ECE 358
Practice questions about MAC protocols

Q1. Efficiency of the CSMA/CD protocol

Consider a LAN based on the CSMA/CD protocol.
Let the link speed be 10 Mbps, and MTU (Max Transfer Unit) length of frames be 1500 bytes.
Let the max separation distance between two nodes be 100 meters.
Let the signal speed over the medium be $(2/3)x10^8$ meters/sec.

Compute the max efficiency of the CSMA/CD protocol running on the given LAN.

Q2. Suppose two nodes (computers or routers) A and B are on the same 10 Mbps Ethernet broadcast link. Node A detected a collision after transmitting 60 Bytes from a frame, and the corresponding delay in detecting collision was the longest among millions of its transmissions.

What might be the propagation delay (in bit-time) between the two nodes? Justify your answer.

Q3. Recall that with the CSMA/CD protocol, the adapter waits $R \times 512$ bit times after a collision, where R is drawn randomly. For $R = 100$, how long does the adapter wait (in seconds) before starting to sense the medium for a 100 Mbps broadcast channel?

Q4. The receiver of a network adapter running the CSMA/CD protocol needs to be able to distinguish a frame from the one following it and have enough time for bookkeeping of those frames in hardware. This is achieved by ensuring that there a minimum time gap between successive frames transmitted by the same transmitter, and this time gap is formally known as Interframe Gap (IFG).

For a 100 Mbps link, compute the value of the IFG. For a 1 Gbps link, compute the value of the IFG.
Are the above two IFGs almost identical? If not, justify their widely differing values.

Hint: In CSMA/CD Medium sensing is done for 96 bit-times.

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Q5. All the following parts refer to the CSMA/CD protocol.
(a) If two frames collide at a receiver, how does the receiver know this, and what does the receiver do with the frames(s)?
(b) Considering the fact that receivers have the ability to know whether a frame has been received correctly, why is it important for the sender to know if its transmitted frame has collided with another frame?

Q6. When two MAC frames, say F1 and F2, collide:
(a) Can their heads (the bits being transmitted first) collide? Y / N
(b) Can their tails (the bits being transmitted last) collide? Y / N
(c) Can the head of one frame, F1, collide with the tail of F2? Y / N

Q7. Assume that the CRC checking hardware of all the computers/routers connected on a LAN fail to function as expected. Discuss its impact on the communicating applications running on those computers/routers.

Q8. Assume that there are 2 nodes connected on a LAN. One node is running the slotted Aloha protocol and the other is running the CSMA/CD protocol. For the sake of discussion, assume that both the protocols have adopted the same frame format and both the computers have much data to send to the other side.

Discuss the data transfer performance of the two nodes.