Homework 3

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Due 9/23

P1:

	Source Port #	destination Port
a.) A → S	467	23
b.) B → S	513	23
c.) S → A	23	467
d.) S → B	23	513

e.) Yes
f.) No

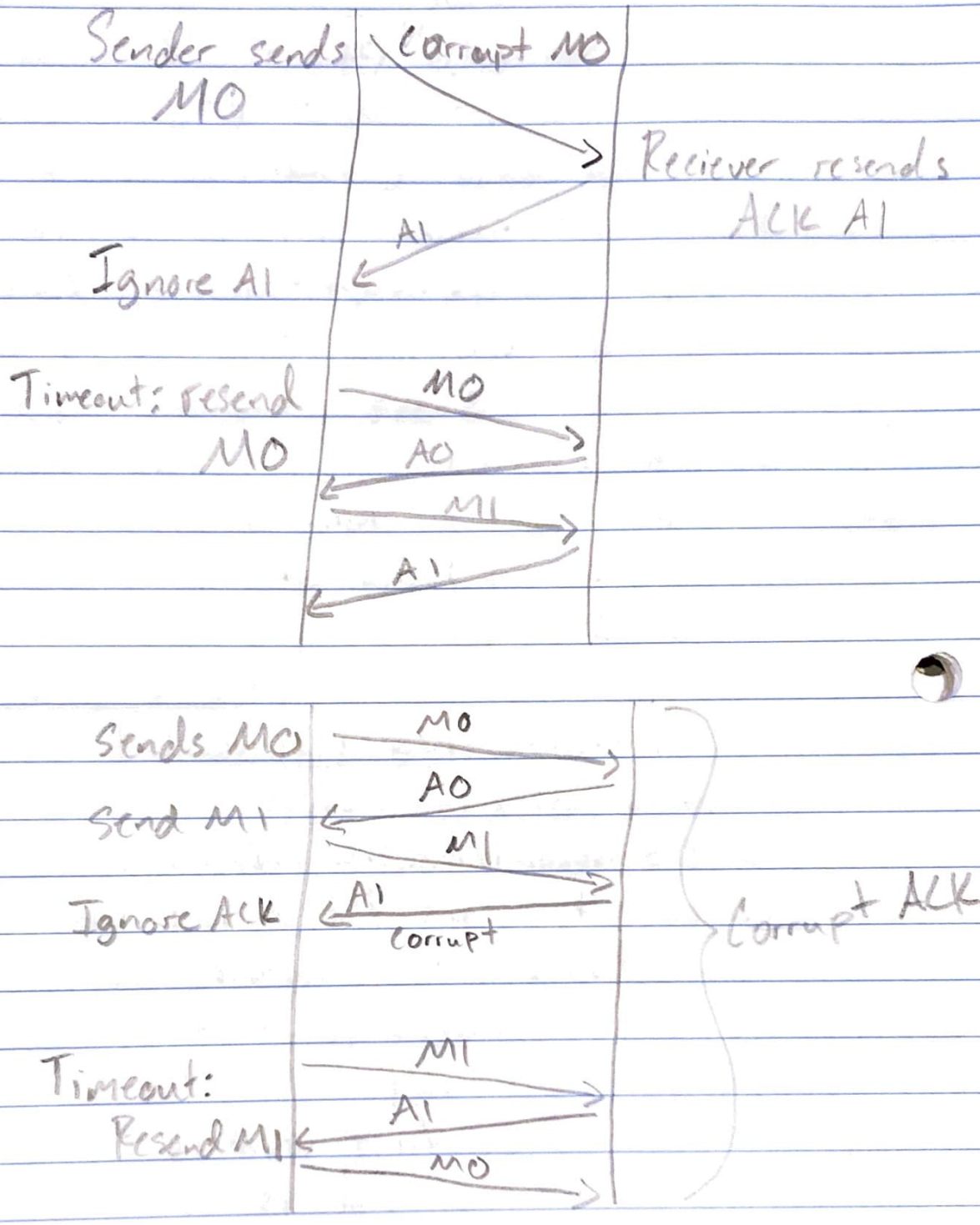
P3:

$$\begin{array}{r} 01010011 \\ +\,01100110 \\ \hline 10111001 \end{array} \qquad \begin{array}{r} 10111001 \\ +\,01110100 \\ \hline 00101110 \end{array}$$

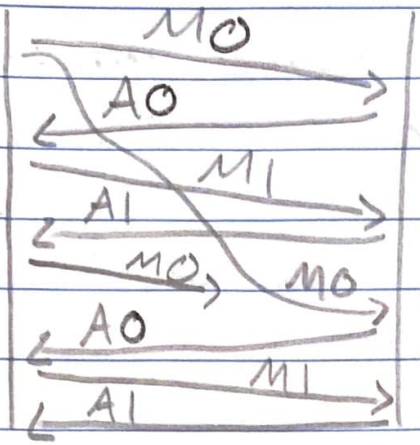
One's compliement = 11010001
To detect errors the recievuer adds the 4 words. If sum contains 0, the recievuer sees an error. All 1-bit errors will be detected, but not all 2-bit errors if last digit of first word is 0 and last digit of second word is converted to 1.

P5: No the recievuer cannot be certain no bit errors have occured. If two corresponding bits are 0 and 1, then when they are flipped their sum stays the same. Recievuer calculations are then also the same. Checksum will always verify.

P9:


Sender sends M0
Corrupt M0
Reciever resends ACK A1
A1
Ignore A1
Timeout: resend M0
M0
A0
M1
A1
Sends M0
M0
Send M1
A0
M1
Ignore ACK
A1
Corrupt
Corrupt + ACK
Timeout: Resend M1
M1
A1
M0

P13:



P15: It takes 12μS to send packet.
$1500 \cdot 8 / 10^9 = 12\mu S$
$util = 0.98 = 0.012x / 30.012$
$x \approx 2451$ packets.

P22: a.) window size $N=3$
this is by seeing reciever K-1 means senders window = K, K+N-1. Second case is then K-N, K-1. This means window size $N=3$ & begins in range K-N, K

b.) If waiting for K, then currently has K-1, N-1. This means sender has sent packets K-N, K-1. Once an Ack was sent for K-N-1, it will never send one less. So Ack can range from K-N-1 to K-1.

P23: If lowest number reciever is waiting for is packet m. Then window (w) = m, m+w-1 and Ack has values m-w, m-1. This means the Senders window would be m-w, m-1. In order for leading edge of recievers window to not overlap trailing edge of sender window, the sequence number space must be big enough to accomodate 2w numbers. So the sequence number space must be at least twice as large as the window size.

P24: a.) True - if send 1,2,3 at t0, then by t4 Sender recieves Ack's that reciever sent at t1 and goes to window 4,5,6. t5 Sender recieves Acks 1,2,3 reciever sent at t2, these Acks are outside its window.

b.) True - same scenario as part (a)

c.) True

d.) True - with window size 1, GBN and SR and alternating bit protocol are equivalent. Window size 1 diffuses the idea of out of order packets. Cumulative Ack is just a normal Ack since window size = 1.