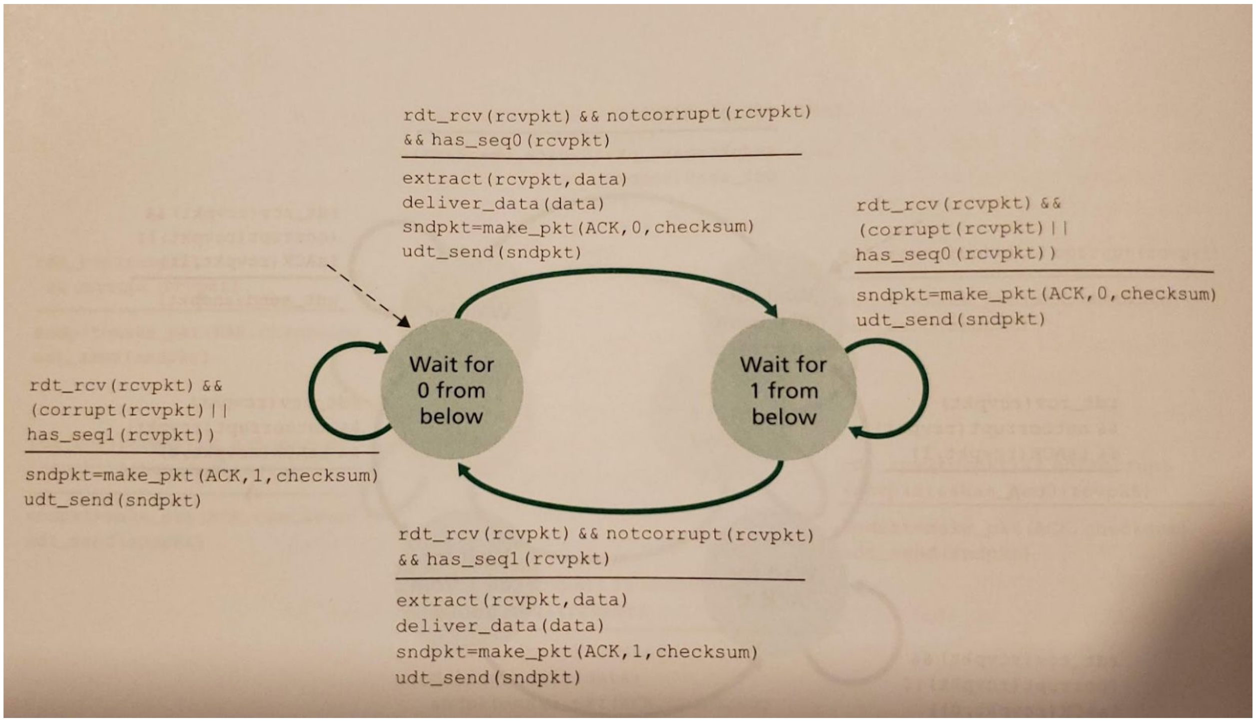
CS 3251 – Spring 2019 - Homework 3 - Corresponds to chapter 3 of the book.
Assigned: April 1, 2019, Due: April 09, 2019

P11. Consider the rdt2.2 receiver in Figure 3.14, and the creation of a new packet in the self-transition (i.e., the transition from the state back to itself) in the Waitfor-0-from-below and the Wait-for-1-from-below states: *sndpkt=make_pkt(ACK,0,checksum)* and *sndpkt=make_pkt(ACK,0,checksum)*. Would the protocol work correctly if this action were removed from the self-transition in the Wait-for-1-from-below state? Justify your answer. What if this event were removed from the self-transition in the Waitfor-0-from-below state? [Hint: In this latter case, consider what would happen if the first sender-to-receiver packet were corrupted.]



P14. Consider a reliable data transfer protocol that uses only negative acknowledgments. Suppose the sender sends data only infrequently. Would a NAK-only protocol be preferable to a protocol that uses ACKs? Why? Now suppose the sender has a lot of data to send and the end-to-end connection experiences few losses. In this second case, would a NAK-only protocol be preferable to a protocol that uses ACKs? Why?

P16. Suppose an application uses rdt 3.0 as its transport layer protocol. As the stop-and-wait protocol has very low channel utilization (shown in the crosscountry example), the designers of this application let the receiver keep sending back a number (more than two) of alternating ACK 0 and ACK 1 even if the corresponding data have not arrived at the receiver. Would this application design increase the channel utilization? Why? Are there any potential
problems with this approach? Explain.

P19. Consider a scenario in which Host A wants to simultaneously send packets to Hosts B and C. A is connected to B and C via a broadcast channel—a packet sent by A is carried by the channel to both B and C. Suppose that the broadcast channel connecting A, B, and C can independently lose and corrupt packets (and so, for example, a packet sent from A might be correctly received by B, but not by C). Design a stop-and-wait-like error-control protocol for reliably transferring packets from A to B and C, such that A will not get new data from the upper layer until it knows that both B and C have correctly received the current packet. Give FSM descriptions of A and C. (Hint: The FSM for B should be essentially the same as for C.) Also, give a description of the packet format(s) used.

P20. Consider a scenario in which Host A and Host B want to send messages to Host C. Hosts A and C are connected by a channel that can lose and corrupt (but not reorder) messages. Hosts B and C are connected by another channel (independent of the channel connecting A and C) with the same properties. The transport layer at Host C should alternate in delivering messages from A and B to the layer above (that is, it should first deliver the data from a packet from A, then the data from a packet from B, and so on). Design a stop-and-wait-like error-control protocol for reliably transferring packets from A and B to C, with alternating delivery at C as described above. Give FSM descriptions of A and C. (Hint: The FSM for B should be essentially the same as for A.) Also, give a description of the packet format(s) used.

P24. Answer true or false to the following questions and briefly justify your answer:

A. With the SR protocol, it is possible for the sender to receive an ACK for a packet that falls outside of its current window.
B. With GBN, it is possible for the sender to receive an ACK for a packet that falls outside of its current window.
C. The alternating-bit protocol is the same as the SR protocol with a sender and receiver window size of 1.
D. The alternating-bit protocol is the same as the GBN protocol with a sender and receiver window size of 1.

P27. Host A and B are communicating over a TCP connection, and Host B has already received from A all bytes up through byte 126. Suppose Host A then sends two segments to Host B back-to-back. The first and second segments contain 80 and 40 bytes of data, respectively. In the first segment, the sequence number is 127, the source port number is 302, and the destination port number is 80. Host B sends an acknowledgment whenever it receives a segment from Host A.

A. In the second segment sent from Host A to B, what are the sequence number, source port number, and destination port number?

B. If the first segment arrives before the second segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number, the source port number, and the destination port number?

C. If the second segment arrives before the first segment, in the acknowledgment of the first arriving segment, what is the acknowledgment number?

D. Suppose the two segments sent by A arrive in order at B. The first acknowledgment is lost and the second acknowledgment arrives after the first timeout interval. Draw a timing diagram, showing these segments and all other segments and acknowledgments sent. (Assume there is no additional packet loss.) For each segment in your figure, provide the sequence number and the number of bytes of data; for each acknowledgment that you add, provide the acknowledgment number.