

CS447 – Networks and Data Communications

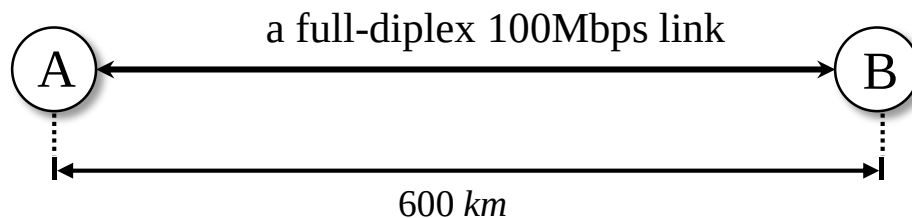
Summer 2026

Exercise Questions on July 2nd, 2026

EXERCISE #1:

Estimate the link-bandwidth utilization for the link (connection) from A to B using selective-reject ARQ:

- The signal transmission rate between A and B (each direction) is 100 Mbps ($M = 10^6$)
- The propagation delay is $5\mu\text{s}/\text{km}$ for both lines
- The link (connection) is full-duplex connection
- All packets are 1,000 bits long; ACK messages are separate packets of negligible length.
- The link distance is 600 km
- Window-size is 20
- The packet error rate is 0.12 (12%)



EXERCISE #2:

Predict how will increase in N (open window size) impact to the link utilization (U) where a packet error rate is P ($1.0 > P > 0.0$, P is a fraction between 0.0 and 1.0, but larger than 0.0 and less than 1.0) by guessing how the utilization will be impacted when N was increased. Show your plot in the following graph for GBN ARQ. Assume that P is low enough so that it still achieves a relatively high link utilization (e.g., $U = 0.8$).

Questions:

- Plot the predicted graph for the link utilization in the following figure when N is increased to a large number (10 points).
- Justify your solution (10 points).

Notes: It is your responsibility to emphasize your idea(s) by plotting the graph. Solutions for this question will be graded based on “how clearly the correct ideas are visualized”. “Nothing wrong” does not necessarily result in the full credit if the correct idea(s) is not emphasized (or clearly visualized) enough.

