# Lecture 14 - ARQ and Flow Control

**Exercise 1**: Create a table summarizing the different types of ARQ. Include: throughput, transmitter memory, receiver memory and relative complexity.

| | stop & wait | go back N | selective repeat |
|---|---|---|---|
| throughput with delay → | low | good | good |
| with errors | — | — | better |
| complexity | simplest | ↔ | most complex |
| transmitter memory | 1 | as many sent during timeout duration | ← same |
| receiver memory | 0, 1 | 0, 1 | enough to reassemble packets in order |

**Exercise 2**: A data communication system operates at 1 Mb/s and uses 10000-bit data frames and 100-bit ACK frames. What are the frame durations? What is the throughput if there is no channel delay and no errors? If the round-trip channel delay is a 0.5s (typical for satellite links)? If go-back-N ARQ is used, assuming the transmitter can store 200 unacknowledged frames?

**Exercise 3**: A communication system loses every 10th frame (e.g. due to periodic noise bursts). Ignoring ACK overhead, what is the throughput using go-back-N ARQ? Using Selective ARQ?

**Exercise 4**: Which of the above flow control methods can be used with frame-oriented protocols? On unidirectional links?