Lab Assignment 4: Additive Synthesis

You are going to create two functions

makeWaveforms() – to generate a specific type of waveform

visualizeWaveforms() – to call makeWaveforms() to generate a waveform and then plot it in the time and frequency domains

1) In cell 1: import the necessary libraries

```
import numpy as np
import matplotlib.pyplot as plt
import librosa
import librosa.display
import IPython.display
```

2) In cells 2 copy plotAudio3() from echoes.ipynb

3) In cell 3 copy plotAudioFreqDomain() that you created in Lab Assignment 3

4) In cell 4 copy additiveSynthesis() from additiveSynthesis.ipynb

5) In cell 5 create a function called makeWaveforms () that inputs
- frequency for the generated waveform (frequency)
- sampling rate for the generated waveform (samplingRate)
- number of harmonics in the generated waveform (numHarmonics)
- type of waveform to be generated (waveType)
  - either 'sawtooth', 'triangle', 'square', or 'sine'
    (if nothing '' is entered then a sine will be plotted)

The function will
- use an if/elif/else statement to set up the parameters for the different type of waveforms based on the code in additiveSynthesis.ipynb
- call additiveSynthesis() to generate a waveform
- return the generated waveform (signal)

6) In cell 6 create a function called visualizeWaveforms() that inputs
- frequency for the generated waveform (frequency)
- sampling rate for the generated waveform (samplingRate)
- number of harmonics in the generated waveform (numHarmonics)
- type of waveform to be generated (waveType)
- either 'sawtooth', 'triangle', 'square', or 'sine'
  (if nothing '' is entered then a sine will be plotted)
- window size for the spectrogram (winSize)
- spectrogram type, 'linear' or 'log' (specType)

The function will
- call makeWaveform() –*test whether makeWaveforms() runs without error before you try plotting anything*
- call plotAudio3()
- call plotAudioFreqDomain()

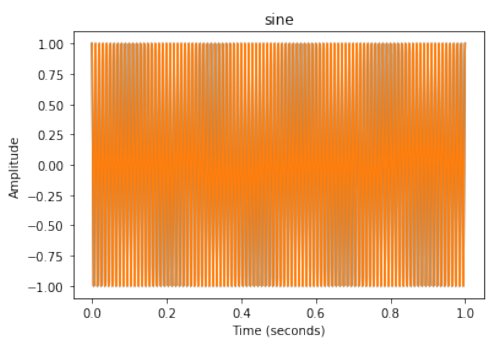
And it will return the output of makeWaveform()

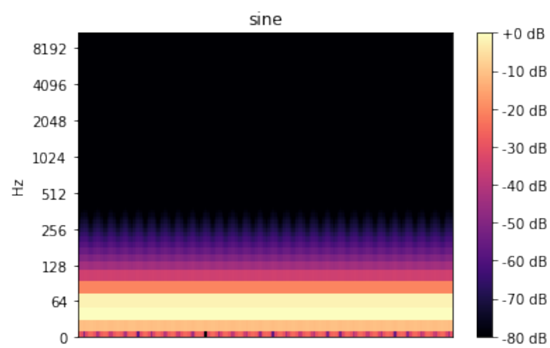
7) In cell 7: call visualizeWaveforms() with the following arguments

frequency = 100
samplingRate = 44100
numHarmonics = 100
waveType = 'sine'
winSize = 1024
specType = 'log'

and IPython.display.Audio() with the signal returned from visualizeWaveforms()

This should generate the following plots (note that the plots will be above and below each other, not side by side)



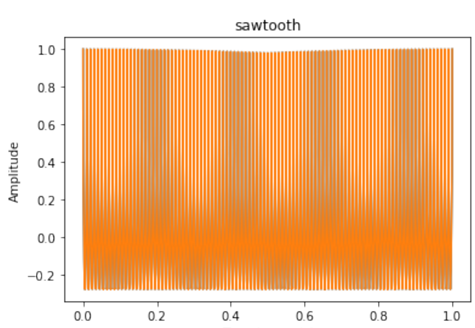


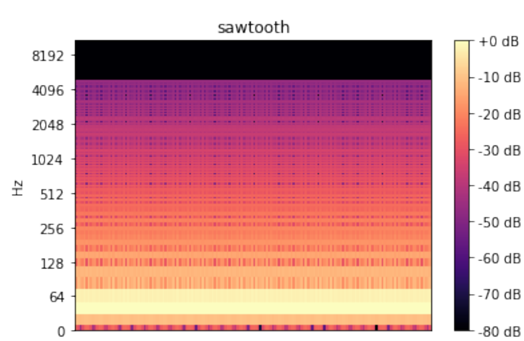
8) In cell 8: call visualizeWaveforms() with the following arguments

frequency = 100
samplingRate = 44100
numHarmonics = 100
waveType = 'sawtooth'
winSize = 1024
specType = 'log'

and IPython.display.Audio() with the signal returned from visualizeWaveforms()

This should generate the following plots (note that the plots will be above and below each other, not side by side)



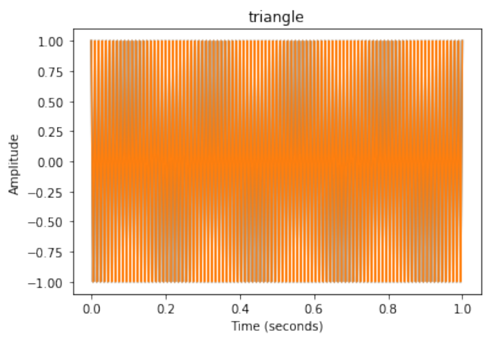


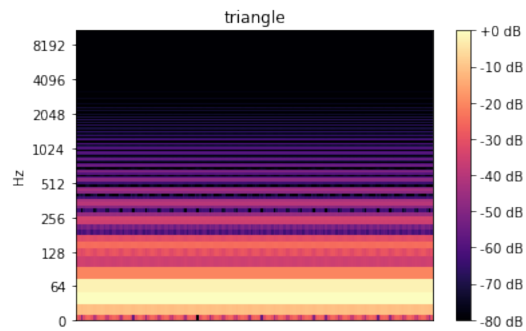
9) In cell 9: call visualizeWaveforms() with the following arguments

frequency = 100
samplingRate = 44100
numHarmonics = 100
waveType = 'triangle'
winSize = 1024
specType = 'log'

and IPython.display.Audio() with the signal returned from visualizeWaveforms()

This should generate the following plots (note that the plots will be above and below each other, not side by side)





10) In cell 10: call visualizeWaveforms() with the following arguments

frequency = 100
samplingRate = 44100
numHarmonics = 100
waveType = 'square'
winSize = 1024
specType = 'log'

and IPython.display.Audio() with the signal returned from visualizeWaveforms()

This should generate the following plots (note that the plots will be above and below each other, not side by side)