Homework 4

1). As expected, lowering or raising the fundamental frequency lowers or raises the resulting pitch of the sound. Although not immediately obvious due to the automatic scaling in the graphs, it changes the time domain on the x-axis. Higher frequency fundamentals yield shorter time intervals between waveforms.

2). Using more harmonics creates a much smoother waveform. For example, at 10 harmonics the sawtooth wave resembles a stairstep, while at 100 harmonics the lines are almost perfectly clean. The sound qualities are also markedly different, especially for the sawtooth and square waves. I would hesitate to try 1000000 harmonics because 1) that would take awhile to process, 2) any perceptual changes would be affected long before that many harmonics, and 3) you will have well-exceeded the Nyquist Rate, resulting in a final signal that has been heavily aliased (in fact, the large majority of waveforms that you are adding will only have one measured data point). This seems like a good place to mention that I added a warning about exceeding the Nyquist rate to my function so that it prompts for confirmation and offers an early exit when inputs would result in that.

3). Adjusting the phase totally changes the shape of the graphs. For example, the square wave is no longer square at all, and instead takes on shapes with much more curve. At phase 0, it sort of resembles calipers, to my eyes. There are some detectable differences in sound quality as well. The fundamental remains the same, but the timbre is altered in minor ways. For example, that same phase 0 square wave has a slightly harsher quality to it than a normal square wave does.