

## Midterm Examination

October 30

Be neat and concise. Show your work. Good luck!

Name: \_\_\_\_\_

Problem	Points	Score
1	15	
2	10	
3	20	
4	20	
5	10	
6	10	
7	15	
Total	100	

For extra credit, invent an expansion for the acronym ALOHA:

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1. 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.

2. Give short answers to the following:

(a) List three advantages of PPP over SLIP.

(b) Give one use for the Link Control Protocol (LCP) and one use for the Network Control Protocol (NCP) in PPP connection setup.

3. Consider a CRC encoder and decoder that use a polynomial of  $P = 11011$  for a message  $M = 100101$ .

(a) Show the long division computation of the frame check sequence. Clearly indicate the codeword that results.

(b) Show the shift register implementation at the receiver and show the verification process when the codeword does not have any errors.

4. Consider a new coding scheme that works on messages of  $n^2$  bits. The new scheme organizes the bits into a matrix of  $n$  rows of  $n$  bits each. A parity bit is attached to each row and each column, for a total of  $2n$  parity bits. State and explain answers to the following:

(a) What is the Hamming distance of this code?

(b) What are the error detection capabilities of the code?

(c) What are the error correction capabilities of the code?

(d) Can one additional parity bit change the error detection and/or correction properties of the code? Explain.

5. A multicast message transmission is one that goes to a group of receivers, not just a single receiver. If all receivers get the message and send back acknowledgements, then the sender can be overwhelmed by the responses. This is called the “ACK implosion problem.” Give one idea for how to solve the ACK implosion problem.

6. Give an example of an HDLC timing diagram that shows the need for a timeout.

7. Give an equation for the efficiency of roll call polling medium access as a function of  $p$ , the probability that a station has a message to send, and any other variables needed to characterize the system. Be sure to define clearly the other variables that you are using. Write a brief statement of the general conditions under which roll call polling makes good use of the channel.