Matthew Keitelman

### Intended Objective

We sought to update our device to use cosine tables in order to generate waveforms for pure tones, which would lead the way fairly straightforwardly to being able to produce a complex waveform for a real instrument note from a predefined table of values.

### Outcome

We ultimately found an Arduino library to handle the technical details of actually creating the waveform while we developed the system to hold a user-defined cosine table, and updated the code to change the frequency of the wave based on the key that is pressed on the keyboard.

### Individual contribution

I was responsible for finding and adapting the Mozzi library, which handles sound synthesis, to building our table-based cosine. We initially tried using a simple table of values and outputting through basic pwm, but we found that the result was very unpalatable and very distorted from a simple sine wave. Looking at the signal on an oscilloscope, we realized we needed some type of reconstruction filter.

One thing led to another and by putting load impedances on the buzzer now had to be considered so I planned a voltage buffer as well. Because our rails are 0 and +5 V, I designed a simple common collector unity gain buffer. Eventually, I discovered Mozzi while looking for examples of projects that play tones on the buzzer. With the Mozzi implementation of waveform building, a low-pass filter wasn’t very necessary so none of these problems occurred, and my the fruits of my electrical labor were made unnecessary.