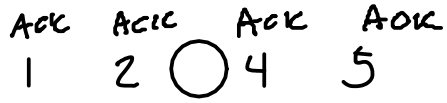


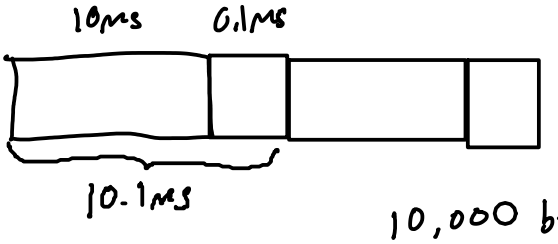
go-back N retransmits 3 4 5

selective repeat retransmits 3

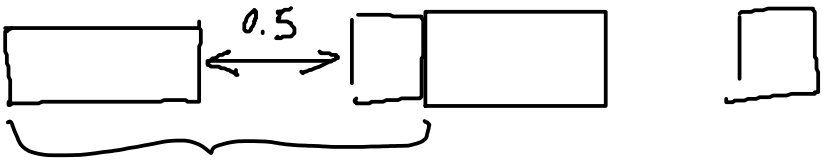
Exercise 1: A data communication system operates at 1 Mb/s and uses 10000-bit data frames and 100-bit ACK frames. What are the frame durations? What is the throughput if there is no channel delay and no errors? If the round-trip channel delay is a 0.5s (typical for satellite links)? If go-back-N ARQ is used, assuming N is larger than the number of frames transmitted in 0.5 seconds?

data: $\frac{10{,}000}{1\times10^6} = \frac{10^4}{10^6} = 10^{-2} = 10\text{ ms}.$

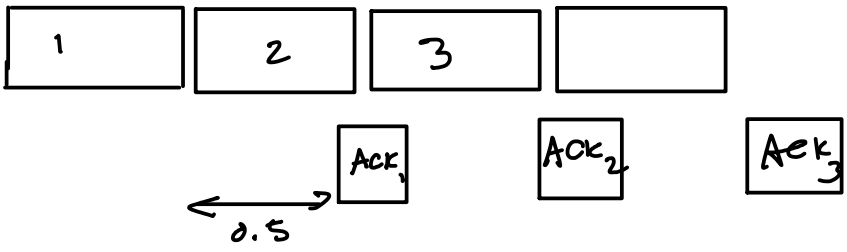
ACK: $\frac{100}{10^6} = 0.1\text{ ms}$



$\frac{10{,}000\text{ bits}}{10.1\text{ ms}} \approx 1\text{ Mb/s}$



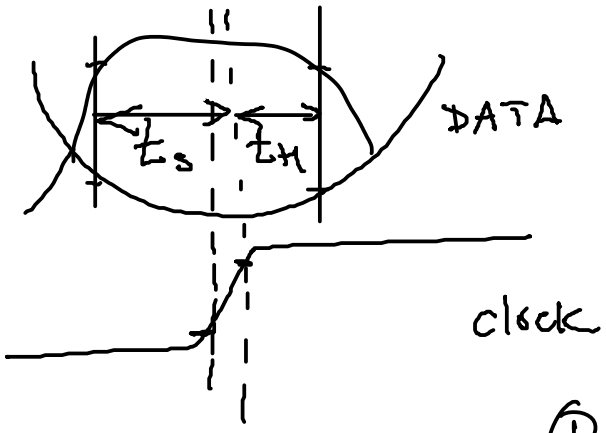
$\text{throughput} = \frac{10{,}000}{510.1} \approx 19\text{ kb/s}.$



$\text{throughput} = \frac{10{,}000\text{ bits}}{10\text{ ms}}$

$= 1\text{ Mb/s}$

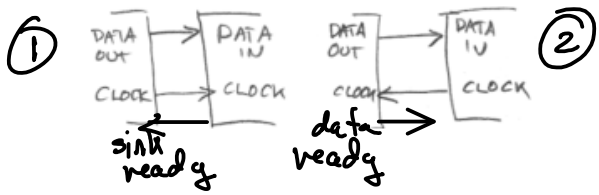
Exercise 2: What are the definitions of clock setup and hold times?



t_S = setup time

t_H = hold time

Exercise 3: Which of the above flow control methods can be used with asynchronous interfaces? With source-clocked synchronous interfaces? With sink-clocked synchronous interfaces?

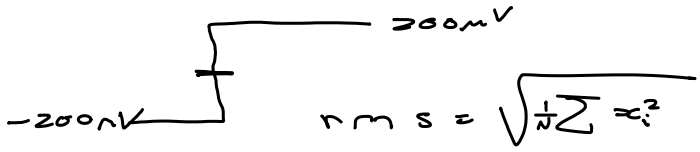


(avoid overflow)

(avoid underflow)

	Async. (RS-232)	source-clocked sync. ①	sink-clocked sync. ②'
② data ready (RTS) (from source) signal	Y	N/A (source will not clock w/o data)	Y
① sink ready (CTS) (from sink) signal	Y	Y	N/A
delayed frame ACK	N/A	N/A	N/A
insert NULL data/frames/escape sequences	N/A (no clocks)	N/A	Y (assuming protocol allows it)

clocked vs. synchronous



V_{rms} = peak voltage