**第二次作业：（英文版教材第二章 2, 3, 4, 7, 8, 21, 24, 25, 26, 28, 36, 37, 教材第四章14）**

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

3. 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?

4. What signal-to-noise ratio is needed to put a T1 carrier with data rate 1.544Mbps on a 100-kHz line?

7. It is desired to send a sequence of computer screen images over an optical fiber. The screen is 1920 × 1200 pixels, each pixel being 24 bits. There are 50 screen images per second. How much bandwidth is needed?

8. Is the Nyquist theorem true for high-quality single-mode optical fiber or only for copper wire?

21. A modem constellation diagram similar to Fig. 2-23 has data points at (0, 1) and (0, 2). Does the modem use phase modulation or amplitude modulation?

24. An ADSL system using DMT allocates 3/4 of the available data channels to the down-stream link. It uses QAM-64 modulation on each channel. What is the capacity of the downstream link?

25. 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.

* 1. Sketch the Manchester encoding on a classic Ethernet for the bit stream 0001110101.

26. Why has the PCM sampling time been set at 125 μsec?

28. 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.

36, Compare the delay in sending an ***x-bit*** message over a ***k-hop*** path in a circuit-switched network and in a (lightly loaded) packet-switched network. The circuit setup time is ***s*** sec, the propagation delay is ***d*** sec per hop, the packet size is ***p*** bits, and the data rate is ***b*** bps. Under what conditions does the packet network have a lower delay? Also, explain the conditions under which a packet-switched network is preferable to a circuit switched network.

37. Suppose that ***x*** bits of user data are to be transmitted over a ***k-hop*** path in a packet switched network as a series of packets, each containing ***p*** data bits and ***h*** header bits,

with *x >> p + h*. The bit rate of the lines is ***b*** bps and the propagation delay is negligible.

What value of ***p*** minimizes the total delay?