11.6.3 Problems

P11-1. Assume PPP is in the established phase; show payload encapsulated in the frame.

P11-2. Using the following specifications, draw a finite state machine with three states (I, II, and III), six events, and four actions:

- **a.** If the machine is in state I, two events can occur. If event 1 occurs, the machine moves to state III. If event 3 occurs, the machine performs actions 2 and 4 and moves to state II.
- **b.** If the machine is in state II, two events can occur. If event 4 occurs, the machine remains in state II. If event 6 occurs, the machine performs actions 1 and 2 and moves to state III.
- **c.** If the machine is in state III, three events can occur. If event 2 occurs, the machine remains in state III. If event 6 occurs, the machine performs actions 2, 3, 4, and 5 moves to state I. If event 4 occurs, the machine performs actions 1 and 2 and moves to state I.

P11-3. Redraw Figure 11.12 using the following scenario:

- **a.** The first frame is sent and acknowledged.
- **b.** The second frame is sent and acknowledged, but the acknowledgment is lost.

c. The second frame is resent, but it is timed-out.

d. The second frame is resent and acknowledged.

P11-4. In Example 11.4 (Figure 11.13), assume the round trip time for a frame is 50 milliseconds. Explain what will happen if we set the time-out in each of the following cases.

a. 45 milliseconds **b.** 55 milliseconds **c.** 50 milliseconds

P11-5. Byte-stuff the following frame payload in which E is the escape byte, F is the flag byte, and D is a data byte other than an escape or a flag character.

D	**E**	D	D	**E**	D	D	**E**	**F**	D	**F**	D

P11-6. In Figure 11.11, show what happens in each of the following cases:

a. The receiver is in the ready state and a packet comes from the network layer.

b. The receiver is in the ready state and a corrupted frame arrives.

c. The receiver is in the ready state and an acknowledgment arrives.

P11-7. In Figure 11.11, show what happens in each of the following cases:

a. The sender is at the ready state and an error-free ACK arrives.

b. The sender is at the blocking state and a time-out occurs.

c. The sender is at the ready state and a time-out occurs.

P11-8. Redraw Figure 11.21 with the system not using authentication.

P11-9. Using the following specifications, draw a finite state machine with three states (I, II, and III), five events, and six actions:

a. If the machine is in state I, two events can occur. If event 1 occurs, the machine moves to state II. If event 2 occurs, the machine performs actions 1 and 2 and moves to state III.

b. If the machine is in state II, two events can occur. If event 3 occurs, the machine remains in state II. If event 4 occurs, the machine moves to state III.

c. If the machine is in state III, three events can occur. If event 2 occurs, the machine remains in state III. If event 3 occurs, the machine performs actions 1, 2, 4, and 5 moves to state II. If event 5 occurs, the machine performs actions 1, 2, and 6 and moves to state I.

P11-10. Redraw Figure 11.2 using the following scenario:

a. Frame 0 is sent, but lost.

b. Frame 0 is resent and acknowledged.

c. Frame 1 is sent and acknowledged, but the acknowledgment is lost.

d. Frame 1 is resent and acknowledged.

P11-11. Bit-stuff the following frame payload:

```
000111110000111110100011111011110000111
```

P11-12. Assume the only computer in the residence uses PPP to communicate with the ISP. If the user sends 10 network-layer packets to ISP, how many frames are exchanged in each of the following cases:

a. Using no authentication?

b. Using PAP for authentication?

c. Using CHAP for authentication?

P11-13. Assume PPP is in the authentication phase, show payload exchanged between the nodes if PPP is using

a. PAP

b. CHAP

P11-14. Unstuff the following frame payload:

```
00011111000001011101110100111011111001101111
```

P11-15. Redraw Figure 11.11 using a variable to hold the one-bit sequence number and a variable to hold the one-bit acknowledgment number.

P11-16. Unstuff the following frame payload in which E is the escape byte, F is the flag byte, and D is a data byte other than an escape or a flag character.

E	**E**	D	**E**	**F**	D	D	**E**	**F**	**E**	**E**	D	D	D	

P11-17. Assume we change the Stop-and-Wait Protocol to include a NAK (negative feedback), which is used only when a corrupted frame arrives and is discarded. Redraw Figure 11.9 to show this change.

P11-18. Redraw Figure 11.10 using piggybacking.