

Name: _____

Section: _____

EE334 Homework: DAC

Problems (Based on problems from Chapter 7 of the Beige Book):

1. The sampling rate used in the conversion of an analog signal to digital is 20 KHz. The analog signal contains components of high enough frequency to cause aliasing problems. To avoid aliasing, the analog signal is low pass filtered before being sampled. What value should the cutoff frequency of the low pass filter have? Assume ideal filtering.
2. The quantization interval (resolution) for an analog signal, which varies between 0 and 5 V, is to be less than 1 mV.
 - a. Find the minimum number of bits for the digital conversion that satisfies the constraint.
 - b. Assuming that sample values are centered inside each quantization interval, what is the maximum quantization error possible for that minimum number of bits?
 - c. What would be the maximum quantization error if sample values were always rounded down to the next nearest quantization level?
3. An analog signal which varies over the range -1 V to 1 V is to be converted to a 4-bit digital signal. The input analog signal is band limited to the range 100 Hz to 1000 Hz.
 - a. Determine the minimum sampling rate for the conversion.
 - b. Determine the number of quantization levels and the resolution of the analog-to-digital conversion.
 - c. What is the bit rate of the resulting digital signal?
 - d. Find the rms noise voltage: $v_{\text{noise}} = \frac{\text{resolution}}{2\sqrt{3}}$.
4. Graph the analog signal that would result by feeding the following binary sequence through a DAC. Each sample is 3 bits. The sample rate is 5000 samples per second. The analog output should range from 0V to 0.7V.

100101110110100010000011001101

Problems from ADC/DAC Supplement (Supplement III on syllabus):

- 2.3 (Choose $R_0 = 12 \text{ k}\Omega$)