**CSC 745 Advanced Multimedia Programming**

**Exercise No. 1, August 30, 2018**

**Python Review**

**Goal**

Learn about harmonics and phases and aliasing

**Background**

Chapter 2 focuses on the harmonic structure of sounds and illustrates aliasing.

**Procedure**

Open chap02.ipynb in jupyter and use it to answer the following questions.

1. What is the primary difference between the spectrum of the triangle wave (cell 8) and the spectrum of the square wave (cell 10)? You can’t really tell from the plot, but these waves have only the odd harmonics (first, third, fifth, etc) – the even harmonics have an amplitude of 0. Can you think of an instrument that sounds like the triangle wave?

Violin

1. How does the spectrum of the sawtooth wave (cell 13) compare to that of the triangle and square waves?

Square wave contains only odd harmonics, But the amplitude of the harmonics drops off more slowly. Specifically, amplitude drops in proportion to frequency (not frequency squared).

1. Cell 14 creates a signal at 4500 Hz; cell 15 creates a signal at 5500 Hz. Why do the two plots look the same?

**Aliasing**. Because when the high frequency signal is sampled, it appears to be a low frequency signal.

1. The two signals plotted in cells 18 and 26 have the same frequencies at the same amplitudes. Why do they look different? Do they sound different (cells 29 and 30).

Because the phases are different. The second one is brighter

1. In cell 32, set the frequency to 700 Hz; leave the framerate at 5000 Hz. Note that the framerate (the sampling rate) is well above the Nyquist frequency for 700 Hz. Why does the spectrum change so dramatically?