LabVIEW Lecture

Arrays, Clusters, Waveforms

Arrays (Ch. 7)

We have briefly mentioned arrays in the previous lecture. We used auto-indexing on For loops and While loops to create arrays.

In LV, there is a vast amount of things you can do with Arrays.

There are 1D arrays, 2D arrays, multiple dimension arrays. 2D arrays and larger are really matrices, but matrices have their own functions and are rarely used in LV. Used more for mathematical operations.

Arrays Index

Array's index in LabVIEW always start at 0.

CLAD Question

Which of the following statements regarding the index of Arrays are NOT true:

a. The index is used to access a particular element of an Array.
b. The index ranges from 1 to n.
c. A 2-D Array has both a column index and a row index.
d. The index ranges from 0 to n-1.

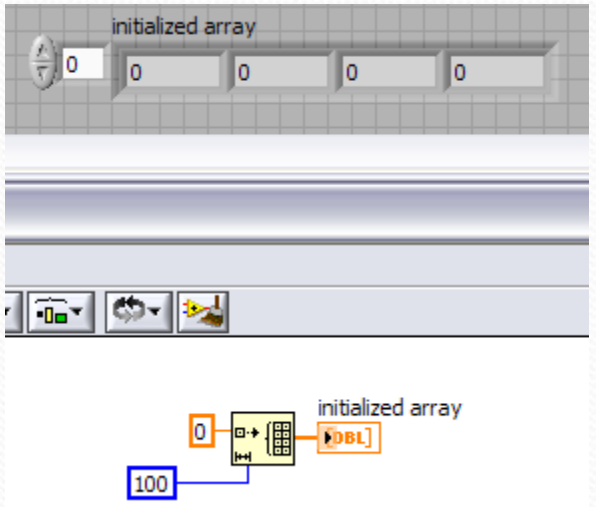
CLAD Question

Which of the following statements regarding the index of Arrays are NOT true:

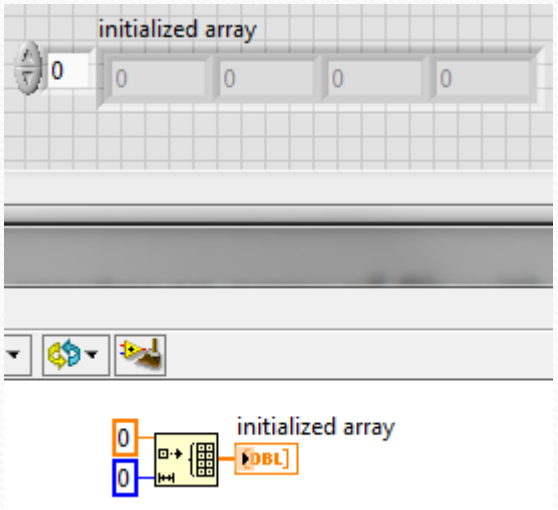
a. The index is used to access a particular element of an Array.
b. The index ranges from 1 to n.
c. A 2-D Array has both a column index and a row index.
d. The index ranges from 0 to n-1.

Initialize Array

This example creates an array of 0's with a size of 100.

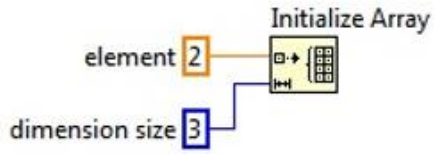


This example creates an empty array which is used often (to clear a graph, etc.)



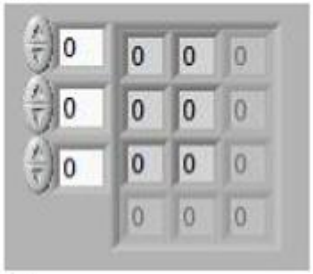
CLAD Question

Q29: What is the output of the Initialize Array function after the following code has completed execution?



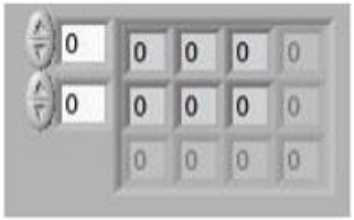
A

B



C

D



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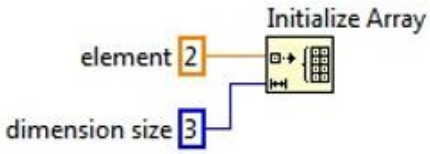
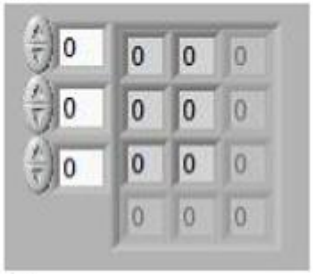


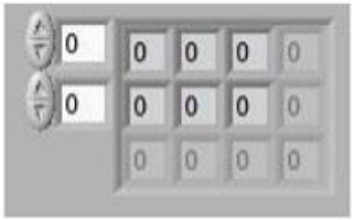
A

B



C

D



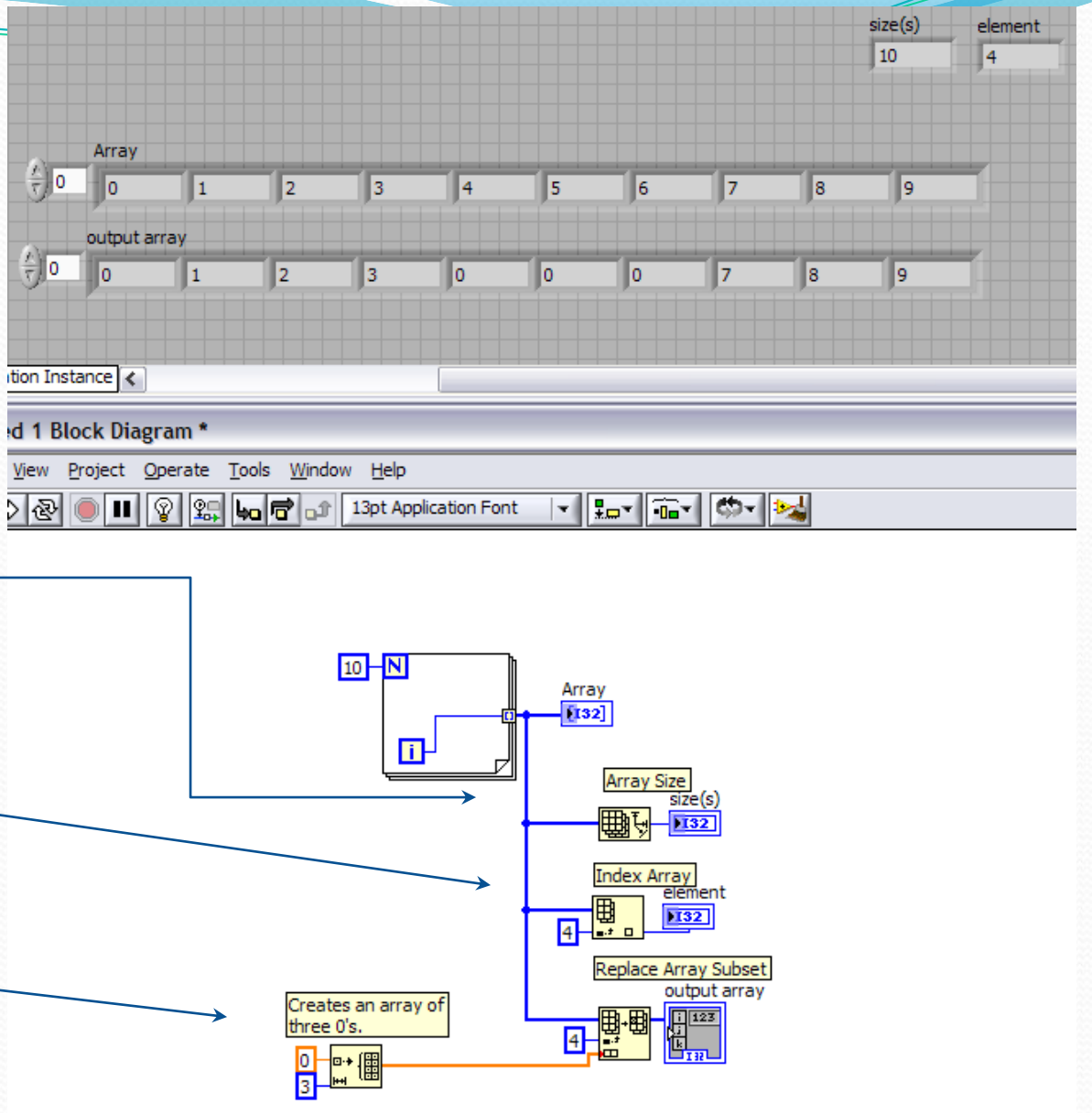
Array Size, Index Array, Replace Array Subset

The For loop creates an array of 10 numbers (0 through 9).

Array Size measures the size of the array, which is 10 in this instance.

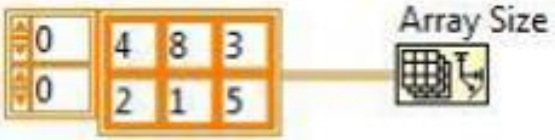
Index Array grabs the 5th element from the array (0 being the 1st).

Replace Array Subset replaces the 5th element with another array or value. The other array in this case is an array of three 0's.



CLAD Question

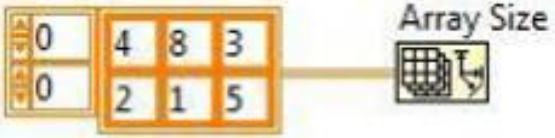
In the figure below, the output of Array Size is



a. 1D Array of {2, 3}
b. 1D Array of {3, 2}
c. 2
d. None of the above

CLAD Question

In the figure below, the output of Array Size is

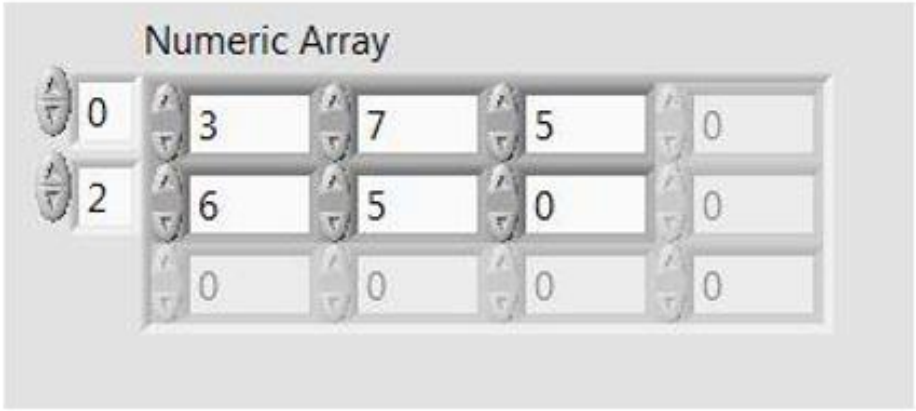


a. 1D Array of {2, 3}
b. 1D Array of {3, 2}
c. 2
d. None of the above

Sample

CLAD Question

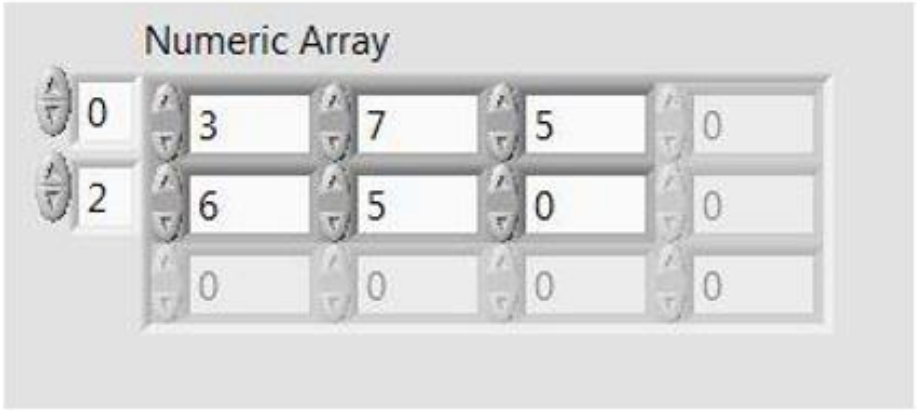
Q28: Which of the following statements is TRUE about **Numeric Array**?



A It is an indicator
B It contains exactly 10 elements
C It contains exactly 12 elements
D It contains exactly 8 elements

CLAD Question

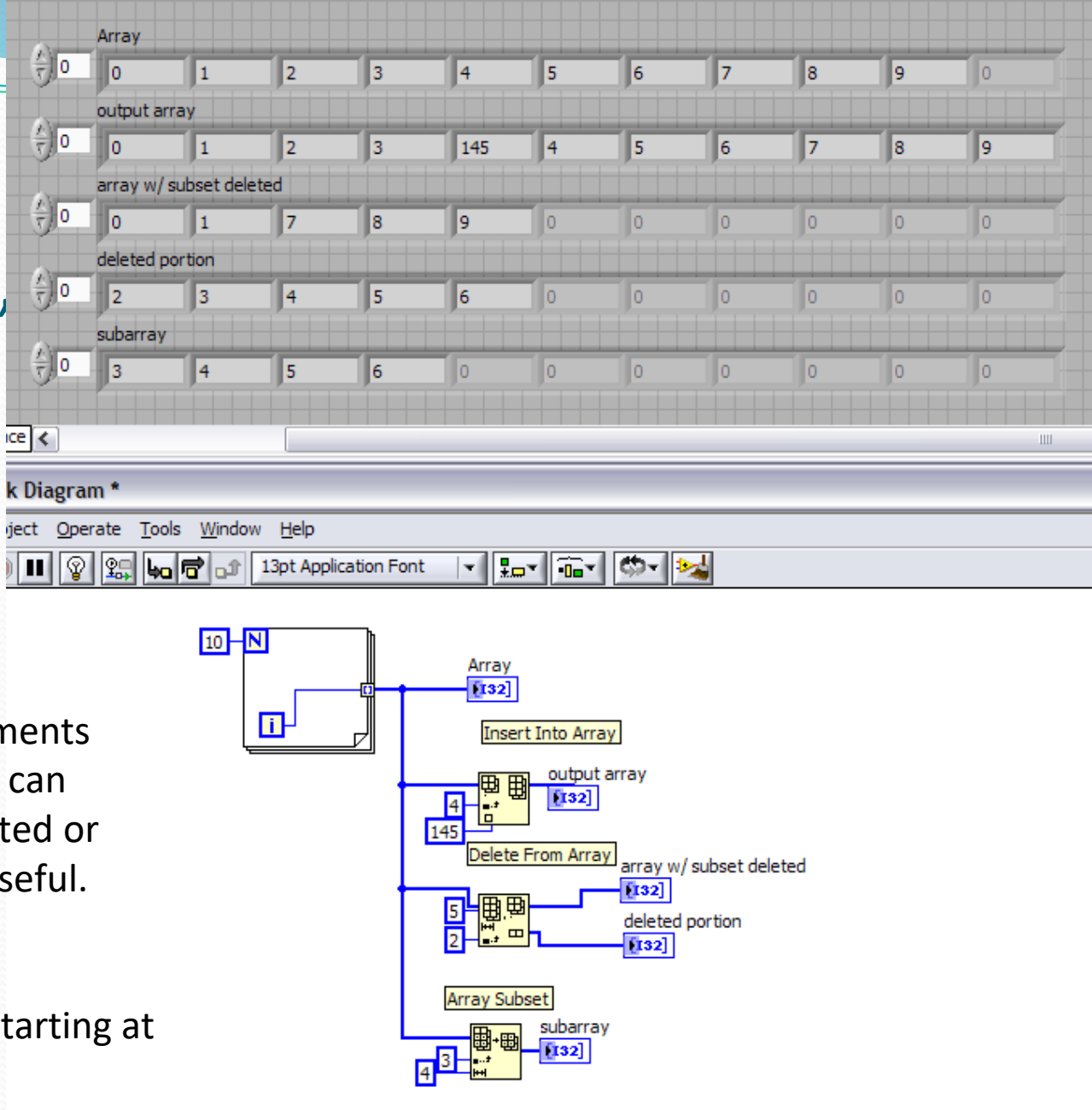
Q28: Which of the following statements is TRUE about **Numeric Array**?



A	It is an indicator
B	It contains exactly 10 elements
C	It contains exactly 12 elements
D	It contains exactly 8 elements

Notice that the array has 2 indices (the top index is for rows and the bottom index is for columns). Because the column index is set to 2, there are 2 columns that come before this that it shifted over and we can't see. So the array should be shifted to the right 2 places, which would make 2x5=10 elements.

Insert Into Array, Delete From Array, Array Subset



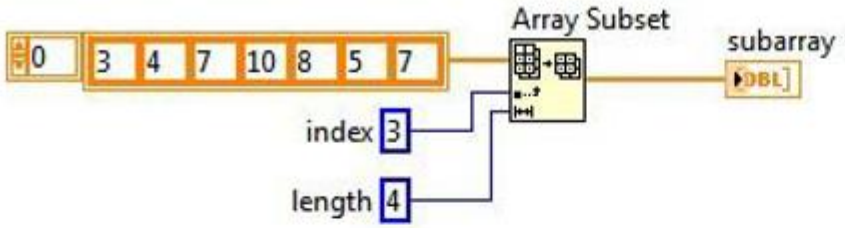
Insert Into Array inserts an array or value into the array. I inserted a 145 into the 5th element.

Delete from array deletes 5 elements starting at the 3rd element. You can output the array w/ subset deleted or the deleted portion. Both are useful.

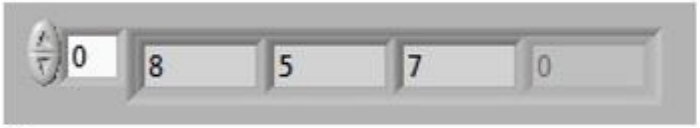
Array Subset grabs 4 elements starting at the 4th element.

CLAD Question

Q17: What value will be displayed in the **subarray** indicator after the following code has executed?



A



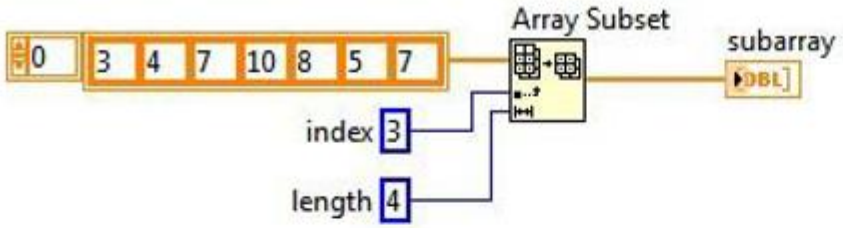
B

C

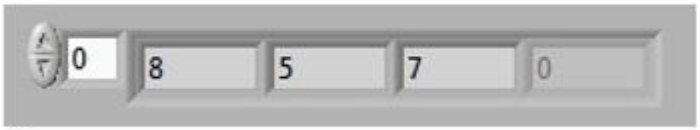
D

CLAD Question

Q17: What value will be displayed in the **subarray** indicator after the following code has executed?



A

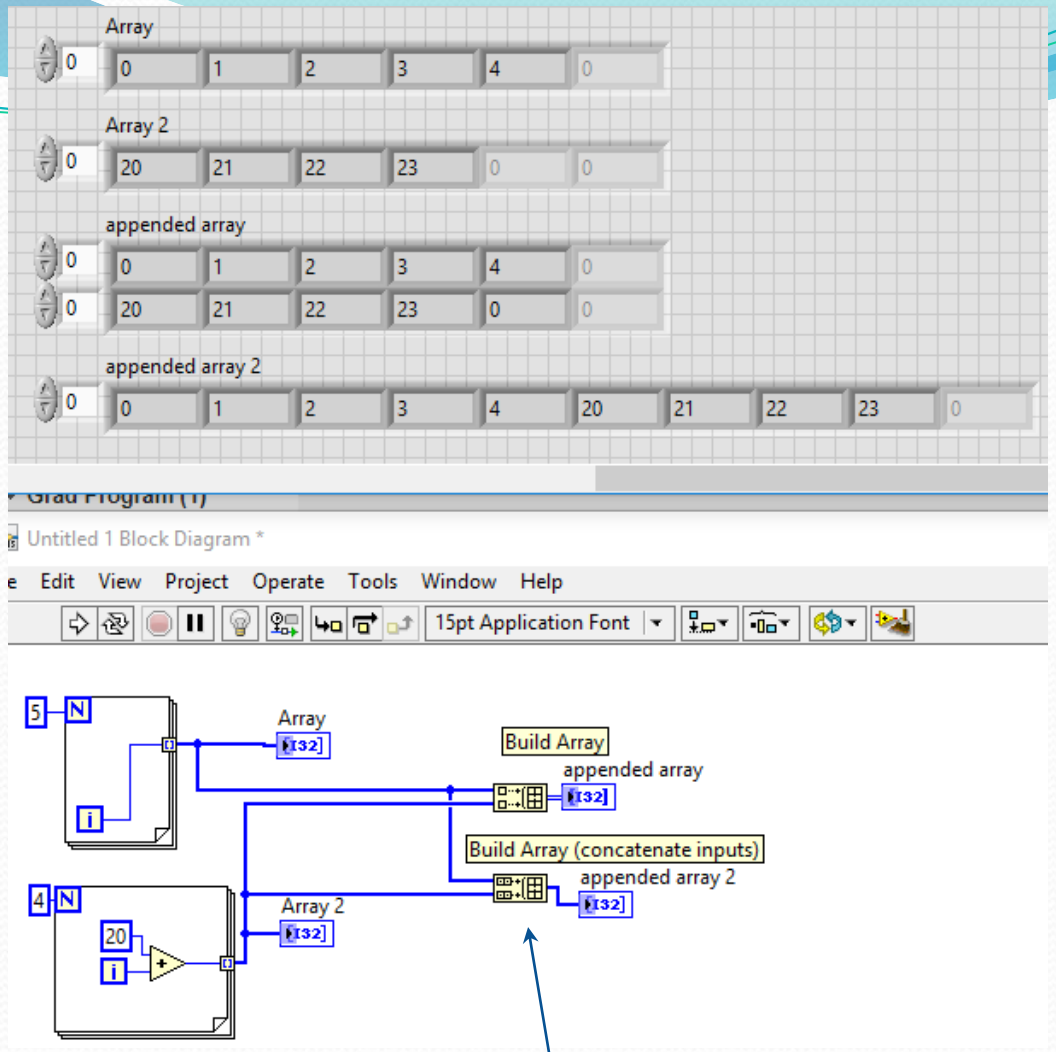


B

C

D

Build Array (concatenate inputs vs. regular)

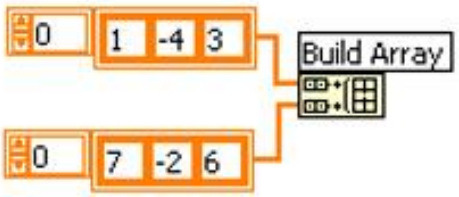


Build Array combines 2 arrays. Here we made two arrays: First with 5 elements that goes from 0 to 4 and the Second with 4 elements that goes from 20 to 23.

Or you can combine an array to the end of the other array. You have to right-click and select "Concatenate Inputs." This is not obvious.

CLAD Question

What is the output of the Build Array function in the following block diagram when *Concatenate Inputs* is selected?

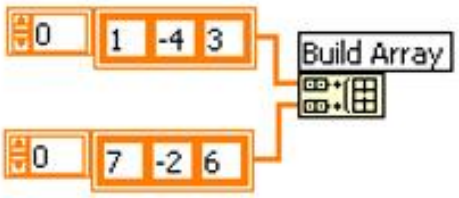


a. 1-D Array of {1, -4, 3, 7, -2, 6}
b. 1-D Array of {1, 7, -4, -2, 3, 6}
c. 2-D Array of {{1, -4, 3, 0}, {7, -2, 6}}
d. 2-D Array of {{1, -4, 3}, {7, -2, 6}}

CLAD Exam

CLAD Question

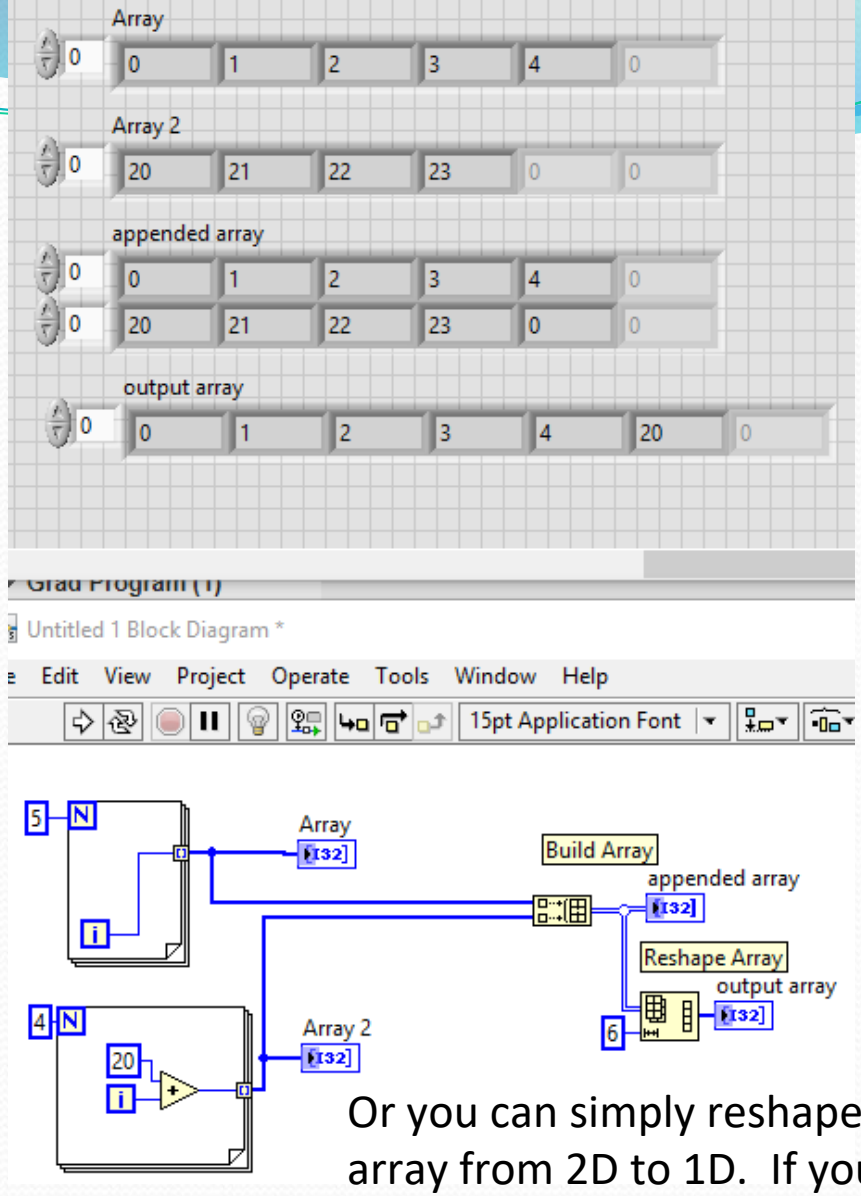
What is the output of the Build Array function in the following block diagram when *Concatenate Inputs* is selected?



a. 1-D Array of {1, -4, 3, 7, -2, 6}
b. 1-D Array of {1, 7, -4, -2, 3, 6}
c. 2-D Array of {{1, -4, 3, 0}, {7, -2, 6}}
d. 2-D Array of {{1, -4, 3}, {7, -2, 6}}

CLAD Exam

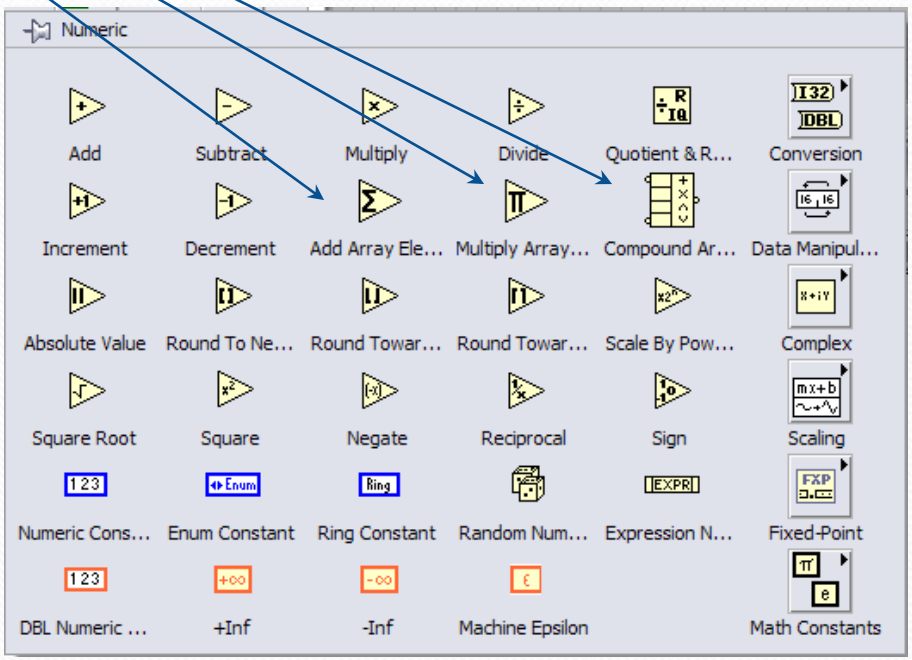
Reshape Array



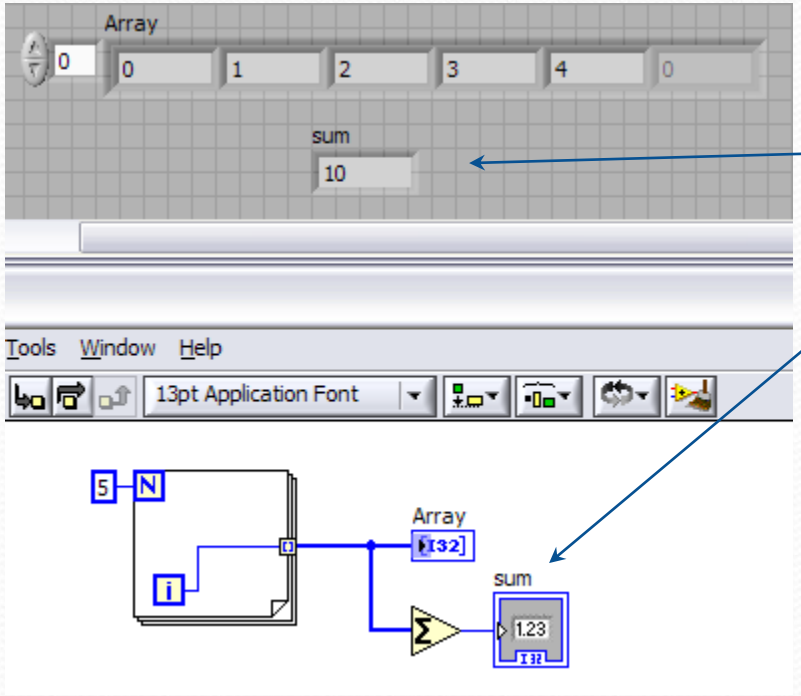
Or you can simply reshape the array from 2D to 1D. If you wanted all the items to show, then you would need to show 10 elements instead of 6.

Add all elements of array

This array function is actually in the Numeric Palette (not obvious)



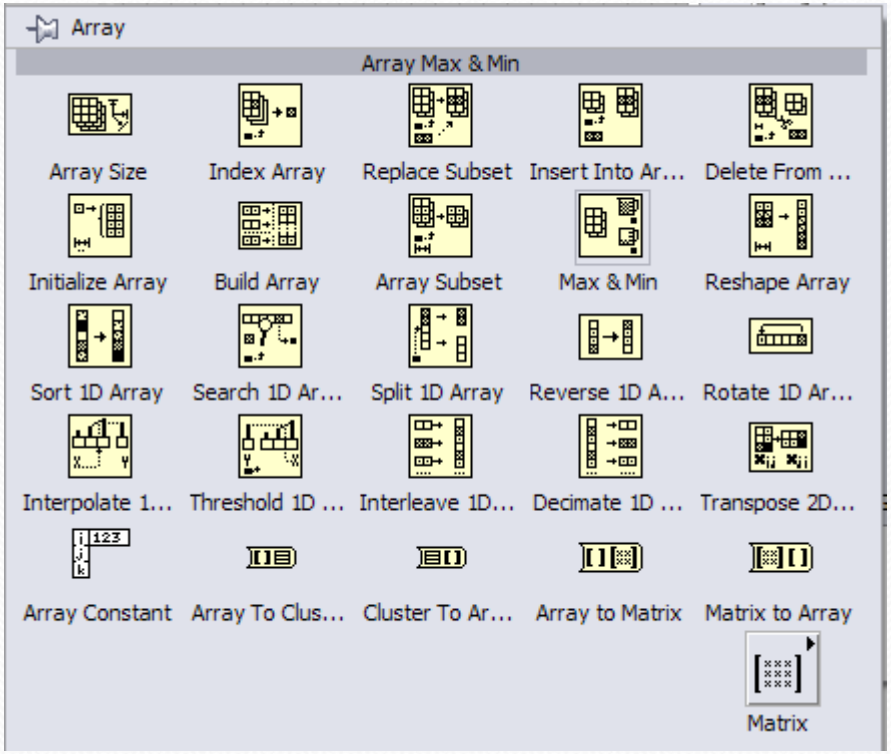
Add all elements of array



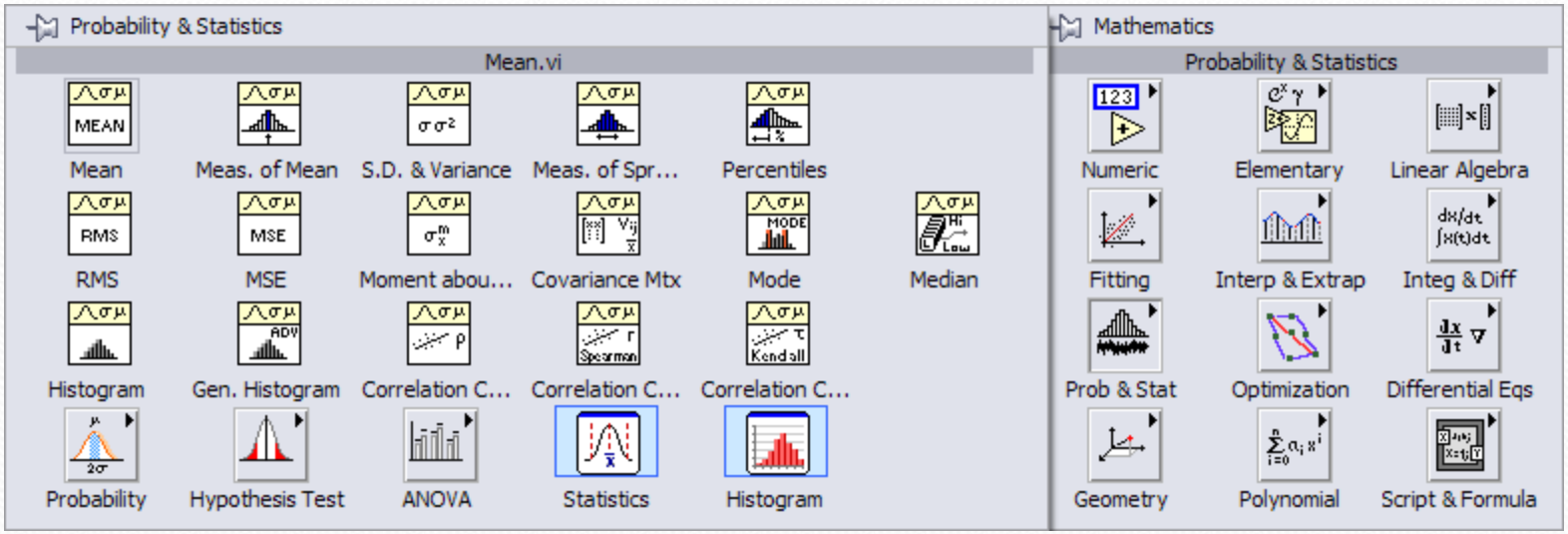
Works!

Other Array Options

You can also find the maximum and minimum values (and their indices) of the array, sort arrays, split arrays, reverse order of array (012345 ⍰ 543210), rotate array (012345 ⍰ 123450).



Other Array Options



There are other options with Arrays found in other palettes. In particular, the Probability & Statistics palette has several choices to input an array into. This palette is within the Mathematics palette.

CLAD Question

Which of the following methods is NOT a method to create a 1-D Array:

a. Place an Array Shell on the Front Panel and drag a Control into the shell.
b. Use a While Loop with auto-indexing disabled.
c. Use a For Loop with auto-indexing enabled.
d. Use the Initialize Array function.

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Which of the following methods is NOT a method to create a 1-D Array:

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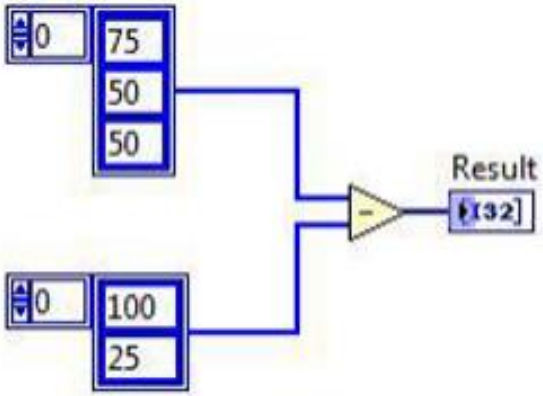
b. Use a While Loop with auto-indexing disabled.
c. Use a For Loop with auto-indexing enabled.
d. Use the Initialize Array function.

If auto-indexing is disabled, then the structure will only output the last value, which is not an array.

CLAD Question

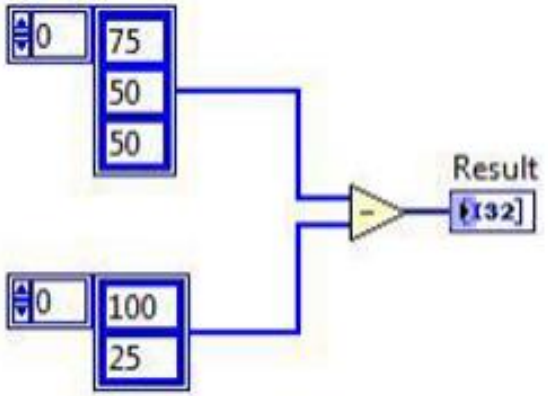
What value is displayed in **Result** when the code executes?



a. A 1-D Array of {-25, 25, 50}
b. A 1-D Array of {-25, 25}
c. A 2-D Array of {{-25, -50, -50} , {50, 25, 25}}
d. A 1-D Array of {75, -50, 25}

CLAD Question

What value is displayed in **Result** when the code executes?



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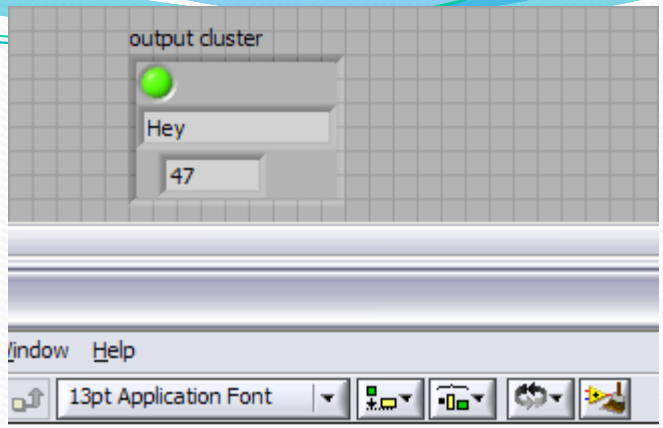
b. A 1-D Array of {-25, 25}
c. A 2-D Array of {{-25, -50, -50} , {50, 25, 25}}
d. A 1-D Array of {75, -50, 25}

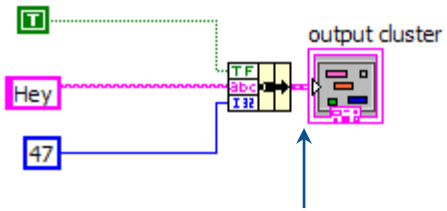
It's really important to note that a number plus not-a-number (NaN) equals NaN. This has cause me problems before.

Clusters

Clusters are like arrays, but instead of all the values having the same type, clusters allow values of different types to be grouped together by using the Bundle function.

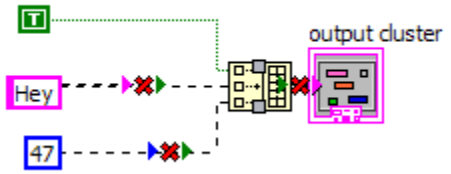
For example, you can combine a Boolean, a String, and a Numeric, etc.





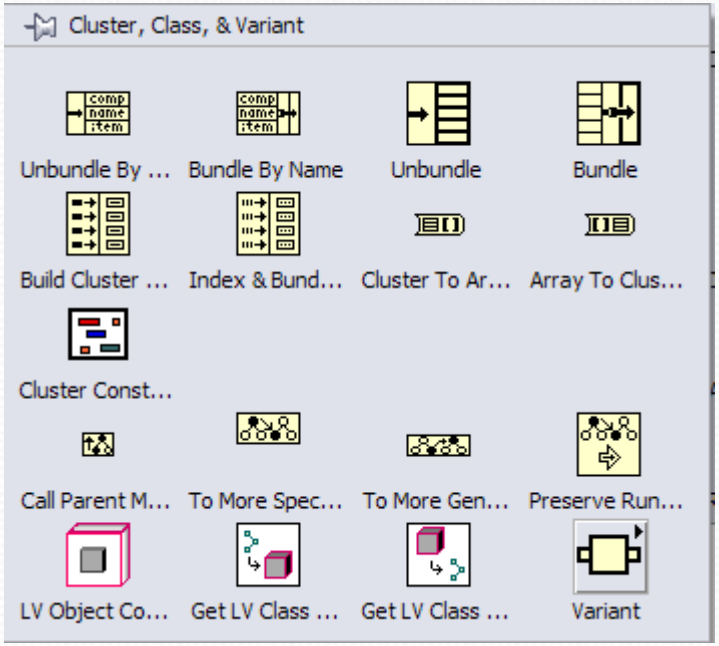
Notice that clusters use thick pink lines.

If you try build an Array of different types, then you get errors. ☹



Clusters

You usually bundle and unbundle clusters instead of build clusters. You can also unbundle by name, which gives you the name of the element which is nice.



CLAD Question

The function of a Cluster is to:

a. Grouping of mixed data types into logical structures.
b. Present data on the Front Panel using charts or graphs.
c. Provide a means of differentiating between data types on the Block Diagram.
d. Separate data objects by data type on the Front Panel.

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CLAD Question

Which of the following functions assembles Cluster elements by their owned labels?

a. Unbundle by Name
b. Unbundle
c. Bundle by Name
d. Bundle

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CLAD Question

Clusters provide a user with which of the following benefits?

a. Clusters allow a logical grouping of related data elements.
b. Clusters increase the number of Connector Pane terminals of SubVI's.
c. Clusters help to reduce wire clutter on the Block Diagram.
d. Both A. and C.

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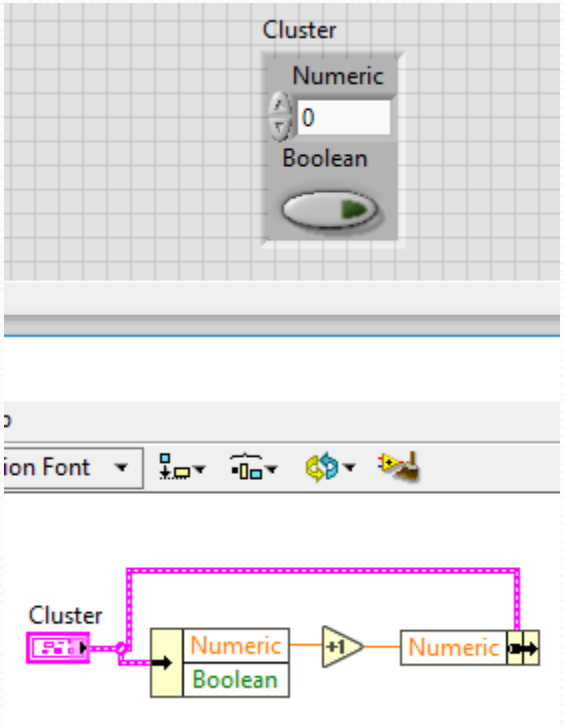
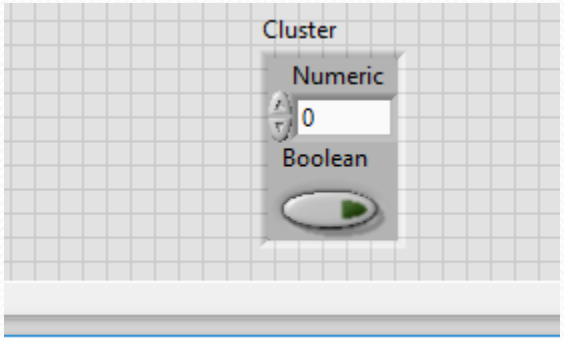
Cluster LabVIEW tricky example



What will the value of Numeric equal after this VI executes?

a) 0 b) 1

Cluster LabVIEW tricky example



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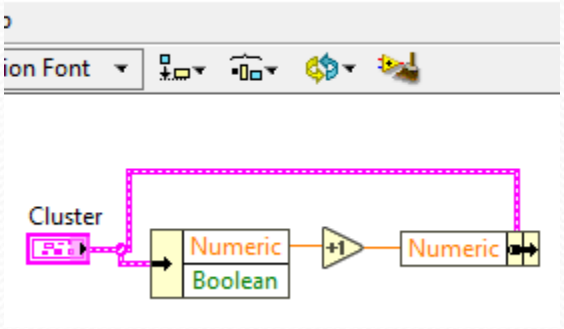
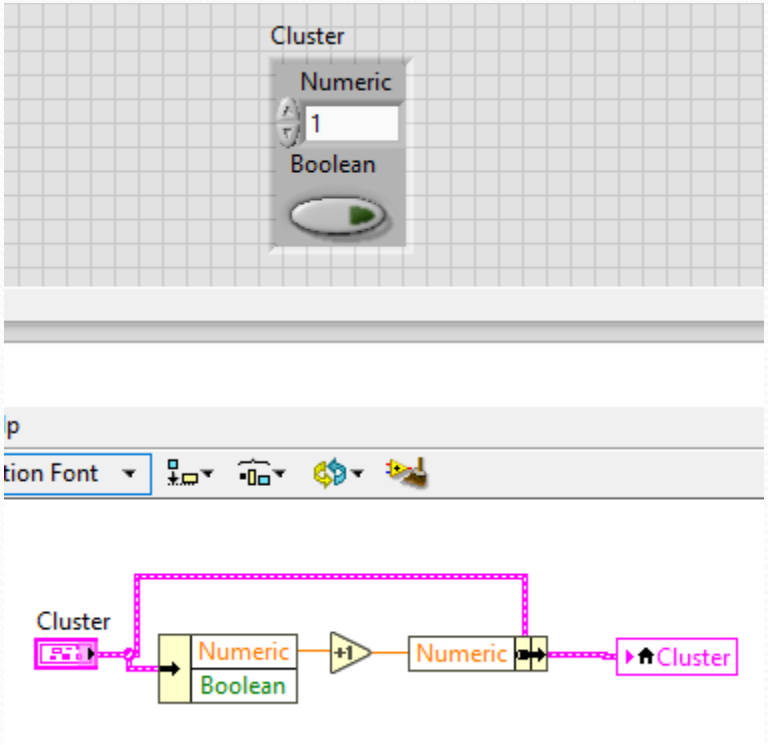


Bundling the cluster does not change the value!

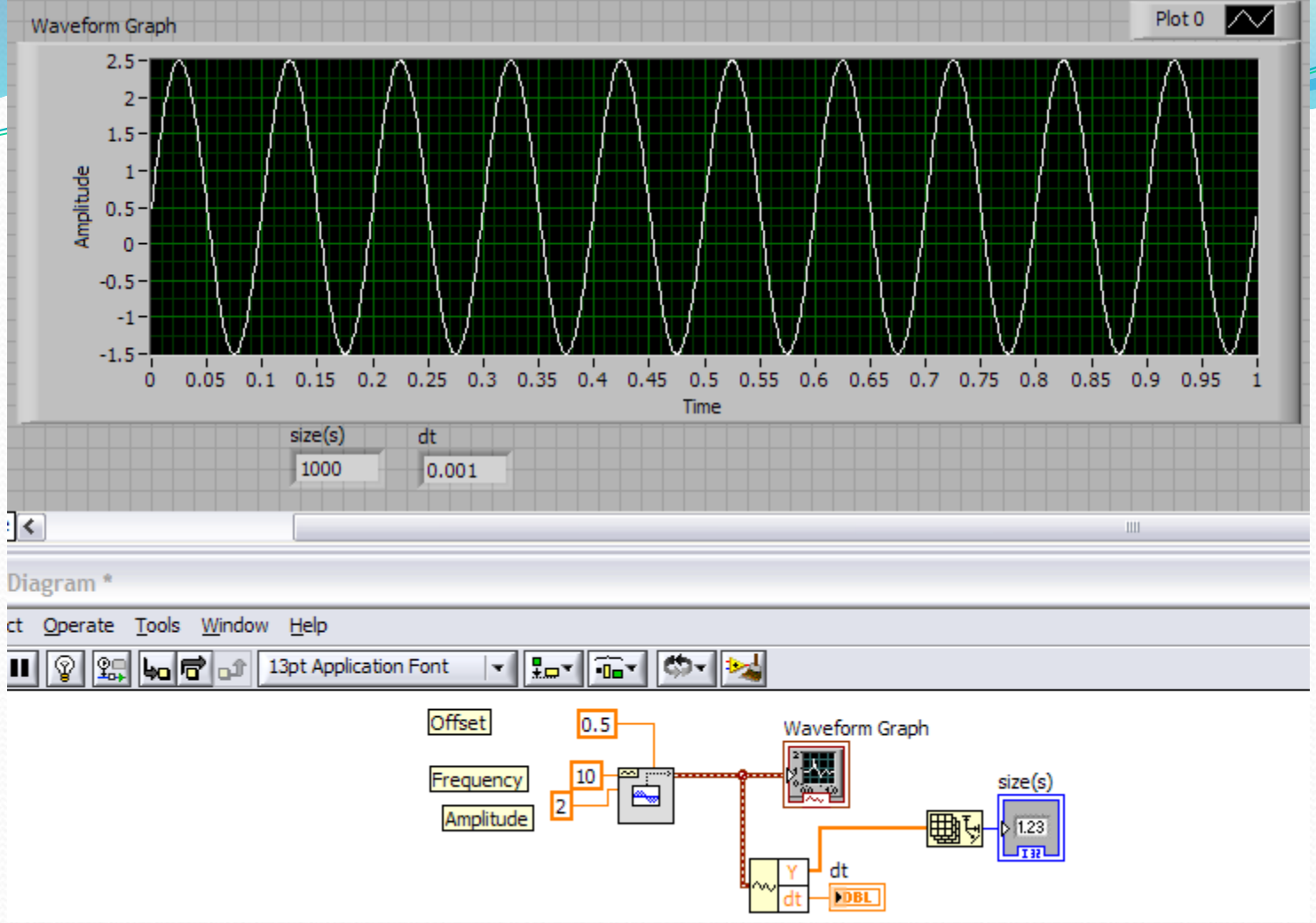
Cluster LabVIEW tricky example



This fixes it because we rewrite to the cluster. Numeric is now changed to a 1.

Waveforms (Ch. 8, p. 356)

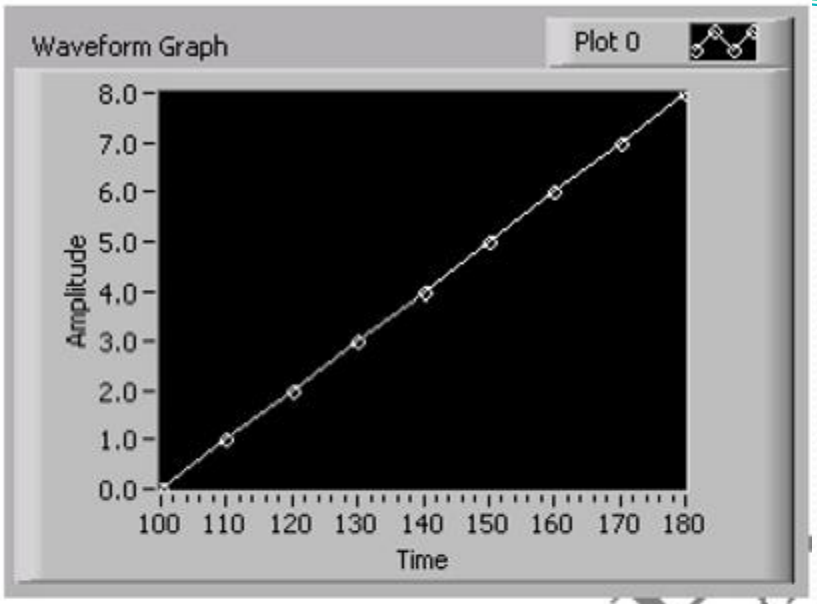
Waveforms are special clusters that consist of the vertical data points (the y values) of the waveforms as well as the *dt* value and other values. The *dt* value is the difference in time between consecutive array points. If the *dt* is smaller, then the frequency is larger.



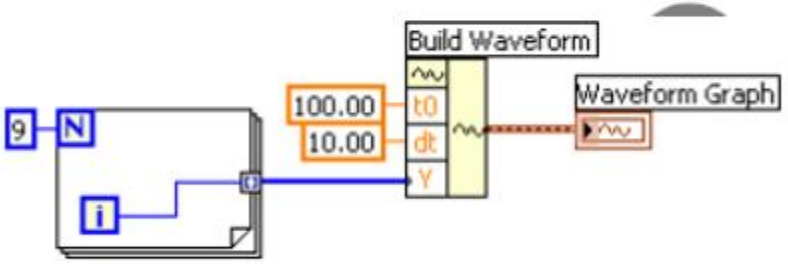
The generate Sine Wave function is in the Signal Processing > Wfm Generation palette. Notice that I set the offset, frequency, and amplitude. The brown line usually represents a waveform. I can take the individual components of that waveform from "Get Wfm Components" vi. I grabbed the dt value which is 1 ms. Notice that the entire array consist of 1000 data points. You could also figure this out by dividing the total time (1 sec) by dt (.001) and you get 1000 data points.

CLAD Question

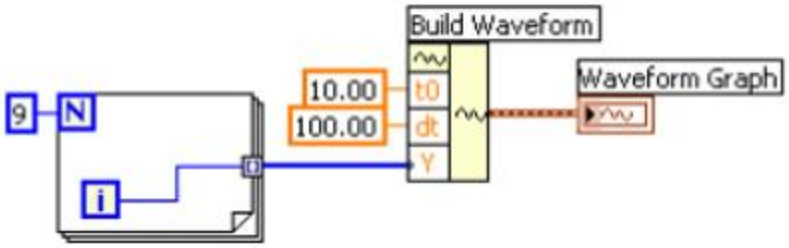
Which block diagram would generate the following front panel?



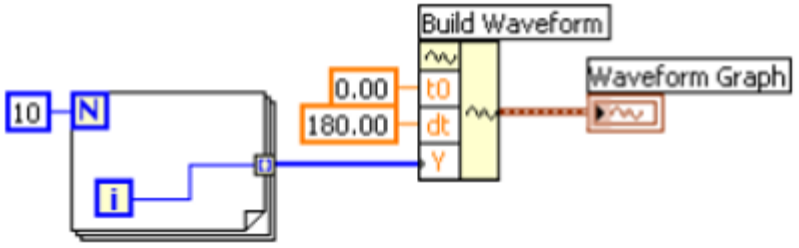
a.



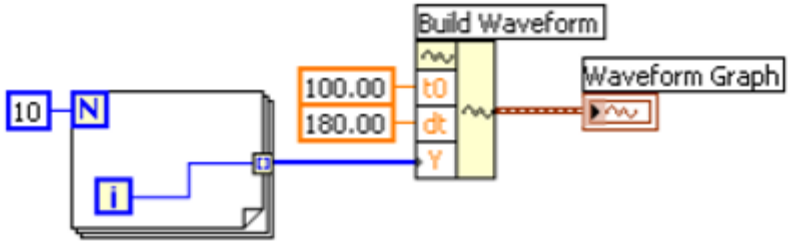
b.



c.

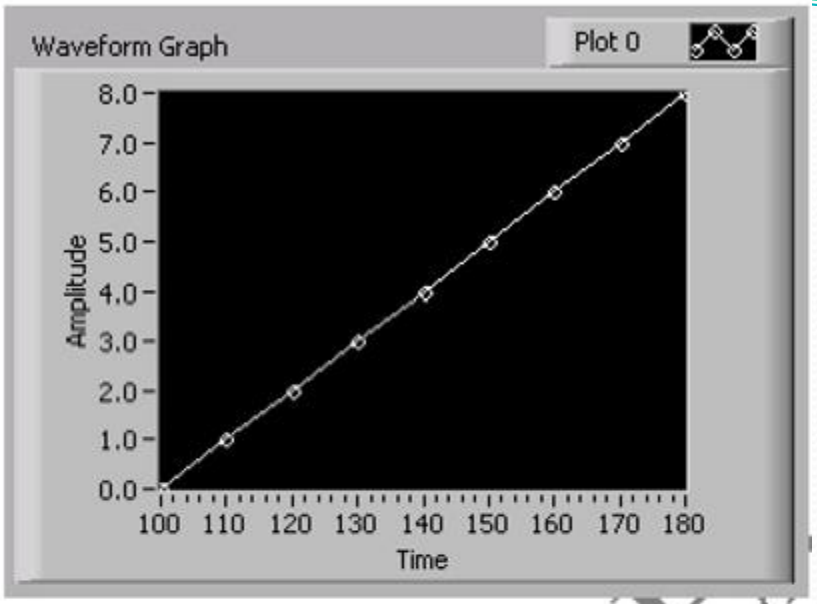


d.

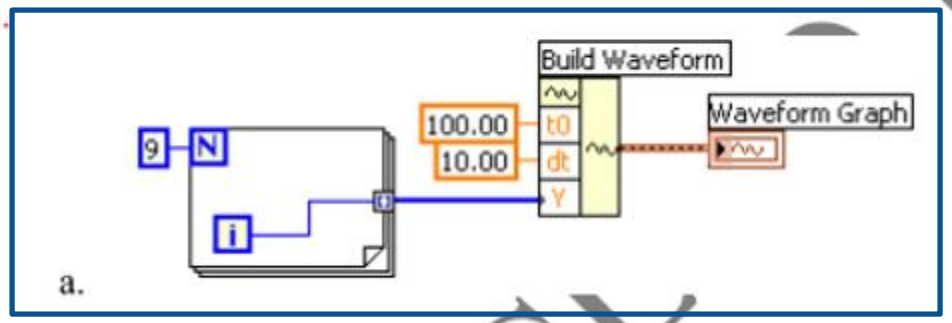


CLAD Question

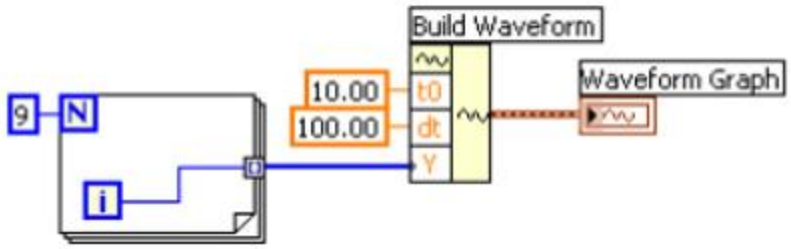
Which block diagram would generate the following front panel?



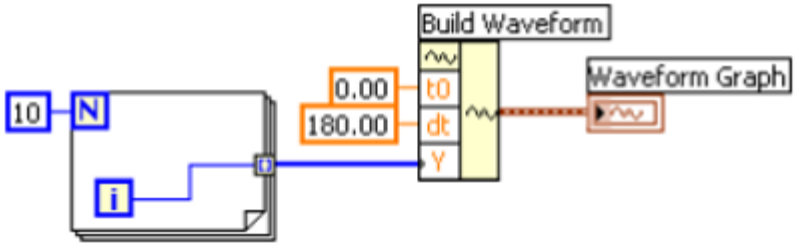
a.



b.



c.



d.