Homework 4

Problem 4.1
Solution:

a) SEQ = 1030
   ACK = 3848
   F = ACK
   WIN = 4000
   Total amount of data = 1200

b) After a period of time, where the server has not received anything from the client. The server's window in that time has increased as a process has consumed the data in the buffer. This caused the process to send an additional acknowledgment indicating the window has increased.

c) SACKs is a system that allows a receiver to acknowledge non consecutive data. This optimizes the system by allowing the sender to retransmit only missing data at the receiver end. This is done by allowing the receiving TCP to send specific acknowledgments (SACK) packets of received data, in turn the sender retransmits only the missing data segments, thus improving efficiency as in normal cases without sack. the whole window would have to be retransmitted .

d) TCP segment could the server have used selective acknowledgments is segment 7 which now has to retransmit everything. The system could have used SACKs with the right most window being 1030 and the left most being 2230.

e) It is the client side which goes into WAIT-TIME. This is part of the process of closing the connection Which must happen on both sides of the connection. Given that the client is the one closing the connection; it is the one that goes into WAIT-TIME.

Problem 4.2
Solution:

a) According to the graph, 1290000 bytes have been transferred. The average data rate over the closed time interval [0.5, 12.5] can be calculated as :

$$1290000/12 = 107500$$

b) The minimum advertised Window is calculated receive window - Ack.
   minimum window: 31000 - 0 = 31000
   Maximum window: 300000-120000 =180000

c) At T=12, 5 segments have been lost and have not yet transmitted.

d) In the first few moments is the TCP slow start process which will start to send the full ICW to the Receiver. Thus with every ACK received the CW will be increased with one segment.