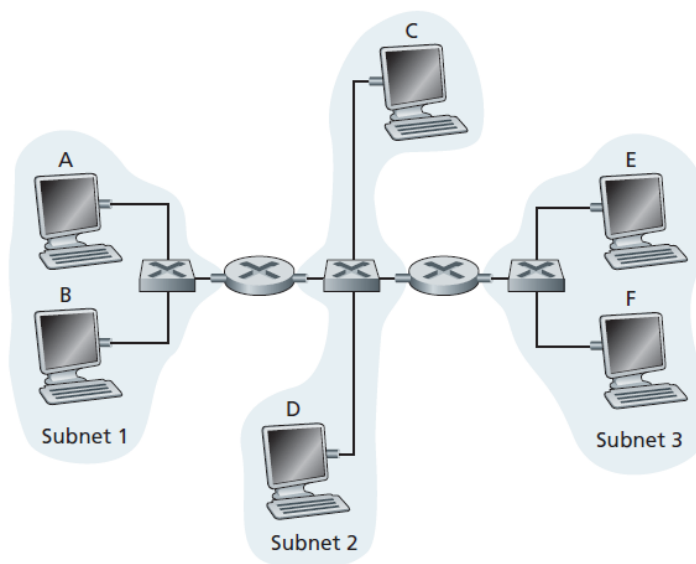


Figure 6.33 ♦ Three subnets, interconnected by routers

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?

P18. Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 325 bit times. Suppose CSMA/CD and Ethernet packets are used for this broadcast channel. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not? If the answer is yes, then A incorrectly believes that its frame was successfully transmitted without a collision. [Hint: Suppose at time \$t = 0\$ bits, A begins transmitting a frame. In the worst case, A transmits a minimum-sized frame of \$512 + 64\$ bit times. So A would finish transmitting the frame at \$t = 512 + 64\$ bit times. Thus, the answer is no, if B's signal reaches A before bit time \$t = 512 + 64\$ bits. In the worst case, when does B's signal reach A?](#)

P26. Let's consider the operation of a learning switch in the context of a network in which 6 nodes labeled A through F are star connected into an Ethernet switch. Suppose that (i) B sends a frame to E, (ii) E replies with a frame to B, (iii) A sends a frame to B, (iv) B replies with a frame to A. The switch table is initially empty. Show the state of the switch table before and after each of these events. For each of these events, identify the link(s) on which the transmitted frame will be forwarded, and briefly justify your answers.