**DSPIRA GnuRadio Lessons**

**Lesson 2: Multiple Signal Sources**

In this activity you will construct a program that is a signal generator comprised of multiple sine waveforms with the ability to control their amplitudes and frequencies. These are added together to create a more complex output.

**Build a Two Waveform Signal Generator**

* Open your signal source frequency file from Lesson 1.
* **Save as . . .** using a new file name.

We will be working with sine waveforms.

* In the ***Signal Source*** block, change the *Waveform* type to "Sine". Also change the name of *Frequency* to "frequency1" and *Amplitude* to "amplitude1".
* In the ***QT GUI Range*** block for "frequency", change the *ID* to "frequency1", and in the ***QT GUI Range*** block for "amplitude", change the *ID* to "amplitude1".
* Add a second signal source by completing the following:
  + Copy the frequency1 ***QT GUI Range*** block, and paste it on the canvas. Then change the *ID* to “frequency2”.
  + Copy the amplitude1 ***QT GUI Range*** block, and paste it on the canvas. Open this block, and change *ID* to "amplitude2".
  + Click on the ***Signal Source*** block and copy it (right-click Copy, or ctrl-c) and paste it on the canvas.

[Alternately, import a ***Signal Source*** block from the library on the right. Be sure to change the *Waveform* type to "Sine".]

In this new ***Signal Source*** block change the *Frequency* to "frequency2" and *Amplitude* to "amplitude2".

* + Delete the connections from the original ***Signal Source*** block. (Highlight and hit "Delete".)
  + Add an ***Add*** block to the canvas. Make sure its ***IO Type*** is set to "float".
  + Connect both ***Signal Source*** blocks to the inputs of the ***Add*** block, one to each input.
  + Connect the output of the ***Add*** block to the ***Audio Sink*** and ***QT GUI Sink***.
  + Your canvas should look similar to the following:

A screenshot of a computer

AI-generated content may be incorrect.

* Run the program.
* Explore the graphical displays and audio output while changing the frequencies and amplitudes.

**Build a Three Waveform Signal Generator**

* Add a third signal source:
  + Repeat the steps above to add a third ***Signal Source***. Be sure to add the appropriate frequency and amplitude variables by adding additional ***QT GUI Range*** blocks.
  + Change the ***Num Inputs*** in the ***Add*** block to "3".
  + Run the program and explore the output audio and the displays by the changing the frequencies and amplitudes of each input.

**Build a six Waveform Signal Generator**

* Add 3 more signal sources to make a signal generator comprised of 6 sine waveforms.
* We will be using this in Lessons 3 and 4.