CS 4380 Data Communications **Spring Quarter, 1995**

Midterm Examination

April 25

Be neat and concise. You may use your calculator and one page cheat sheet. Show your work. Good luck!

Name: _____

Problem	Points	Score
1	20	
2	15	
3	10	
4	15	
5	15	
6	15	
7	15	
Total	110	

1. {Channel Modeling} The binary symmetric channel (BSC) model from class does a reasonable job of modeling some of the errors on a channel. The following model attempts to improve upon the BSC model:

(10) a. State the assumptions about the channel that are reflected in this model.

(5) b. Give the expression for the probability the sender transmits 1011 and the receiver receives 1000.

(5) c. Is this model better than the binary symmetric channel model? Justify your answer.

2. {Coding} Consider a code in which the data is replicated r times to form the codeword.

(5) a. What is the Hamming distance of this code for data of length l?

(8) b. What are the error detection and correction properties of this code?

(2) c. Suppose the data is 01. Is there any information that would be useful in deciding whether to organize the codeword by replicating each bit of the data (i.e., 0011) or the entire data (i.e., 0101)? How would this information help?

3. {Cyclic Redundancy Check}

(5) a. Generate the CRC codeword for the data bits 0011010 using the predefined divisor 1011. Show your work and clearly indicate the final codeword.

(5) b. Show the calculation at the receiver for CRC codeword 1110001001 and polynomial $x^4 + x^3 + 1$. Does this codeword contain errors?

4. {Stop-and-Wait} Are sequence numbers are needed on the ACKs in the Stop-and-Wait ARQ protocol? If yes, demonstrate the need by example. If no, argue why not. In either case, assume that the channel always delivers frames in the order sent and that frames may be lost or subject to *detectable* errors.

5. {Definitions} Give short answers for the following questions.

(5) a. Explain the difference between a peer-to-peer protocol and an interface protocol.

(5) b. Give an example of a peer-to-peer protocol issue that arises in designing a CRC decoder.

(5) c. Give an example of an interface protocol issue that arises in designing a CRC decoder.

6. {High Level Data Link Control (HDLC)}

(10) a. Fill in the blanks in the following HDLC diagram. If there are blanks that can be filled in by more than one symbol, indicate all possibilities.

(5) b. What is the maximum receive window size that can be used in HDLC and still have correct operation?

7. {Go-Back-N/Sliding Window} The throughput of Go-Back-N with window flow control depends on the size of the sending window. Specifically, if the window is small then the channel will not fill up with frames while waiting for an acknowledgement. If the window is large then the channel can be kept full.

(10)a. Draw a timing diagram illustrating the transmission of I-frames and acknowledgements with a window size of four, such that the window size is too small to keep the channel full.

(5)b. Pick a "typical" I-frame from your diagram in part (a). Clearly indicate which I-frames will cause retransmission of the frame you have selected, if they are received in error.

(5)c. If each I-frame is independently in error with probability p, what is the probability that a particular frame requires one or more retransmissions?