Problem 1 (Chapter 4, Problem 27, 10 points) - Consider the network shown in Problem 26 in your book. Using Dijkstra's algorithm, and showing your work using a table similar to Table 4.3, do the followings:

a. Compute the shortest path from t to all network nodes.
b. Compute the shortest path from u to all network nodes.
c. Compute the shortest path from v to all network nodes.
d. Compute the shortest path from w to all network nodes.
e. Compute the shortest path from y to all network nodes.
f. Compute the shortest path from z to all network nodes.

Problem 2 (Chapter 4, Problem 28, 10 points) - Consider the network shown under problem 28, chapter 4 in your book, and assume that each node initially knows the costs to each of its neighbors. Consider the distance vector algorithm and show the distance table entries at node z.

Problem 3 (Chapter 5, Problem 4, 5 points) - Consider Problem 3, Chapter 5. Instead, suppose these 10 bytes contain

a. the binary representation of the numbers 1 through 10.
b. the ASCII representation if the letters B through K (uppercase).
c. the ASCII representation if the letters b through k (uppercase).

Compute the Internet checksum for this data.

Problem 4 (Chapter 5, Problem 5, 5 points) - Consider the 5-bit generator, G=10011, and suppose that D has the value 1010101010. What is the value of R?

Problem 5 (Chapter 5, Problem 11, 10 points) - Suppose four active nodes-- nodes A,B,C, and D -- are competing for access to a channel using slotted ALOHA. Assume each node has an infinite number of packets to send. Each node attempts to transmit in each slot with probability p. The first slot is numbered slot 1. The second slot is numbered slot 2, and so on.

a. What is the probability that node A succeeds for the first time in slot 5?
b. What is the probability that some node (either A,B,C or D) succeeds in slot 4?
c. What is the probability that the first success occurs on slot 3?

Problem 6 (Chapter 6, Problem 1, 10 points) - Consider the single sender CDMA example in figure 6.5 of your book. What would be the sender’s output (for the 2 data bits shown) if the sender’s CDMA code were \((1, -1, 1, -1, 1, 1, -1, 1)\) ?

Problem 7 (Chapter 6, Problem 8, 10 points) - Consider the scenario shown in Figure 6.33 in your book, in which there are four wireless nodes A, B, C and D. The radio coverage of the four nodes is shown via the shaded ovals; all nodes share the same frequency. When A transmits it can only be heard/received by B; when C transmits both B and D can head/receive from C; when D transmits only C can hear/receive from D.

Suppose now that each node has an infinite supply of messages that it wants to send to each of the other nodes. If a message’s destination is not an immediate neighbor, then the message must be relayed. If A wants to send to D, a message from A must first be sent to B, which then sends the message to C, which then sends the message to D. Time is slotted, with a message transmission time taking exactly one time slot, e.g. as in slotted ALOHA. During a slot, a node can do one of the following:

i) send a message; ii) receive a message (if exactly one message is being sent to it) iii) remain silent. As always, if a node hears two or more transmissions, a collision occurs and none of the messages are received successfully. You can assume here that there are no bit-level errors, and thus if exactly one message is sent it will be received correctly by those within the transmission radius of the sender.

a. Suppose now that an omniscient controller (i.e. a controller that nodes the state of every node in the network.) can command each node to do whatever it (the omniscient controller) wishes, i.e. to send or receive a message or to remain silent. Given this omniscient controller, what is the maximum rate at which a data message can be transferred from C to A, given that there are no other messages between any other source/destination pairs?

b. Suppose now that A sends messages to B and D sends messages to C. What’s the combined maximum rate at which data messages can flow from A to B and from D to C?

c. Suppose now that A sends messages to B and C sends messages to D. What’s the combined maximum rate at which data messages can flow from A to B and from C to D?

d. Now suppose we are again in the wireless scenario, and that for every data message sent from source to destination, the destination will send an ACK back to the source (e.g. as in TCP). Also suppose that each ACK message takes up one slot. Repeat questions a through c above for the scenario.