CS447: Lecture Note (Lecture #16, October 10, 2023)

The agenda for CS447 lecture #16 (October 12, 2023)

1. **Distribute:**
   - (1) Attendance cards

2. **Announcements**
   - (1) No Quiz #8 today.
   - (2) Midterm exam is scheduled on 10/17 (Tuesday next week)
     - There can be questions about the programming project
     - Some Exercises questions (those we did not have a chance to go through in the classroom) can appear in the midterm exam.

3. **Medium Access Control (CSMA/CD continued)**
   - Contention-based MAC vs. token-based MAC
   - CSMA and CSMA/CD Ethernet MAC
   - BEB (Binary Exponent Back-off) algorithm

4. **Exercises:**

**QUESTION #4**

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 100 tapping repeaters and 100 links (for 100 host computers and 1 connection to a bridge).
- The mean failure rate for a tapping repeater is \( P_1 (0 < P_1 < 1) \)
- The mean failure rate for a link is \( P_2 (0 < P_2 < 1) \)
- The mean failure rate for a bridge is \( P_3 (0 < P_3 < 1) \)
- 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

![Diagram of network system with four rings and two bridges](image)
QUESTION #2

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 ≤ p ≤ 1.0) during each slot. What fraction of slots will be wasted due to collisions 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).

EXERCISE #3:

What is the probability of non-detectable error for even parity error detection using the following assumptions (give the formula - you do not have to complete calculation)?

- Bit error rate = 10^4
- Frame size (excluding the start/stop bits) = 8 bits
- Start and stop bits will never cause bit errors.
- Transmission rate = 56.7 Kbps.

EXERCISE #4:

In the asynchronous transmission as defined below, what is the minimum receiver-side clock drift rate that can cause a framing error?

![Diagram of a clock cycle at the sender]

Center of a clock cycle at the sender

\[ \text{frame} \]

\[ \text{S 1 2 3 4 5 6 7 PR S 1} \]

Time