1. A bit string, 0111101111101111110, needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing?

011110111110011111010

1. What is the remainder obtained by dividing x^7 + x^5 + 1 by the generator polynomial x^3 + 1? (give your answer as bit string)

10100001/1001 = 111

1. 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 percent?

When send one frame costs the RTT (Round trip time) time, the utilization efficient of the channel will be 50%.

L/4kbps = 40 msec, so L = 160bits. (假设t=0 表示传输开始的时间，用x表示发送一帧数据需要时间，那么在x + 20msec时刻这帧数据到达目的地，然后有一个近乎处理时间可以忽略不计的非常小的ACK返回，ACK到达源端的时间为x + 2×20msec，因为信道的利用率为50%，所以(x + 20msec)/( x + 2×20msec) = 0.5，所以x = 40msec。)

1. Consider an error-free 64-kbps satellite channel used to send 512-byte data frames in one direction, with very short acknowledgements coming back the other way. What is the maximum throughput for window sizes of 1, 7, 15? The earth-satellite propagation time is 270 msec. (give your answer as an integer)

使用卫星信道端到端的传输延迟为270ms，以64kb/s 数率发送长度为512字节一帧，发送一帧的时间为512×8/(64kbps)= 4096/(64kbps) = 64ms，从发送一帧到收到ACK总共需要270×2+64=604msec，因此我们需要604/64=9 个帧才能保持通道不空。

对于窗口值1，每604ms 发送4096 位，吞吐率为4096/0.604=6.8kb/s。

对于窗口值7，每604ms 发送4096\*7 位，吞吐率为4096\*7/0.604=47.5kb/s。

对于窗口值超过9（包括15、127），吞吐率达到最大值，即64kb/s。

1. A 100-km-long cable runs at the T1 data rate. The propagation speed in the cable is 2/3 the speed of light in vacuum. How many bits fit in the cable?

在该电缆中的传播速度是每秒钟2×108m，即每毫秒200km，因此100km 的电缆将会在0.5ms 内填满。T1 速率125传送一个193 位的帧，0.5ms 可以传送4 个T1 帧，即193\*4=772bit。

1. A CRC generator polynomial is G(X)= X^16+X^15+X^2+l. How many bits will the checksum be?

16

1. Assume the sequence number has 4 bits. What is the maximum number of outstanding sending frames for a go back N protocol?

15

1. Assume the sequence number has 3 bits. What is the maximum number of outstanding sending frames for a selective repeat protocol?

4

9)

Which is not the CSMA／CA rule of 802.11?

* If station X received RTS of station A, X must remain silent for a short time
* If station X received RTS, but did not receive CTS, then X may not transmit its data.√
* If station X has not received RTS, but received CTS, then X may not transmit its data
* If station X has received both RTS and CTS, then X may not transmit its data

10) After the sender first sends frames from 0 to 6 and at the end of timeout receives the acknowledgements for frame 1, 3, and 5, the next frame it will re-transmit is frame \_\_6\_\_\_\_\_\_. (assume the protocol is go-back-n)