Report - Lab 7

Sannidhya Gupta `(2021112012)`

Q1:

Q1-d

As we can see, on increasing B, the maximum values of the quantization error get reduced, as the quantization process gets more precise.

Q1-e

As discussed in the histograms of the previous part, we can observe that the maximum absolute error (quantization) gets lesser and lesser the more we increase the value of B.

Q1-f

As it can be seen in the expression for SQNR (Signal to Quantization noise ratio):

$$SQNR = \frac{\Sigma_n |x[n]|^2}{\Sigma_n |e_q[n]|^2}$$

The value of SQNR will increase when the values of absolute error decrease, and as discussed before, on increasing the value of B, the value of error decreases, and hence the signal to quantization noise ratio increases, and in short, we get a better yield, and the trade off being increased memory usage.

Q1-g

I feel that both the quantizers have different usage and applications. The quadratic quantizer will offer more accuracy for values that lie closer to the end points of the interval, whereas if we consider that the input signal will contain values equally distributed throughout the interval $[-a, a]$ then the uniform quantizer will perform a better job as it gives all range of amplitudes equal weightage instead of being more accurate for higher amplitude values.

Q2:

Q2-a

The sound quality difference is pretty obvious. The sound of the quantized signal is very harsh and unpleasant to the ears, and in comparision to the original signal, sounds very distorted.

Q2-b&c

As the value of B is increased the sound quality of the quantized signal gets better and the distortion from the original signal can be observed to be reduced. When the value of B is increased, the output quantized signal supports a wider range of frequencies which gives a better output, whereas when the value of B is less, the sound appears to be distorted as a lot of close frequencies are merged and mapped to a single frequency, which is why the sound lacks detail.

A sample plot of quantization for B=4