CS447–002 Networks and Data Communications
Spring 2024

Exercise Questions on March 13th

QUESTION #1

A disadvantage of the contention-based approach for medium access control, such as CSMA, is the capacity wasted due to multiple stations attempting to access the transmission channel (such as an Ethernet cable) at the same time. Suppose that time is divided into discrete slots, with each of N stations attempting to transmit with a probability of p ($0.0 \leq p \leq 1.0$) during each slot. What fraction of slots will be wasted due to contentions by multiple simultaneous transmission attempts by N stations? If the transmission rate of the cable used for this CSMA is R bps, what will be the throughput achievable (ignore all other overhead)?

Note: I will try my best to give you partial credit to any meaningful work. However, presenting (or describing) your ideas in such a way that it is easy to follow will increase your partial credit (or it may bring you full credit to do so).

QUESTION #2

One of the weaknesses in CSMA/CD is that, if a collision is not detected, CSMA/CD does not take advantage of "CD". How large the minimum packet size, if any collision will be detected?

- Transmission rate = 1 Gbps ($G = 10^9$)
- Segment length of a LAN: 300 meters
- Signal propagation speed: 200 m/μs

QUESTION #3

For a network system that consists of four rings and two bridges as shown below, find the probability that any two stations, selected at random, will be unable to communicate.

For this question, you do not have to complete your calculation. Establish a formula to calculate the probability with all necessary numbers in it.

- Each ring consists of **101** tapping repeaters and **101** links (for 100 host computers and 1 connection to a bridge).
- The mean failure rate for a tapping repeater is $\boldsymbol{P_R}$ ($0 < \boldsymbol{P_R} < 1$)
- The mean failure rate for a link is $\boldsymbol{P_L}$ ($0 < \boldsymbol{P_L} < 1$)
- The mean failure rate for a bridge is $\boldsymbol{P_B}$ ($0 < \boldsymbol{P_B} < 1$)
- Wires between a tapping repeater and a bridge will never fail
- Wires between a tapping repeater and a host computer will never fail
- Host computers will never fail