Homework Assignment: 데이터통신 연습문제

Chapter 2

P2-3.

In an internet, we change the LAN technology to a new one. Which layers in the TCP/IP protocol suite need to be changed?

P2-4.

Assume that an application-layer protocol is written to use the services of UDP. Can the application-layer protocol use the services of TCP without change?

P2-6.

Assume a system uses five protocol layers. If the application program creates a message of 150 bytes and each layer (including the fifth and the first) adds a header of 20 bytes to the data unit, what is the efficiency (the ratio of application layer bytes to the number of bytes transmitted) of the system?

P2-8.

Match the following to one or more layers of the TCP/IP protocol suite:

a. route determination

b. connection to transmission media

c. providing services for the end user

P2-9.

Assume we have created a packet-switched internet. Using the TCP/IP protocol suite, we need to transfer a huge file. What are the advantage and disadvantages of sending large packets?

P2-13.

Match the following to one or more layers of the TCP/IP protocol suite:

a. creating user datagrams

b. responsibility for handling frames between adjacent nodes

c. transforming bits to electromagnetic signals

Chapter 3

P3-4.

A computer monitor has a resolution of 1600 by 800 pixels. if each pixel uses 1024 colors, how many bits are needed to send the complete contents of a screen?

p3-5.

A line has a signal-to-noise ratio of 2000 and a bandwidth of 5000KHz. What is the maximum data rate supported by this line?

p3-7.

What is the bit rate for each of the following signals?

a. A signal in which 1 bit lasts 0.001 s

b. A signal in which 1 bit lasts 2 ms

c. a signal in which 10 bits last 20 μs

p3-17.

What is the theoretical capacity of a channel in each of the following cases ?

a. Bandwidth : 30KHz $\mathrm{SNR}_{\mathrm{dB}} \nabla 40$

b. Bandwidth : 100KHz $\mathrm{SNR}_{\mathrm{dB}} \nabla 4$

c. Bandwidth : 1MHz $\mathrm{SNR}_{\mathrm{dB}} \nabla 20$

P3-18.

A TV channel has a bandwidth of 6 MHz. If we send a digital signal using one channel, what are the data rates if we use one harmonic, three harmonics, and five harmonics?

P3-19.

A signal with 200 milliwatts power passes through 20 devices, each with an average noise of 2 microwatts. What is the SNR? what is the SNRdB?

P3-25.

A periodic composite signal with a bandwidth of 2000 Hz is composed of two sine waves. The first one has a frequency of 100 Hz with a maximum amplitude of 20 V; the second one has a maximum amplitude of 5 V. Draw the bandwidth.

P3-29.

We have a channel with 4 KHz bandwidth. If we want to send data at 100 Kbps, what is the minimum $\mathrm{SNR}_{\mathrm{dB}}$? what is the SNR?

Chapter 4.

P4-3.

What is the maximum data rate of a channel with a bandwidth of 200KHz if we use four levels of digital signaling.

P4-5.

What is the Nyquist sampling rate for each of the following signals?

a. A low-pass signal with bandwidth of 300 KHz?

b. A band-pass signal with bandwidth of 300 KHz if the lowest frequency is 100 KHz?

P4-7.

We have a baseband channel with a 2-MHz bandwidth. What is the data rate for this channel if we use each of the following line coding schemes?

a. NRZ-L b. Manchester c. MLT-3 d. 2B1Q

P4-8.

We have sampled a low-pass signal with a bandwidth of 300 KHz using 1024 levels of quantization.

a. Calculate the bit rate of the digitized signal.

b. Calculate the $\mathrm{SNR}_{\mathrm{dB}}$ for this signal.

c. Calculate the PCM bandwidth of this signal.

P4-10.

Draw the graph of the NRZ-1 scheme using each of the following data streams, assuming that the last signal level has been positive. From the graphs, guess the bandwidth for this scheme using the average number of changes in the signal level. Compare your guess with the corresponding entry in Table 4.1.

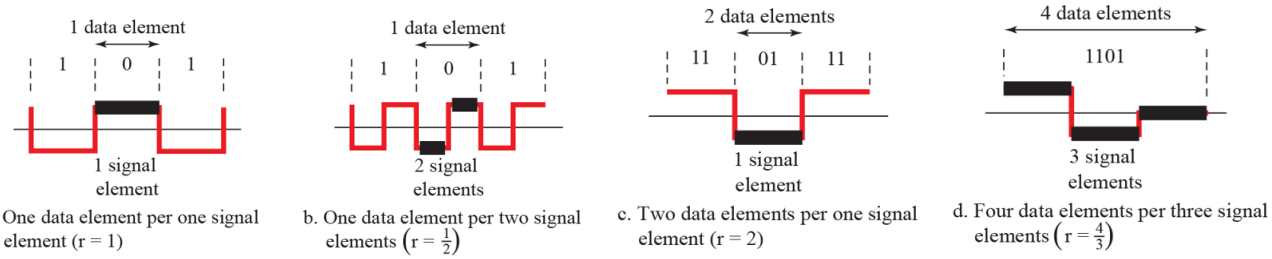
Table 4.1: Summary of line coding schemes

Category	*Scheme*	*Bandwidth (average)*	*Characteristics*
Unipolar	NRZ	$B = N/2$	Costly, no self-synchronization if long 0s or 1s, DC
Polar	NRZ-L	$B = N/2$	No self-synchronization if long 0s or 1s, DC
	NRZ-I	$B = N/2$	No self-synchronization for long 0s, DC
	Biphase	$B = N$	Self-synchronization, no DC, high bandwidth
Bipolar	AMI	$B = N/2$	No self-synchronization for long 0s, DC
Multilevel	2B1Q	$B = N/4$	No self-synchronization for long same double bits
	8B6T	$B = 3N/4$	Self-synchronization, no DC
	4D-PAM5	$B = N/8$	Self-synchronization, no DC
Multitransition	MLT-3	$B = N/3$	No self-synchronization for long 0s

P4.11.

Calculate the value of the signal rate for each case in Figure 4.2 if the data rate is 1 Mbps and c = 1/2.

Figure 4.2: Signal elements versus data elements



a. One data element per one signal element (r = 1)

b. One data element per two signal elements $\left(r = \frac{1}{2}\right)$

c. Two data elements per one signal element (r = 2)

d. Four data elements per three signal elements $\left(r = \frac{4}{3}\right)$

P4-16.

Draw the graph of the MLT-3 scheme using each of the following data streams, assuming that the last signal level has been positive. From the graphs, guess the bandwidth for this scheme using the average number of changes in the signal level. Compare your guess with the corresponding entry in Table 4.1.

a. 00000000 b. 11111111 c. 01010101 d. 00011000

P4-18.

Repeat Problem P4-16 for the differential Manchester scheme.

Chapter 5.

P5-1.

What is the required bandwidth for the following case if we need to send 6000 bps? Let d = 1.

a. ASK

b. FSK with $2\Delta f$ = 4 KHz

c. QPSK

d. 16-QAM

P5-3.

Find the bandwidth for the following situations if we need to modulate a 5-KHz voice.

a. AM b. FM(β=5) c. PM(β=1)

P5-5.

What is the number of bits per band for the following techniques?

a. ASK with four different amplitudes

b. FSK with eight different frequencies

c. PSK with four different phases

d. QAM with a constellation of 128 points

P5-6.

Draw the constellation diagram for the following:

a. ASK, with peak amplitude values of 1 and 3

b. BPSK, with a peak amplitude value of 2

c. QPSK, with a peak amplitude value of 3

d. 8-QAM with two different peak amplitude values, 1 and 3, and four different phases

P5-7.

Calculate the baud rate for the given bit rate and type of modulation.

a. 3000 bps, FSK

b. 2000 bps, ASK

c. 4000 bps, QPSK

d. 36,000 bps, 64-QAM

P5-9.

A corporation has a medium with a 1-MHz bandwidth (lowpass). The corporation needs to create 10 separate independent channels each capable of sending at least 10 Mbps. The company has decided to use QAM technology. What is the minimum number of bits per baud for each channel? What is the number of points in the constellation diagram for each channel? Let d = 0.