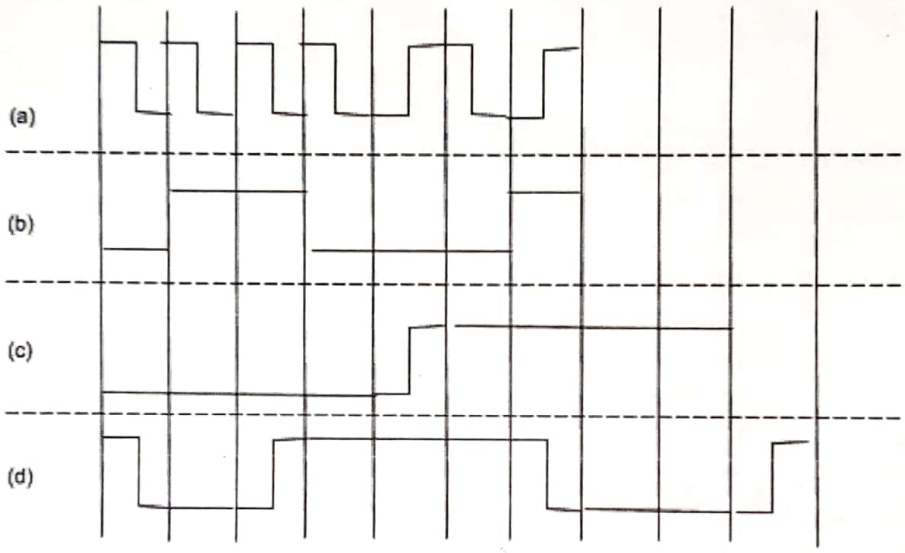
CS 224 Theory Quiz 1 - Spring 2020

Friday, February 7th, 2020. 830am-925am. Marks: 20

Write your answers in the answer book provided. Explain all your answers. Unexplained answers may get zero marks even if correct.

1. **(Marks: 5)** The following are four signal patterns arriving over a link at a receiver. Which encoding(s) could each of these patterns represent? Write the decoded bit pattern. If the signal could represent multiple encodings, write the decoded bits from both patterns.



a. _____

b. _____

c. _____

d. _____

4B/5B encoding table

0	0	0000	11110
1	1	0001	01001
2	2	0010	10100
3	3	0011	10101

4	4	0100	01010
5	5	0101	01011
6	6	0110	01110
7	7	0111	01111

8	8	1000	10010
9	9	1001	10011
10	A	1010	10110
11	B	1011	10111

12	C	1100	11010
13	D	1101	11011
14	E	1110	11100
15	F	1111	11101

2. **(Marks: 3)** How will the following character sequences (after "STX") be interpreted by a receiver implementing BISYNC framing? Write the character sequence recovered as the original sequence or write "INVALID SEQUENCE" or any other remark.

   a. g C W y x ETX

   b. DLE h y T ETX

   c. F Y DLE DLE r p ETX

   d. DLE ETX

   e. J u DLE ETX DLE DLE DLE DLE DLE ETX ETX

   f. R K ETX DLE ETX

3. (**Marks: 4)** In a packet-switched (store-and-forward) network, Suppose a sender node n_0 is connected to a receiver node n_L, through *L-1* intermediate nodes and *L* links (n_0-n_1-n_2...n_{L-1}-n_L). Suppose n_0 wants to send to n_L a message of size *M* bits. If frame size is *P* bits, each link has bandwidth *B* bits/s and propagation delay *d* seconds, and processing delay at each *intermediate node only* is *s* seconds per packet, derive the expression for the entire message transfer delay (time from starting to send the first bit of the message from n_0, to time of arrival of last bit of message to n_L). Ignore all things not given here as negligible (e.g. no headers, no delays which cannot be determined from data given here, no acks, nothing that's not given here). Also you can assume *M* is a multiple of *P*.

4. **(Marks: 4)** Consider a sender-receiver pair using the sliding window protocol, with SWS=4 and RWS=4 and sequence numbers 0,1,2,3,4,5,6. Suppose sender window is currently = [4,5,6,0] (i.e. Cumulative ACK for packet sequence number 3 has been received]. Describe (draw and annotate, label clearly, a standard network timeline diagram) a scenario to show that 7 sequence numbers are not enough for this protocol to work properly.

5. **(Marks: 4)** Suppose the IEEE 802.3 CSMA/CD Ethernet MAC protocol has to support PHY data rates of the bus link that have evolved to 1Gpbs (1 gigabit per second). What is the maximum length of the cable (in bus topology) that can be supported without making any changes in the protocol? Assume propagation speed of 2 x 10^8 m/s.