Assignment#2 CS305 Fall 2023

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PROBLEM 1. Answer the questions related to UDP checksum with the 32-bit word transmitted

$$01100110011000000101010101010101$$

SOLUTION. **a)** Break the word into 16 bits

$$\begin{aligned} Word_1 &= 0110011001100000 \\ Word_2 &= 0101010101010101 \end{aligned}$$

And their 1's complements are

$$\begin{aligned} Word_1{}' &= 1001100110011111 \\ Word_2{}' &= 1010101010101010 \\ checksum &= 0100010001001010 \end{aligned}$$

b) The receiver verifies the message by checking the sum of segments of 16 bits

$$\begin{aligned} result &= Word_1 + Word_2 + checksum \\ &= 1111111111111111 \end{aligned}$$

If the bits of result are 1, then no error detected. Otherwise there must be errors.

c) No, the message might have errors, for example considering the corrupted message

$$Word_1 = 0110011001100001$$
$$Word_2 = 0101010101010100$$

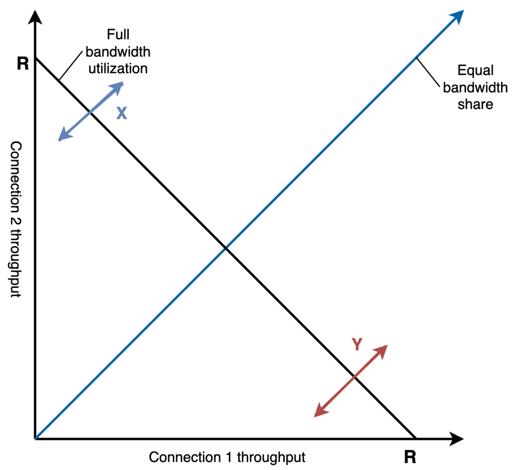
say, if the least bits of Word1 and Word2 exchanged, the checksum cannot detect the error.

PROBLEM 2. In a TCP connection, Fill in the blanks (B1) and (B2) in the below figure for go-back-N and selective repeat.

SOLUTION. **a)** (B1) resend **ack0** (B2) 01 $\boxed{234}$ 56
b) (B1) send **ack2** (B2) 0123 $\boxed{456}$

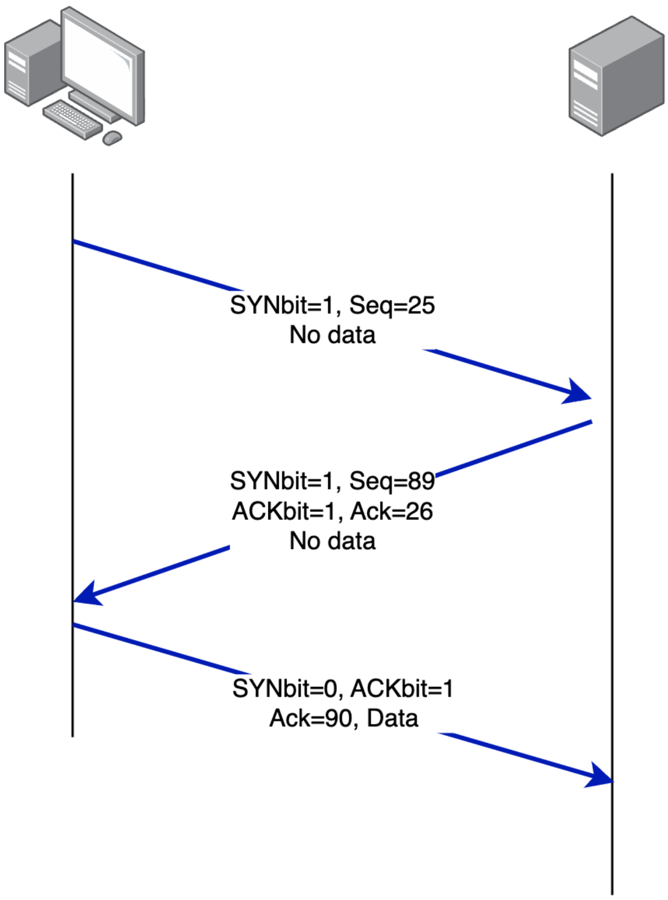
PROBLEM 3. Suppose that instead of multiplicative decrease, TCP decreased the window size by a constant amount. Would the resulting AIAD algorithm converge to an equal share algorithm?

SOLUTION. No, the AIAD algorithm will never converge to an equal share algorithm since the rates are limited to their initial rates X and Y



PROBLEM 4. Draw the TCP connection-establishment procedure between a client host and a server host with the initial sequence number of the client host is 25, and that of the server host is 89.

SOLUTION. The figure is shown below, only the third segment can carry payload while the first two segments cannot send data.



PROBLEM 5. Consider the TCP procedure for estimating RTT. Suppose that $\alpha = 0.1$, and $EstimatedRTT$ is initialized as $EstimatedRTT_0$. Recall

that

$$EstimatedRTT = (1-\alpha)EstimatedRTT + \alpha SampleRTT$$

Solution. **a)** The *EstimatedRTT* is

$$
\begin{aligned}
&= 0.9 \cdot EstimatedRTT_0 + 0.1 \cdot SampleRTT_1\\
&= 0.81 \cdot EstimatedRTT_0 + 0.09 \cdot SampleRTT_1 + 0.1 \cdot SampleRTT_2\\
&= 0.729 \cdot EstimatedRTT_0 + 0.081 \cdot SampleRTT_1 + 0.09 \cdot SampleRTT_2 + 0.1 \cdot SampleRTT_3\\
&= 0.6561 \cdot EstimatedRTT_0 + 0.0729 \cdot SampleRTT_1 + 0.081 \cdot SampleRTT_2\\
&\quad + 0.09 \cdot SampleRTT_3 + 0.1 \cdot SampleRTT_4
\end{aligned}
$$

b) From the patterns above, it's obvious that for n sample RTTs we have

$$EstimatedRTT = 0.9^n EstimatedRTT_0 + 0.1 \cdot \sum_{i=1}^{n} 0.9^{n-i} SampleRTT_i$$