LabVIEW                                                                                              Dr. Pogo
Assignment is due "in class" on Tuesday, October 31, 2023

## Quiz #5: Playing Waveforms on the sound card

> **Hardware**: Computer's sound card

This program allows the user to create, edit, save, and load a musical "score". The score consists of chords called "triads", meaning (up to) three notes played simultaneously. Each chord has a "duration", where "0.25" indicates the chord is made of quarter notes, and so on. All notes within any chord will have the same duration. The user is permitted to choose chords with fewer than three notes. Choosing zero notes is the same as choosing a "rest".

The front panel has 6 regions:
- **Region 1**: allows the user to save the current song, or to load a previously saved song, or to delete the entire song so far ("new"), or to quit the program.
- **Region 2**: The "new chord working space" allows the user to specify the properties of whatever chord the user is working on. Since there is more than one "A" note, the "octave" control specifies which one will be used. For this program, the lowest note is an "A" with a frequency of 110 Hz.
  For music in the "12 tone" western scale, frequencies are distributed as follows. Once you know the frequency of any note (for example, a certain "A" has $f_i = 110$ Hz), then the next higher note that may exist has the frequency $f_{i+1} = 2^{(1/12)} \times f_i$. One of the mathematical outcomes of this formula is that $f_{i+12} = 2 \times f_i$, which we call an "octave". So, the next "A" will be 220 Hz.
- **Region 3**: The largest region shows the properties of all of the chords currently in the song being created.
- **Region 4**: Is used to make changes to the chords in the song. The "Add" button copies the current chord from Region 2 to the end of the song. The "Chord #" control is used with the other two buttons. When it is changed, the chord shown in Region 2 is updated to match the selected chord number from the entire song. The "Edit" button copies the chord properties from Region 2 onto the selected chord number in the overall song. The "Delete" button removes that chord number altogether, and of course renumbers the chords for the entire song.
- **Region 5**: The tempo is a property of the song, rather than of any chord. The tempo is in standard musical notation "beats per minute", where "beats" means "quarter notes". This region also displays the current number of chords in the song.
- **Region 6**: Controls the playback of the song, in realtime. The green light stays on while the playback is occurring. The "frame" is the same as the current chord number being played, and obviously uses language similar to video playback. "Cancel" stops a playback in the middle of the song. The playback quality changes the "sample rate" of the playback from 3000 to 33000 Hz. This rate must be about an order of magnitude higher than the frequency of any note being played. The limits of human hearing are perhaps 50 Hz to 20 kHz, but most music is nearer the lower end of this range.

You will start with the baseplate provided. As usual, some parts have been deleted, and your task is to repair/replace them. Many hints and notes appear in the baseplate!

**1**

Load Song    New Song

Save Song    Quit

**2**

New Chord Working Space

|  | Note 1 | Note 2 | Note 3 |
|---|---|---|---|
| Duration 0.25 | A ▽ | C# or Db ▽ | E ▽ |
| Note Qty 3 | Octave 1 ▽ | Octave 1 ▽ | Octave 1 ▽ |

0

Entire Song

**4**

Add New Chord

Chord #

Confirm Edit    1

Delete Chord

**5**

Song Properties

Tempo (beats/min)

100

Chord Count

4

**6**

Playback?

Play Song

frame

Cancel    0

Playback Quality

**3**

|  | Note 1 | Note 2 | Note 3 |
|---|---|---|---|
| Duration 0.25 | C ▽ | E ▽ | G ▽ |
| Note Qty 3 | Octave 1 ▽ | Octave 1 ▽ | Octave 1 ▽ |
| Duration 0.25 | A ▽ | E ▽ | C ▽ |
| Note Qty 3 | Octave 1 ▽ | Octave 1 ▽ | Octave 1 ▽ |
| Duration 0.25 | D ▽ | F# or Gb ▽ | A ▽ |
| Note Qty 3 | Octave 1 ▽ | Octave 1 ▽ | Octave 1 ▽ |
| Duration 0.25 | A ▽ | C# or Db ▽ | E ▽ |
| Note Qty 3 | Octave 1 ▽ | Octave 1 ▽ | Octave 1 ▽ |
| Duration 0 | A ▽ | A ▽ | A ▽ |
| Note Qty 0 | Octave 0 ▽ | Octave 0 ▽ | Octave 0 ▽ |
| Duration 0 | A ▽ | A ▽ | A ▽ |
| Note Qty 0 | Octave 0 ▽ | Octave 0 ▽ | Octave 0 ▽ |