Chapter 7 Problems
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7.1)

a: No effect on utilization.
b: Utilization decreases, as the transmitter waits more often for acks.
c: Utilization increases, as fewer acks must be transmitted.

7.2)

1 / (1 + 2((20ms * 4kbps) / L)) = U
For frames larger than 160 bits, utilization is greater than 50%.

7.3)

a: U = 1 / (1 + 2(270ms / (1000 / 1Mbps))) = 0.00185
a = 270 2a + 1 = 541
b: 7 / 541 = 0.0129
c: 127 / 541 = 0.235
d: 255 / 541 = 0.471

7.6)

With stop-and-wait, only one frame is ever outstanding at a time, so if an ACK is not received, there is only one frame to retransmit.

7.7)

If a 2-bit sequence number is used with a 4-frame window, there exists the possibility that a request for a frame to be resent will be mistaken for a bulk-acknowledge of all subsequent frames. For example, suppose frame 0 is lost, and frames 1, 2, and 3 are transmitted. If RR 0 is received by the transmitter at this point, it will be assumed to refer to the frame after frame 3, as opposed to frame 0.

7.9)

a: | [0 1 2 3] 4 5 6 7
b: 0 1 | 2 [3 4 5] 6 7
c: 0 1 2 3 | 4 5 [6 7]

7.12)

7.13)

Bit stuffing would be unnecessary, except in the case of 16-bit control fields. This is because none of the fields in an 8-bit control field is long enough to create a flag.

7.16)

N(R) = 2 (binary: 010)

7.18)

Selective-reject would be most effcient, as it allows the least amount of data to be retransmitted in case of errors.