***The following is an optional exercise that will not impact your grade, but it will give you something cool to show off to friends and family this holiday season* ☺**

First, go ahead and download the following file.

https://cs.gmu.edu/~marks/112/projects/TonePlayer.py

Save it in the same folder as your project 5 python file, then follow the below instructions for your operating system in order to download the required modules correctly.

Installing PyAudio on Mac OS

1. Verify that your Python version is at least 3.4.0 by running the command **`python3 --version`**
   a. If your version of python is not at least 3.4.0, you need to download the most recent version of Python.
   b. In the terminal, verify that the command **`python3`** is now the most recent version.
2. Download the brew package manager by following the instructions here: https://brew.sh
3. Run the following commands in a terminal window:
   ```
   brew install portaudio
   python3 -m pip install pyaudio
   python3 -m pip install numpy
   ```

Installing PyAudio on Windows 10

1. Verify that your Python version is at least 3.4.0 by running the command **`python --version`**
   a. If your version of python is not at least 3.4.0, you need to download the most recent version of Python.
   b. In the terminal, verify that when you use the command **`python`** is now the most recent version. Remember, you may have to use **`py`** instead of **`python`**
2. Run the following commands in a command prompt window:
   ```
   python -m pip install pyaudio
   python -m pip install numpy
   ```

Installing PyAudio on Linux

If you have a Linux machine you should be able to just follow the mac instructions but with your own package manager. If that doesn't work, either figure it out yourself (as you're probably very capable of already), or see someone at Office Hours!

Read the installation instructions here: https://people.csail.mit.edu/hubert/pyaudio/

Now, you should be able to play a sound from your computer. You can check this by opening up the python interpreter in the terminal (make sure the terminal is in the same folder as TonePlayer.py):
```
>>> from TonePlayer import play
>>> play(440,1)
```

You should hear a tone played from your computer (be careful if you have headphones plugged in) that sounds like A4 on the piano!

In Project 5, we gave you song files that describe notes and note types used to play a song. You had to generate dictionaries that describe what frequencies each note should be played at, and how many seconds each note type should last. You can use all of this, along with your new found capability to play tones from python, to actually play the song files from your program! You can write a function that does exactly that.

play_song(filename):

Description: Play the song that is written in the file. Generate the necessary dictionaries of values for frequencies and durations based on the given song, and then loop through every note and play them one after another (songs are always written in the right order of notes. as they are played).

Parameters: **filename** (string) the name of the song file to play

Return value: None

Try calling **play_song("p5_files/littlelamb.song")** to hear a classic nursery rhyme!
Feel free to share any song files that you create yourself on Piazza. ☺