CS 4380 Data Communications **Spring Quarter, 1994**

Final Examination

June 8

Be neat and concise. You may use your calculator and two cheat sheets. Show your work.

Good luck and have a great summer!

Name: ______________________________

Problem	Points	Score
1	10	
2	25	
3	10	
4	10	
5	20	
6	15	
7	15	
8	20	
Total	125	

1. (10) Briefly explain the following concepts:

   (a.) binary exponential backoff

   (b.) bridge

   (c.) 802.3

   (d.) virtual circuit switching

   (e.) P/F bit in HDLC

2. Consider a medium access system in which there are *two* channels that are shared by all of the stations. Before transmitting, a station chooses at random which channel to use. After choosing a channel, the station uses the ALOHA protocol to access the channel. Acknowledgements are sent on separate channels.

(5) a. Suppose a station has a packet and chooses to transmit it on channel 1. State the conditions (at the other stations) under which this packet is successfully received.

(10) b. Derive an expression for the probability the packet is successfully received.

(5) c. What is the throughput of the overall system as a function of the offered load?

(5) d. How does the throughput compare to a one channel system?

3. **(10)** Draw a flow chart for the processing that goes on at a station using p-persistent CSMA/CD for medium access control.

4. (10) Show that two cascaded binary symmetric channels result in a binary symmetric channel. In other words, if the link A-B is modeled as a binary symmetric channel with parameter p_1 and the link B-C is modeled as a binary symmetric channel with parameter p_2, show that the path A-B-C can be modeled as a binary symmetric channel.

5. (20) What is the largest number of times a node may be put on the queue in the Bellman-Ford-Moore algorithm? Show an example graph that achieves this largest value. Be sure to indicate which node is the source and which node is the one that will be put on the queue repeatedly.

6.(5) a. Give a brief intuitive explanation for why the distributed Bellman-Ford-Moore algorithm will converge to the correct shortest paths even if the distance estimates begin at arbitrary values.

(10) b. Give an example graph in which the distance estimates are initially correct, and show how a change in the cost of a single edge can cause looping while the algorithm converges to the new correct solution. (Hint: the graph need only have three nodes)

7. *Deadlock* occurs when packets in the network are permanently prevented from progressing, due to conditions in the network. Consider the following situation:

All the buffers at A are filled with packets destined for B, and all the buffers at B are filled with packets destined for A.

(5) a. Explain why this is a deadlocked situation.

(10) b. Suggest a scheme to avoid this type of deadlock and explain why it works.

8a.(10) Consider a version of Stop-and-Wait in which, rather than putting a sequence number on each packet, the sender puts the number of times the given packet has been retransmitted. Thus, a packet will be labeled 0 when it is first transmitted, 1 on the first retransmission (if necessary), 2 on the second retransmission (if necessary), and so on. The receiver returns unnumbered ACKs and NAKs. Losses of packets and acknowledgements are possible. Show by example that this strategy does not work.

b.(10) Indicate which sequence numbers are in the sending window at points a, b and c in the timing diagram below, and which sequence numbers are in the receiving window at points d and e. Assume the sequence numbers are in the range 0 to 7 and the ARQ protocol is Selective-Reject.