**ECE 4522/5514: DIgital Signal Processing**

# Computer Assignment (CA) No. 6:Quantization Error

This assignment will teach you the basics of signal quantization. To demonstrate this, we will use a 1 Hz sinewave of amplitude 1, and the previously mentioned audio signal. Use MATLAB for this assignment.

(1) Generate 10 secs of a sinewave of amplitude 1 sampled at 100 Hz.

(2) Write a function in MATLAB that quantizes this signal using a uniform quantizer with a range of [‑1,1] and a step size such that the quantizer uses B bits. (Hint: this is similar to finding the correct bin in a histogram.)

(3) Write a second function that computes the signal to quantizing noise ratio (SQNR) between the original signal and the quantized signal in dB.

(4) Using these two functions, plot the RMS error as a function of B for B=[2,16]. Does this obey the logarithmic relationship we discussed in class? Plot a regression line for your plot and demonstrate the slope is 6 dB per bit.

(5) Repeat this for the audio signal. Note that in this case you are starting with B=16, so plotting from B=2,12 should be sufficient.

(6) Repeat (5), but now take the log base 2 of the signal’s amplitude (watch out for negative numbers), linearly quantize the log amplitude, and compute the SQNR of the reconstructed signal (take the inverse log of the quantized signal). How does the SQNR compare to a linear quantizer with the same number of bits?