CS-455 HW1 Summer 2018 33 points

Show your work and explain all your solutions for full credit.

1. Encode the bit stream 01100011 using the following encoding schemes:
   a) (2 points) NRZ-I
   b) (2 points) Manchester

2. (2 points) We measure the performance of a transmission line (5 kHz of bandwidth). The signal is 10V, the noise is 5 mV. What is the maximum data rate supported by this transmission line?

3. (2 points) A computer monitor has a resolution of 1200 by 1000 pixels. If each pixel uses 1026 colors, how many bits are needed to send the complete contents of a screen?

4. We need to upgrade a channel to a higher data rate.
   a) (2 points) How is the rate improved if we double the bandwidth?
   b) (3 points) How is the rate improved if we double the SNR?

5. (4 points) What is the total delay (latency) for a frame of size 5 million bytes that is being sent on a link with 10 routers each having a queuing time of 2 microseconds and a processing time of 1 microsecond. The length of the link is 2000 km. The speed of the signal on the link is 2×10^8 m/s. The link has a bandwidth of 5 Mbps. Which component of this delay is dominant? Which one is negligible?

6. (2 points) A signal travels from point *A* to point *B.* At point *A* the signal power is 100 W. At point *B* the signal power is 90 W. What is the attenuation in decibels?

7. (4 points) Consider two sine waves $s_1(t)$ and $s_2(t)$ whose periods $T_1=T_2=0.1$ sec. and phases $\alpha_1=\alpha_2=0$ are identical. The amplitude $A_1=10$ V. The power of $s_2(t)$ is lower than the power of $s_1(t)$ by 20 dB. Find an analytical formula for the superposition of these two sine waves in the time domain and draw its frequency domain plot (*t* denotes time).

8. (2 points) Assume that six devices are arranged in a mesh topology. How many links are needed? How many interfaces are needed for each device?

9. (2 points) Define a DC component and its effect on digital transmission.

10. (2 points) What are the headers and trailers, and how do they get added and removed?

11. (4 points) What is the difference between a logical address and a physical address?