

Computer Networks (14033103-4)

Homework #1: Answer Key

Q1: True or false: Ethernet technology can guarantee in-order delivery of frames between senders and receivers. Please explain in a very few words why this is true or false.

A1: False. Ethernet uses datagram approach of packet switching which does not guarantee in order delivery of the frame. Ethernet reliability is limited to error detection and correction of a single frame using the FCS.

Q2: True or false: In internetwork (interconnected networks) we do not need addressing at data link layer because routers can use IP addresses to route packets all the way to the end-destinations. Please explain in a very few words why this is true or false.

A2: False. IP is built on top of data link layer and it needs it to physically deliver the message to the right node in each hop using MAC addresses. A packet is physically delivered to the next node in the path using MAC addresses, which tells the nodes in that network who is the destination and the sender inside this network. IP address on the other hand determine the address of the final destination, thus, can be used by routers to route the packets across networks.

Q3: A 100 Mbps link between video server and a client is established. If receiving video frames of size 13.5 Megabyte has a latency of 1.1 seconds. Find the following: (assume that the speed of light is 2.8×10^8 and no queuing delay)

- The distance between the client and server
- The latency of delivering the video frames if the connection is upgraded to 1Gbps link

A3.a: Latency = PD + Tx + Queuing $\rightarrow 1.1 = \frac{\text{distance}}{2.8 \times 10^8} + \frac{13.5 \times 8 \times 10^6}{100 \times 10^6}$

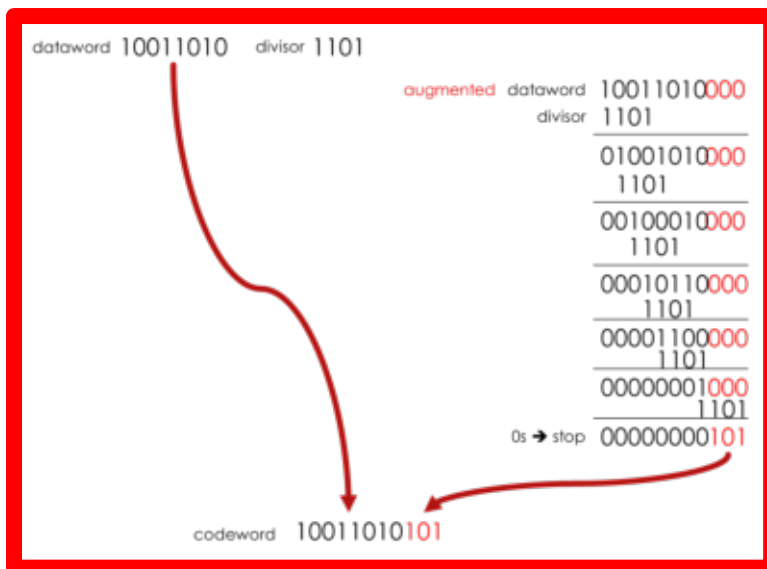
$\rightarrow \text{distance} = \left(1.1 - \frac{13.5 \times 8 \times 10^6}{100 \times 10^6}\right) \times 2.8 \times 10^8 \rightarrow \text{distance} = 5600 \text{ Km}$

A3.b: Latency = PD + Tx + Queuing $\rightarrow \text{Latency} = \frac{5600 \times 10^3}{2.8 \times 10^8} + \frac{13.5 \times 8 \times 10^6}{1 \times 10^9}$

$\rightarrow \text{Latency} = 0.128 \text{ S} = 128 \text{ ms}$

Q4: Show how to generate a codeword for the dataword "10011010" if CRC is used for coding with the divisor "1101".

A4:



Q5: A 1Mbps half-duplex link between an earth station and a satellite is established. If the distance between the two stations is 36,000 Km and if the stations agreed to use CSMA/CD to access the link, what is the minimum frame size that a sender must send to detect any potential collision? (assume that the speed of light is 2.8×10^8)

A5:

$$T_x > 2 \times PD$$

$$\rightarrow \frac{\text{minFrameSize}}{\text{Bandwidth}} > 2 \times \frac{\text{Distance}}{\text{Speed of Light}}$$

$$\rightarrow \text{minFrameSize} > 2 \times \text{Bandwidth} \times \frac{\text{Distance}}{\text{Speed of Light}}$$

$$\rightarrow \text{minFrameSize} > 2 \times 1 \times 10^6 \times \frac{36000 \times 10^3}{2.8 \times 10^8}$$

$$\rightarrow \text{minFrameSize} = 257143 \text{ bit} \approx 31.39 \text{ KB}$$