

CS447-001 – Networks and Data Communications

Summer 2026

Exercise Questions on July 14th

EXERCISE #1:

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

EXERCISE #2:

Suppose that asynchronous serial data transmission is clocked by two clocks (one at the sender and the one at the receiver) that each has a drift of **5 minutes** in one year. How long a sequence of bits can be sent before possible clock could cause a problem? Assume that a bit waveform will be good if it is sampled within 32% from the center. Assume that the bit samples are taken at the middle of the clock period. Also assume that at the beginning of the start bit the clock and incoming bits are in phase. Show all your work.

EXERCISE #3:

Although TCP slow-start is an effective technique for dynamically adjusting the window size under various situations, it can result in long recovery times in high-speed networks.

Assume a round trip-time of 50ms and a link with an available bandwidth of 10 Gbps ($1\text{G} = 10^9$) and a packet size of 420 octets (1 octet = 1 byte = 8 bits). How long will it take to reach the window size that is just large enough for full (= 100%) utilization of this link?

Assume that no error will happen during the packet transmissions.

Show all your work (most of the credit is for showing a correct procedure to find the solution, instead of the solution itself).