EIE 3333 Data and Computer Communications (2019/20)

Tutorial 2

Unit 2: Physical Layer

Review Questions

1. What is the position of the transmission media in the OSI or the Internet model?
2. Name the two major categories of transmission media.
3. How do guided media differ from unguided media?
4. What are the three major classes of guided media?
5. Names three types of transmission impairments.
6. What does the Nyquist theorem have to do with communications?
7. What does the Shannon Capacity have to do with communications?
8. Distinguish between baseband transmission and broadband transmission.
9. List three techniques of digital-to-digital conversion.
10. Distinguish between a signal element and a data element.
11. Distinguish between data rate (bit rate) and signal rate (baud rate).
12. Define a DC component and its effect on digital transmission.
13. Define the characteristics of a self-synchronizing signal.
14. Define scrambling and give its purpose.

Problems

1. A device is sending out data at the rate of 1000 bits/s.
   a. How long does it take to send out 10 bits?
   b. How long does it take to send out a single character (8 bits)?
   c. How long does it take to send out a file of 100,000 characters?

2. If the peak voltage value of a signal is 20 times the peak voltage value of the noise, what is the SNR? What is the SNR_{dB}?

3. A line has a signal-to-noise ratio of 1000 and a bandwidth of 4000 Hz. What is the maximum data rate supported by this line?

4. What is the theoretical capacity of a channel in each of the following cases:
   a. Bandwidth: 20 KHz $SNR_{dB} = 40$
   b. Bandwidth: 200 KHz $SNR_{dB} = 4$
   c. Bandwidth: 1 MHz $SNR_{dB} = 20$

5. A computer monitor has a resolution of 1200 by 1000 pixels. If each pixel uses 1024 colors, how many bits are needed to send the complete contents of a screen?

6. Assume a data stream is made of ten 0s. Encode this stream, using the following encoding schemes.
   a. Unipolar
   b. NRZ-L
   c. NRZ-I
   d. Manchester
   e. Differential Manchester
   f. AMI

7. Repeat Q6 for a data stream of 0101010101.

8. Draw the graph of the MLT-3 scheme using the following data streams. Assume that the last signal level has been positive.

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

9. Draw the graph of the 2B1Q scheme using the following data streams. Assume that the last signal level has been positive.

   a. 0000000000000000
   b. 1111111111111111
   c. 0101010101010101
   d. 0110011001100110

10. What is the result of scrambling the sequence 11100000000000 using each of the following techniques? Assume that the last non-zero signal level has been positive.

    a. B8ZS
    b. HDB3