CSE320: Data Communications

Practice Problems

Statistical TDM (Chapter 6)

1. Suppose we have 10 sources, each creating 200 characters per second. Since only some of these sources are active at any moment, we use **statistical TDM** to combine these sources using **byte interleaving** [ie multiplexing unit = 1 byte]. Each frame carries 8 slots at a time.

   (a) How many address bits do we need for 8 slots? [Recollect that in statistical TDM, we have to send the address of that slot along with the slot (slide 6.50 of chapter 06).]

   (b) What will be the frame size and frame rate?

   (c) What will be the output rate and output bit duration?

Checkshum (Chapter 10)

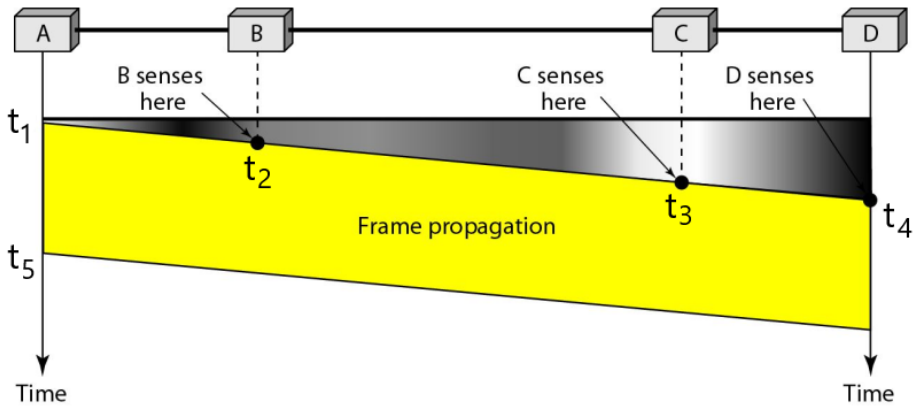
2. Let us assume a packet is made only of four 16-bit words $(4501)_{16}$, $(1A4F)_{16}$, $(A309)_{16}$, $(B007)_{16}$. The given words are in hexadecimal values, where each digit can be represented by 4 bits. Remember that hexadecimal values range from 0000 – FFFF.

   (a) Find out the checksum at the sender.
   Hint: Proceed like this: First find out 4501 + 1A4F + A309 + B007. If you cannot do it by hand, you can do it using a calculator [check out this youtube video on how to do it]. Then we have to negate it as shown in class. First check if the sum is more than 16 bits – if yes, we need to find out the wrap around sum to make it 16 bits. Then take 1's complement.

   (b) If the last hexadecimal digit in the second word is erred from F to A, will the receiver be able to detect it? Show calculations.

Multiple Access (Chapter 12)

3. In the following figure, $t_1 = 1.0\mu s, t_2 = 1.5\mu s, t_3 = 2.4\mu s, t_4 = 2.8\mu s, t_5 = 5.0\mu s$.



- Which multiple access protocol does this figure refer to?
- Find the **transmission time** for this frame.
- Find the maximum time the frame takes to travel between stations **(maximum propagation time)**.
- Find the vulnerable period in this setting, and compare it to the vulnerable periods of the **pure** and **slotted** ALOHA.
- If the channel bandwidth is 10 Mbps, find the **minimum required frame size** in this setting.

4. A common multipoint link is being used by three stations. Station 1 is to the furthest left and station 3 is to the furthest right, with the remaining station in between. Station 1 starts sending a frame to station 3 at time 4 ms. The first bit of the frame reaches station 2 at 13.4 ms and station 3 at 17.1 ms. The frame transmission ends at 21.4 ms.

   - Draw a CSMA/CD diagram for this scenario.
   - Find out the frame transmission time and maximum propagation time. What will be the vulnerable time?
   - If the channel bandwidth is 10 Gbps, find the **minimum required frame size** in this setting.

5. A station continuously senses the medium and finds the following information:

Time interval (s)	**Energy level (J)**
0 - 4	0
4 - 10	5
10 - 14	10
14 - 20	0
20 - 25	5
25 - 30	20
30 - 40	0

   - For each time interval, find the status of the medium (idle, transmission, collision).
   - Find out total time in which the medium was transmitting normally, and was in collision.
   - If a station wanted to send a frame, what time intervals would be available for it?