Theory

Prelab Questions:

- When digitizing a signal, why must it be quantized in space and time?
- In this lab we want to generate a sequence of values representing a sampled sound wave. Assume the function \( s(t) \) gives you the unquantized value of the wave at sequence time \( t \). Using the standard \( \sin() \) function, what is \( s(t) \) for a pure tone (sine wave) of amplitude, \( A \), and frequency, \( f \), sampled at rate, \( r \)?
- In this lab, we will be generating 1 second samples. Given that we will sample at 48,000 Hz, how many points will a 1 second sample require? How does this number change as the sampling frequency changes?

Analysis

Question 1: Looking at the plotted version (not LabVIEW output) of your waves, what do you notice about the shapes of the waveforms as the frequency changes? What is a good explanation for your observation?

Question 2: Describe how the waveforms produced by LabVIEW sound on the headphones and looks on the oscilloscope.

Question 3: How, if at all, are these waveforms different from the waveforms produced by the signal generator in the previous lab? (no amplitude quantization? with amplitude quantization?)

Question 4: How does the wave change (look and sound) as the amplitude quantization level changes?

Question 5: At what amplitude quantization level can you no longer hear the difference between the digital wave and the waves generated by the function generator in lab 1? At what amplitude quantization level can you no longer see the difference? Are these values the same for all frequencies?

Conclusion

Question 6: Considering the full precision waves (no amplitude quantization) produced by LabVIEW, what evidence, if any, can you observe in the output that the input provided was discretely quantized in time? Why do you think this is the case? What does that tell you about sampling and reproducing sampled waves? (We need a very simple answer here. Think about
relationship between the input—the points in your file—and the output and the fact that they are passing through a VI. You will learn more about this in later labs)