第三章作业如下：

3-1. The following data fragment occurs in the middle of a data stream for which the byte stuffing algorithm described in the text is used: A B ESC C ESC FLAG FLAG D. What is the output after stuffing?

答：A B ESC ESC C ESC ESC ESC FLAG ESC FLAG D

3-2. Can you think of any circumstances under which an open-loop protocol (e.g., a Hamming code) might be preferable to the feedback-type protocols discussed throughout this chapter?

答：1.传输延迟非常长，如空间卫星传输，正向纠错是必要的。

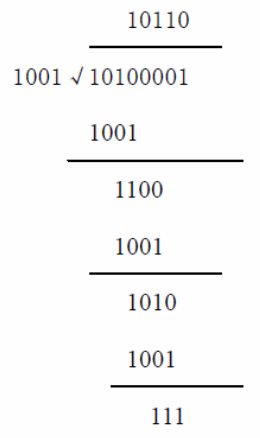
1. 开环协议也适用于军事上，接受者不希望在传输过程中暴露他的位置。
2. 如果错误率非常低，并且纠错码足够好，也可以使用开环协议。
3. 实时系统中无法忍受等待重传的情况。

3-3. An 8-bit byte with binary value 10101111 is to be encoded using an even-parity Hamming code. What is the binary value after encoding?

答：先将检验位置置空得\_ \_ 1\_ 010\_1111,检查每个校验位所影响的位置，使其所有位置上的1的个数为偶数，得出结果101001001111.

3-4. What is the remainder obtained by dividing x7 + x5 +1by the generator polynomial x3+1?

答：由下图可知余数为111，转化为多项式，得所求余数为：x2+x+1



3-5. Suppose that a message 1001 1100 1010 0011 is transmitted using Internet Checksum (4-bit word). What is the value of the checksum?

答：0011+1010=1101

1101+1100=1001+1=1010

1010+1001=0011+1=1100

高位溢出的值，需要带回低位重新计算。

3-6. A channel has a bit rate of 4 kbps and a propagation delay of 20 msec. For what range of frame sizes does stop-and-wait give an efficiency of at least 50%?

答：要使效率达到50%,必须使传输数据包的时间等于来回的传输延迟，在4kbps的速率下，160bit系统40ms(2倍的传输延迟)，所以祯大于160bit时，才能获得50%的效率。

3-7. A 3000-km-long T1 trunk is used to transmit 64-byte frames using protocol 5. If the propagation speed is 6 μsec/km, how many bits should the sequence numbers be?

答：为使操作有效，序列空间必须足够大，使得在第一个ACK返回之前，其他数据还能继续传输。传播时间为3000km\*6us/km = 18ms .T1的速率是1.536Mbps,64byte的祯传输需要0.300ms.所以第一祯到达的时间是18.3ms.ACK回复需要18ms.多以第一祯发送到收到应答需要36.3ms,所以发送的串口大小必须大到足够支持36.3ms的传输时间，每个祯需要0.3ms,所以在这段时间内可以传输36.3ms/0.3ms = 121个祯，所以需要7位序列

3-8. In protocol 6, when a data frame arrives, a check is made to see if the sequence number differs from the one expected and no nak is true. If both conditions hold, aNAK is sent. Otherwise, the auxiliary timer is started. Suppose that the else clause were omitted. Would this change affect the protocol’s correctness?

答：影响了协议正确性，可能造成死锁。假设一批祯已经到达并且被接收，接收者会推进他的窗口，如果所有ACK丢失，发送定时器会超时，并重新发送一个祯，接收者会发送NAK。如果这个包丢失，那么发送者会保持超时，并发送第一个已经被接收祯，而接收者不再管它，那么发送者就会不断发送，最终造成死锁

3-9. Suppose that the three-statement while loop near the end of protocol 6 was removed from the code. Would this affect the correctness of the protocol or just the performance? Explain your answer.

答：这会造成死锁，这是唯一用了处理ACK的进程，如果没有这段代码，那么发送者会保持超时，并不做任何事。

3-10. Frames of 1000 bits are sent over a 1-Mbps channel using a geostationary satellite whose propagation time from the earth is 270 msec. Acknowledgements are always piggybacked onto data frames. The headers are very short. Three-bit sequence numbers are used. What is the maximum achievable channel utilization for

(a) Stop-and-wait?

(b) Protocol 5?

(c) Protocol 6?

答：祯发送需要10000bit/1Mbps=1s,假设t=0, 在t=1ms时，第一个祯被发送出来，在t=270\_1=271ms时，第一个祯到达。T=271\*2=542ms时，第一个祯的ACK到达，所以循环周期是542ms，总共有k个祯在542ms被发送，信道利用率是=k/542

K=1时，信道利用率为1/542=0.18 k必须等于1

K=7时，信道利用率为7/542=1.29%（k=2n-1=7）

K=4时，信道利用率为4/542=0.74%（窗口空间不应该超过序列空间的一半为4）