Chapter 1

1. A factor in the delay of a store-and-forward packet-switching system is how long it takes to store and forward a packet through a switch. If switching time is 10 usec, is this likely to be a major factor in the response of a client-server system where the client is in New York and the server is in California? Assume the propagation speed in copper and fiber to be 2/3 the speed of light in vacuum.

答：波在同轴电缆中的传播速度为200m/μsec，在10s内传播的距离为2000m。因此，每次交换会额外增加相当于2km的电缆距离。纽约与加利福尼亚州的距离约为4000km，交换50次则增加的距离约为100km，仅为总距离的2.5%，占了很小的一部分，因此交换时间并不是延迟的主要因素。

2. Which of the OSI layers handles each of the following:

a. (a) Dividing the transmitted bit stream into frames.

b. (b)Determining which route through the subnet to use.

答： a. 数据链路层(Data link layer). b. 网络层(Network layer).

3. A system has an n-layer protocol hierarchy. Applications generate

messages of length M bytes. At each of the layers, an h-byte header is added. What fraction of the network bandwidth is filled with headers?

答：hn/(hn+M)*100%

4. How long was a bit on the original 802.3 standard in meters? Use a transmission speed of 10 Mbps and assume the propagation speed in coax is 2/3 the speed of light in vacuum.

答：波在同轴电缆中的传播速度为 200m/μsec，而在 10Mbps，传输一位需要 0.1μsec，因此这里的一位是 200*0.1=20m。

Chapter 2

1. If a binary signal is sent over a 3-kHz channel whose signal-to-noise ratio is 20 dB, what is the maximum achievable data rate?

答：由题目可知，带宽B=3-kHz，信噪比$10\log_{10}S/N=20dB$，可推出S/N=100。

①由尼奎斯特定理可知，发送二进制信号的3-kHz信道的传送最大数据速率$=2B\log_2V=2*3*\log_22=6kbps$

②由香农定理可知，对于带宽为B，噪声比S/N的有噪声信道，其最大数据速率为$B\log_2(1+S/N)=3*\log_2(1+100)=19.97kbps$

综上，可取得的最大数据传输速率为6kbps。

2. What signal-to-noise ratio is needed to put a T1 carrier on a 50-kHz line?

查阅资料可知，T1 信号的带宽为 $1.544*10^6$Hz。

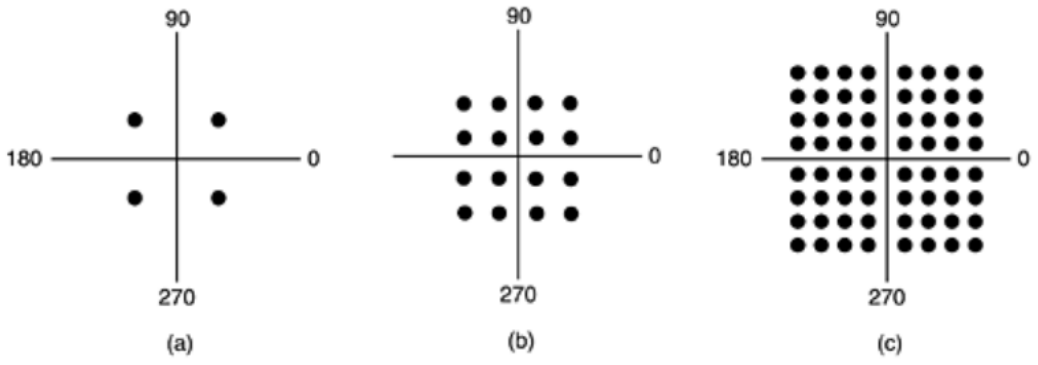
由香农定理，对于带宽为 B，噪声比 S/N 的有噪声信道，其最大数据速率为 $Blog2(1+S/N)=1.54*10^6$Hz，代入数据即 $50000*log2(1+S/N)=1.54*10^6$Hz，得 $S/N=2^{31}-1$。

信噪比为 $10log_{10}S/N=10*log10(2^{31}-1)=93dB$

3. A modem constellation diagram similar to Fig 2-25 has data points at the following coordinates: (1,1), (1.-1),(-1.1) and (-1,-1). How many bps can a modem with these parameters achieve at 1200 baud?

Fig 2-25 如图

Figure 2-25. (a) QPSK. (b) QAM-16. (c) QAM-64.



由题目可知，每个波特有4个合法值，因此可知比特率是波特率的两倍。故1200baud对应的数据速率为2400bps。

4. Ten signals, each requiring 4000 Hz, are multiplexed on to a signal channel using FDM. How much minimum bandwidth is required for the multiplexed channel? Assume that the guard bands are 400 Hz wide.

信道之间有保护带形成的间隔，对于 10 个 4000Hz 的信号，我们需要 9 个防护频段，故所需要的最小带宽为 4000*10+400*9=43600Hz

~~5. What is the essential difference between message switching and packet switching?~~ (本题删掉)