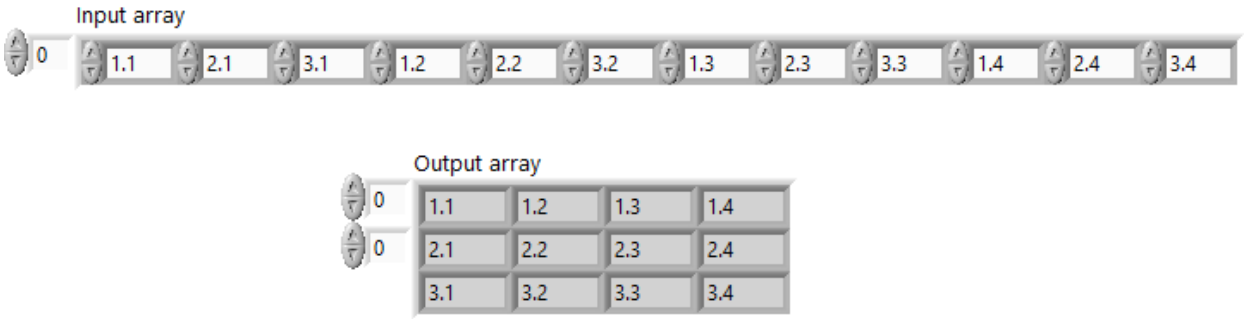
AE251a: Experiments in Aerospace Engineering

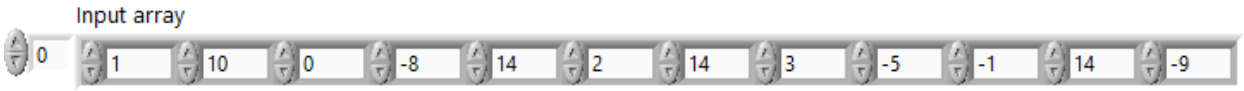
LAB – 3 Date: March 26, 2019

Save your work in your own directory

1. Build a VI to rewrite the "input array" in the form of the "output array" as shown below.



2. For the array given below, build a VI to find the maximum value in the input array along with the indexes. Your VI should work for any 1D array.



3. CLUSTER ERROR. FIND AND RECTIFY?

4. CLUSTER AS MENU

a) BUTTON SELECTION (Demo)

Build a VI that displays a *One Button Dialog Box* any time you operate any of the buttons in a cluster (Login, Configure DAQ, Acquire Data, Analyse / Save Data, View Analysis Results, Quit). The Buttons require a Mechanical Action of *Latch When Released*. This allows random selection of operation sequence.

b) BUTTON SELECTION with Shift Register (Demo)

This problem is same as the previous one (1a - cluster) but the diagram is somewhat different. It employs a shift register. Note that after executing your action it returns to no event, i.e., no button pressed case so that the VI begins monitoring the buttons on the front panel as soon as possible. This VI is the basis of a State machine.

5. BOOLEAN BUTTON AS MENU

This VI uses Boolean buttons for dialog that displays a One Button Dialog Box any time you operate any of the buttons in the front panel (Login, Thermometer, Signal generator, Fern Fractal, XY-plot demo, and Exit). The Buttons require a Mechanical Action of Latch When Released. This allows random selection of operation sequence. Note this VI uses individual Boolean buttons to form a Boolean array and then uses array search function to identify user action.

6. Data Analysis (Exercise)

Build a VI that measures temperature every 100ms for 10s. Use "Measured temperature" subVI available in Lab-3 directory. During the acquisition, the VI displays the measurements in real time on a waveform chart. After the acquisition is complete, the VI calculates the minimum, maximum, and average temperatures and plots these temperatures along with the temperature data in deg C in a single waveform graph.

7. Familiarization with Data Acquisition

8. Acquire, display, and analyse data (Exercise)

The sub-VI "Acquire data" available in the Lab-3 directory can be used to acquire data from three analog input channels at a specified sampling rate. Channel 0 is internally connected to a temperature sensor whose sensitivity is 10mV/degree C. Channel 1 is wired to a sine wave generator and channel 2 is connected to TTL square wave generator. These analog signals (Channels 0 to 2) are connected to a DAQ board through BNC 2120 signal connecting accessory. The data output of "Acquired data" is a 2D array containing three rows (row index 0 is for temperature data, 1 is for sine data, and 2 is for square wave data).

a) Build a VI using "Acquire data" sub-VI to acquire 500 samples/channel at a sampling rate of 10000 samples/sec. Extract the temperature, sine, square wave signals from the 2D array output and display them in separate waveform graphs.

b) Convert the temperature signal to degree C and plot in another waveform graph whose x-axis is time. Also, compute and display the average temperature of the acquired data.

c) It is desired to estimate frequency (in Hz) in the sine wave data. This could be done by carrying out frequency domain analysis (or spectral analysis) of the signal. Use "Auto power spectrum" function available in the Spectral Analysis sub-palette to compute the Power spectrum and plot it against frequency in the x-axis.

9. Write to file

Acquire 1000 samples/channel at a sampling rate of 10000 using Acquire data SubVI and write these data to the following files. Make sure you save data in your working space.

a) Write to a text file
b) Write to a datalog file

10. Read from file

Read the data from the files generated in problem 9 and display the temperature, sine wave, and square wave data in separate waveform graphs.

a) Read from the text file
b) Read from the datalog file