第二章作业如下：

2-1. A noiseless 8-kHz channel is sampled every 1 msec. What is the maximum data rate?

答：对于无噪声的信道不管多久采集一次，都可传输任意数量的数据，高于每秒2B次采样无意义，对于例三等级的模型，最大速率为2H\*每次采样的数据，对于一个4KHZ的信道，H=4K 2H=8K取决于每次采样的数据是多少，若每次采样产生16bit则最大速率为16\*8K=128Kbps,若每次采样1024bit则最大速率为1024\*8K=8Mbps

2-2. 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：信噪比为20dB,即s/N=100,由于log2101≈6.658由香农定理，该信道的容量为3log2(1+100)=19.89kbps

又根据尼奎斯特定理，发送二进制信号的2kHz信道的最大数据传输速率为2\*3\*log22=6kbps

所以可取得的最大数据传输速率为6kbps

2-3. How much bandwidth is there in 0.1 microns of spectrum at a wavelength of 1 micron?

答：△f=c△λ/λ2 △λ=10-7 λ=10-6

带宽为30000GHZ

2-4. It is desired to send a sequence of computer screen images over an optical fiber. The screen is 1920x1200 pixels, each pixel being 24 bits. There are 50 screen images per second. How much bandwidth is needed?

答：通信速率=1920\*1200\*24\*50bps=2764Mbps

2-5. Radio antennas often work best when the diameter of the antenna is equal to the wavelength of the radio wave. Reasonable antennas range from 1 cm to 5 meters in diameter. What frequency range does this cover?

答：λf=c, c=3\*108m/s λ=1m f=300MHZ λ=5m f=60MHZ,所以能覆盖额范围是60MHZ~300MHZ

2-6. Ten signals, each requiring 4000 Hz, are multiplexed onto a single channel using FDM. What is the minimum bandwidth required for the multiplexed channel? Assume that the guard bands are 400 Hz wide.

答：4kHz\*10+400Hz\*9 = 43600HZ

（频分复用技术，10个信道复用在一起需要9个保护带）

2-7. Why has the PCM sampling time been set at 125 μsec?

答：采样时间125μs,所以每秒8000次采样，根据尼奎斯特定理，这是在4k信道上采用的采样频率，例如电话信道。

2-8. Compare the maximum data rate of a noiseless 4-kHz channel using  
(a) Analog encoding (e.g., QPSK) with 2 bits per sample.  
(b) The T1 PCM system.

答：根据尼奎斯特定律，4kHZ信道上需要每秒8000次采样，每次2bit,所以速率为16kbps,T1系统每次7bit,速率为56kbps

2-9. A CDMA receiver gets the following chips: (-1 +1 -3 +1 -1 -3 +1 +1). Assuming the chip sequences defined in Fig. 2-28(a), which stations transmitted, and which bits did each one send?

答：将得到的码片分别与ABCD相乘得到

（-1+1-2+1-1-3+1+1）\*（-1-1-1+1+1-1+1+1）/8=1

（-1+1-2+1-1-3+1+1）\*（-1-1+1-1+1+1+1-1）/8=-1

（-1+1-2+1-1-3+1+1）\*（-1+1-1+1+!+1-1-1）/8=0

（-1+1-2+1-1-3+1+1）\*（-1+1-1-1-1-1+1-1）/8=1

由此可知，A和D发送了1，B发送了0，C沉默

2-10. A cable company decides to provide Internet access over cable in a neighborhood consisting of 5000 houses. The company uses a coaxial cable and spectrum allocation allowing 100 Mbps downstream bandwidth per cable. To attract customers, the company decides to guarantee at least 2 Mbps downstream bandwidth to each house at any time. Describe what the cable company needs to do to provide this guarantee.

答：2Mbps的下行速率，意味着50个用户用同一根电缆，用户数总共5000，所以该公司需要在一根同轴电缆中分离出100根电缆，并且将他们之间连接到光纤结点。