

CS 440 Quiz 2

1. You have a medium that will support a bandwidth of 1000 Hz. Suggest a scheme for sending 4000 bits/second using analog encoding. What is the baud rate of your scheme?

Suppose we decide to use FSK. Normally you have to choose frequencies that don't cancel each other out, but I'll take the easy route and use 200, 400, 600, 800 and 1000 Hz. For each of these frequencies, the maximum baud rate is two times the frequency (400, 800, 1200, 1600 and 2000). If you send 1 bit per baud, you get at total of $(400 + 800 + 1200 + 1600 + 2000) = 6000$ b/s, which is more than enough. Note that Nyquist's Rule applies to each frequency that you use. If you wanted to go with ASK or PSK at 1000 Hz, you would have a maximum baud rate of 2000 and you would need $4000/2000 = 2$ bits per baud, which would mean 4 signal levels.

2. What are the advantages and disadvantages of digital signaling?

The advantages are that it can be repeated rather than amplified so signal degradation is minimal and they are cheap and easy to generate, transmit and manage. On the other hand, digital signals have high frequency components, so they require high-quality media and typically have to be used in baseband mode.

3. Why would you use Manchester Encoding?

Because of the transition in the middle of each bit, a Manchester encoded signal has inherent clock synchronization properties for the receiver. This is necessary if you are transmitting large packets that might have long runs of ones or zeros.

4. A signal transmits at 10 watts and the noise component has an average value of 0.1 watts. What is the signal-to-noise ratio in decibels?

$$\begin{aligned} SN &= 10 \log_{10} \frac{\text{Signal Power}}{\text{Noise Power}} \\ &= 10 \log_{10} \frac{10W}{0.1W} \\ &= 10 \log_{10} 100 \\ &= 20dB \end{aligned}$$

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