

NATIONAL INSTRUMENTS

NI LabVIEW Academy Student Workbook

2009

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Table of Contents

Problem Solving.....	3- 16
Navigating LabVIEW.....	17- 40
Troubleshooting and Debugging VIs.....	41- 63
Implementing a VI	64- 87
Relating Data	88- 107
Storing Measurement Data.....	108- 128
Developing Modular Applications	129- 146
Acquiring Data	147- 168
Instrument Control	169- 190
Common Design techniques and Patterns.....	191- 223
Communicating Among Multiple Loops	224- 247
Event Programming	248- 264
Improving an Existing VI	265- 283
Controlling the User Interface	284- 302
Advanced File I/O Techniques	303- 326
Creating and Distributing Applications	327- 343

Complete the following sentence.

_____ is the ongoing process of resolving programming errors.

Complete the following sentence.

Make sure to _____ your implementation with data that is both logical and illogical for the solution you created.

_____ skills are essential to creating solutions in LabVIEW.

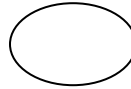
Which flow chart block is associated with...

1. A decision
2. An action or process
3. Start and end
4. Data

a.



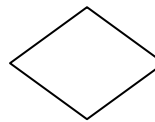
b.



c.



d.



A State Transition Diagram is a specific type of

- a. Algorithm
- b. Flowchart
- c. Spreadsheet
- d. Table

Which of the following is **NOT** a step in the Design Process?

- a. Define the problem
- b. Identify the inputs
- c. Identify the outputs
- d. Identify any additional requirements

Design the algorithm/flowchart/state diagram

A karaoke interface is developed that lets a user add their name and the song they want to sing to a queue. The interface displays the singer and song that is next in line.

Identify the inputs.

Identify the outputs.

The Design step is an important part of the Software Development Method. Fill in the blanks in the following paragraph.

The _____ indicate the raw data that you want to process during the problem solving process.

The _____ represent the result of the calculation, processing or other condition that the problem solving process implements.

In the _____ stage, you create code for your algorithm. Displaying an algorithm as a _____ is a good way of translating an algorithm into code.

The implementation of a state transition diagram requires which of the following? Choose all that apply.

- a. Converting states and transitions to code
- b. Breaking down each state into its elements
- c. A full test and verify scheme
- d. An output from each state

An alarm system measures wind speed and direction every 30 seconds and gives a signal indicating when the wind speed from the north is above 30 miles an hour.

- a. What are the inputs to this alarm system?
- b. What are the outputs to this system?
- c. What is the relationship between the inputs and outputs of this system?

From the given scenario, choose the option which identifies only the elements of the problem.

Assume you must cure a material at a certain temperature for a set amount of time in a furnace. The exact temperature will be recorded along with the exact amount of time the metal remains in the furnace.

- a. You must recognize the cure time, cure temperature as well as some other variables such as time of day.
- b. You must remember that along with the cure time and temperature, the data is also being recorded.
- c. The entire scenario is the problem.
- d. The elements of the problem are only the cure time and cure temperature.

Design a flowchart to find the largest of the three numbers A, B, and C.

Match the following steps in the Software Development Method to their purpose.

1. Defining the problem...
 2. Designing the algorithm...
 3. Implementing the design...
 4. Testing and verifying the implementation...
 5. Maintaining and updating the implementation...
-
- a. is an ongoing process of resolving errors and adding changes to the original solution.
 - b. sets the inputs, outputs, and additional requirements for the problem so a solution can be developed.
 - c. allows you to remove extraneous factors and focus on the core problem.
 - d. allows you to see if your algorithm gives the expected results for valid and invalid data.
 - e. is where you create and build the code for your algorithm or flowchart.

What does LabVIEW stand for?

What is a “VI” and what does it mean with respect to LabVIEW?

_____, _____, _____ are the three parts of a LabVIEW VI.

On a connector pane, what is assigned to the terminals?

What are the main differences between Modern controls & indicators, Classic controls & indicators, and System controls & indicators on a front panel?

What is a subVI and what are the requirements to use a subVI?

In LabVIEW terminology, a _____ is any device that can run a VI.

True or False: Boolean controls and indicators represent only a True or False status.

True or False: All LabVIEW VIs must be created within a LabVIEW project or it will be impossible to edit them after the first save.

Which of the following can be associated with the block diagram? Choose all that apply.

- a. Run button
- b. Stop button
- c. While loop
- d. Numeric control
- e. Highlight execution

Without the use of property nodes, how can the Front Panel Toolbar be made invisible for a particular VI while it is running?

Which of the following can be associated with the front panel? Choose all that apply.

- a. Run button
- b. Stop button
- c. While loop
- d. Numeric control
- e. Highlight execution

True or False: Under the Files page in your Project Explorer window, project operations reflect and update the files on the local machine's disk.

True or False: You have to add dependencies and build specification items to your project in order to see them as family options in the Project Explorer window.

Which of the following does **NOT** appear on the front panel of a LabVIEW VI? Choose all that apply.

- a. subVI
- b. Waveform chart
- c. File path control
- d. Text ring
- e. Numeric indicator
- f. Label
- g. Gauge

Highlight execution allows the user to:

- a. Follow and track the flow of data on their block diagram.
- b. Debug the source of delays and other errors in their code.
- c. See which VIs are executed first in parallel processes.
- d. All of the above
- e. A only
- f. Both A & B

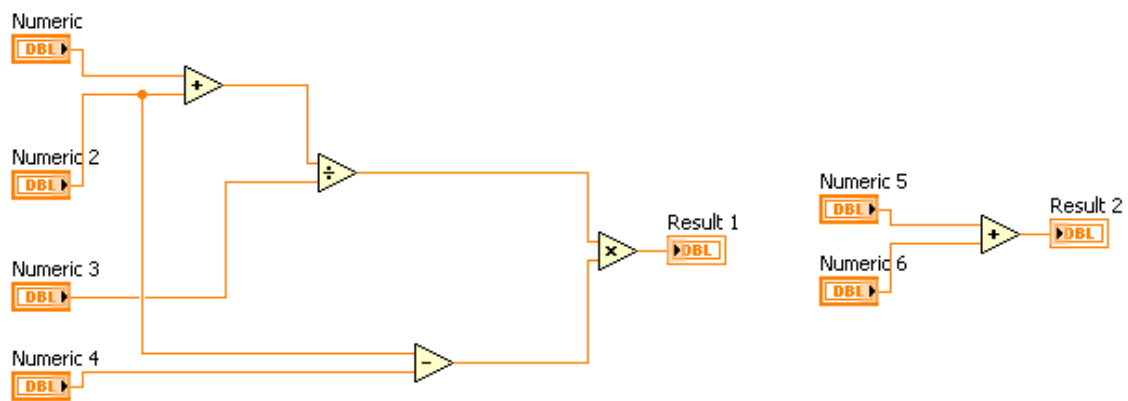
You can add items (i.e. files and folders) to a project through what methods? Choose the best answer.

- a. Right-click on **My Computer** and select **Add>>File**.
- b. Right-click the target and select **New>>VI**.
- c. Drag and drop the VI icon in the upper right corner of a front panel or block diagram.
- d. Drag and drop a folder or file from the file system of the machine onto the project's target.
- e. All of the above.

Decide if each of the VIs listed below are used for acquiring data or analyzing data.

1. Acquire Data
 2. Analyze Data
-
- a. DAQ Assistant
 - b. Instrument I/O Assistant
 - c. Simulate Signal
 - d. Amplitude and Level Measurements
 - e. Statistics
 - f. Spectral Measurements
 - g. Read From Measurement File
 - h. Tone Measurements
 - i. Filter


True or False: Result 1 will be displayed before Result 2.

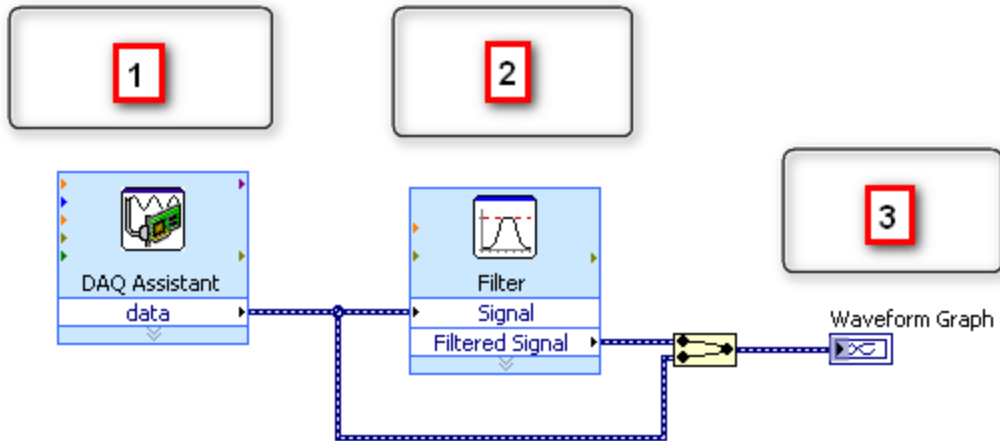




Complete the following sentences.

The above icons are examples of _____ controls and indicators. The _____ and _____ are controls and the _____ is an indicator. This data type has _____ parts.

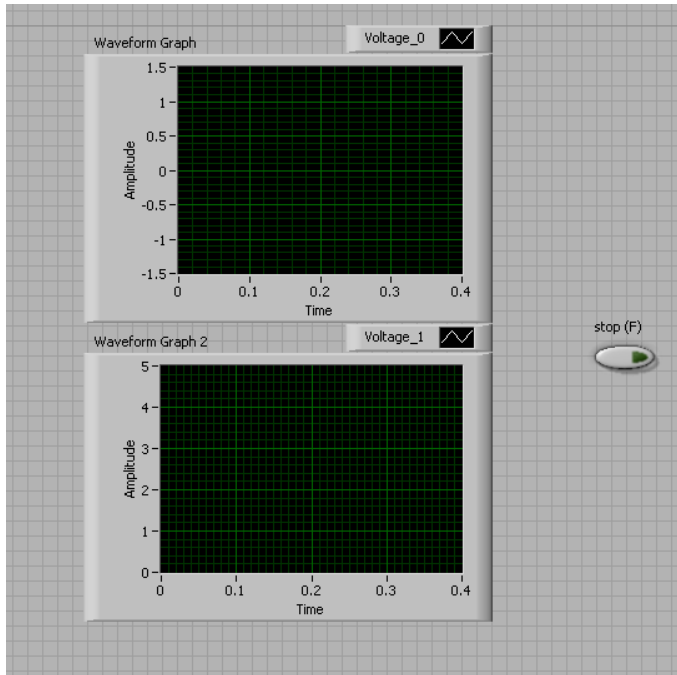
A user is trying to select a control in the block diagram to move it around; however the cursor is stuck as a spool.  How can the user fix this?



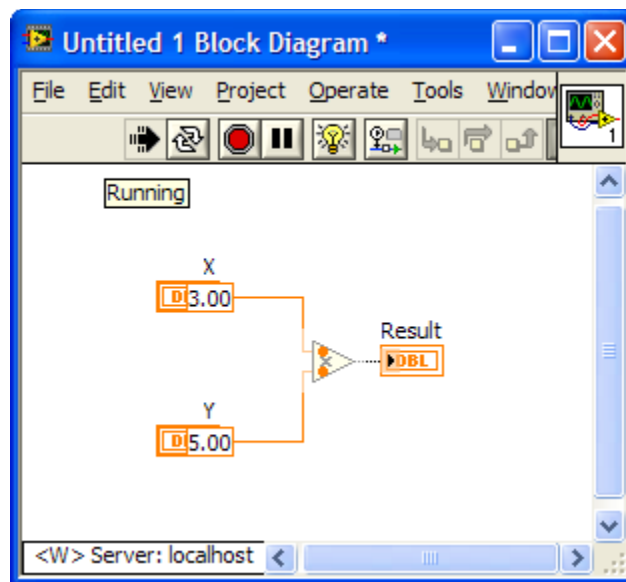
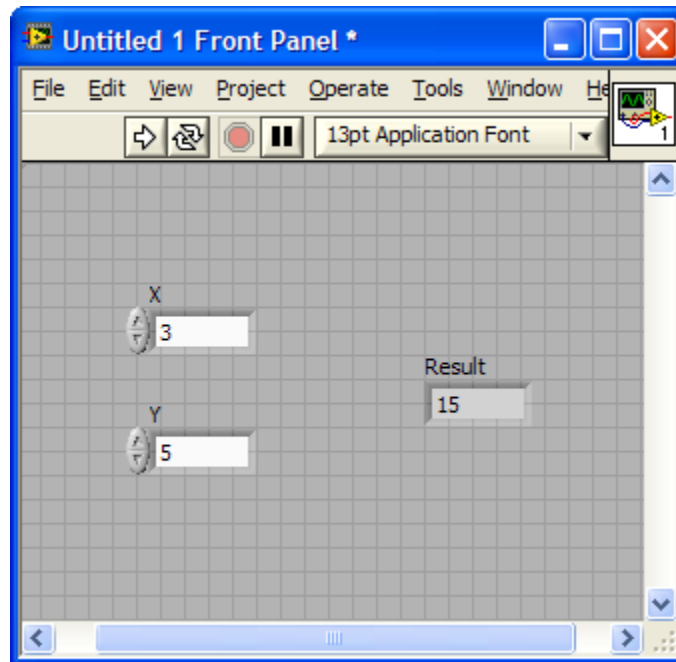
Most LabVIEW VIs have three main tasks. Match each number with the phrase that should appear in each number's respective box.

- 1.
 - 2.
 - 3.
- a. Analyzing the acquired data
 - b. Presenting the result
 - c. Acquiring some sort of data

On the line below each picture, label if the picture is a front panel or block diagram.



The following code simply takes 2 numbers and multiplies them together:



The code appears to be working fine; however, it runs slowly. Determine what is happening and how it can be fixed.

What kind of problems can highlight execution cause when debugging data acquisition or time dependent applications?

What does the acronym NaN mean? What is significant about this value in a VI?

How does the VI Hierarchy help when debugging?

_____ allows you to watch the data move through the block diagram.

Complete the following sentences with the appropriate troubleshooting tool.

Use a _____ to check intermediate values on a wire as a VI runs.

Place _____ on the block diagram to pause execution at that location.

True or False: The information in error wires are organized in a cluster?

True or False: Error wires could be used to establish ordered execution?

What will cause a broken wire?

- a. Connecting a control to an indicator.
- b. Connecting a control to another control
- c. Connecting a double control to an integer indicator
- d. Connecting an array output into a cluster bundle input

Where can LabVIEW users commonly and easily find free, fully functional programs that can be used or modified to suit particular needs? Choose all that apply.

- a. Example Finder
- b. Developer's Zone
- c. LabVIEW help
- d. LabVIEW forums
- e. www.ni.com/support

There are several resources included in LabVIEW that provide assistance for programming effectively. List two of these resources and briefly explain the functionality of each resource.

What information does the Context Help window provide?

Please select all methods to reach the LabVIEW Help Window.

- a. Control + Shift + ?
- b. Help Menu >> Search the LabVIEW Help
- c. Right-click a VI in the block diagram >> select Help
- d. Navigate to Programs > National Instruments >> LabVIEW x.x> >LabVIEW Help

The context help box contains which of the following when the mouse is hovering over a subVI?

- a. Inputs and outputs for the subVI
- b. Name of subVI
- c. Full description of subVI's function
- d. Link to LabVIEW help
- e. a, b and d
- f. All of the above

What does a broken arrow on the run button mean? Choose all that apply.

- a. The error cluster wire must be wired
- b. Front panel elements are missing
- c. There are errors in the block diagram
- d. The VI cannot run as is

True or False: Examples found in the Example Finder can be modified.

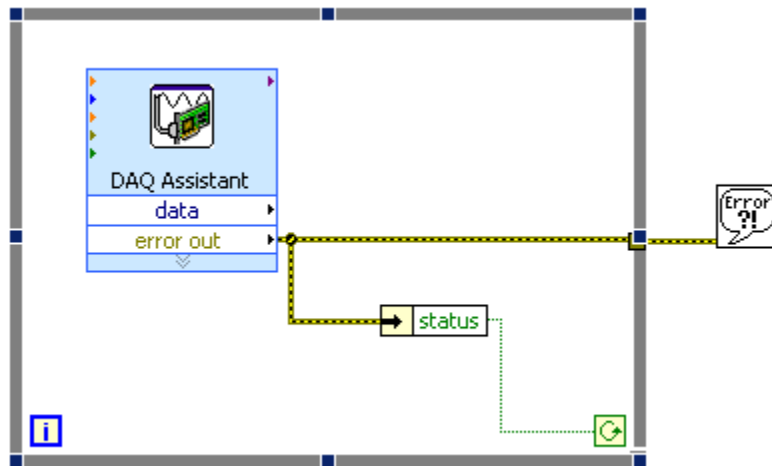
List at least three of the many utilities provided with LabVIEW that help users debug issues with their code.

Match the step buttons with their description.






1. ____ Step Out
2. ____ Step Into
3. ____ Step Over



How many times will this loop execute? Explain your reasoning.

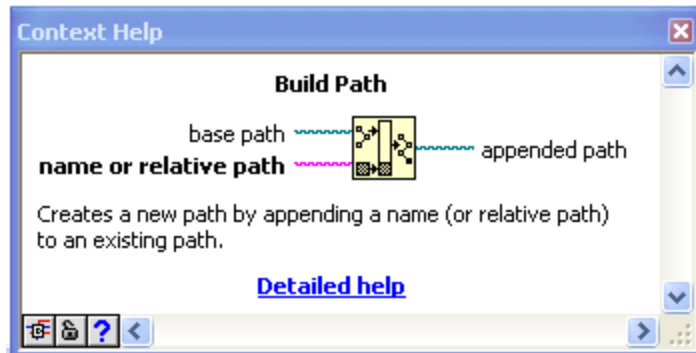


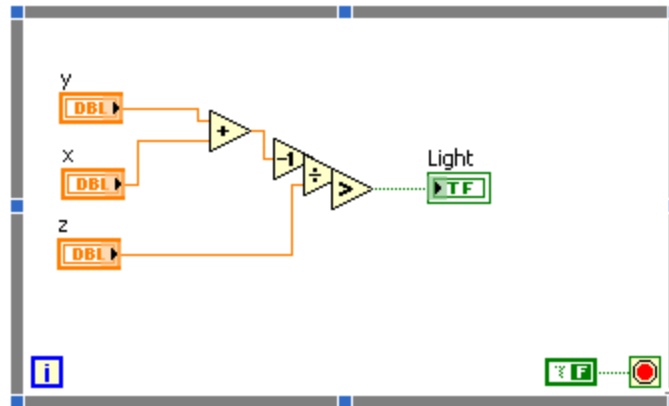
Match the following buttons with their function:

1. 
2. 
3. 
4. 
5. 

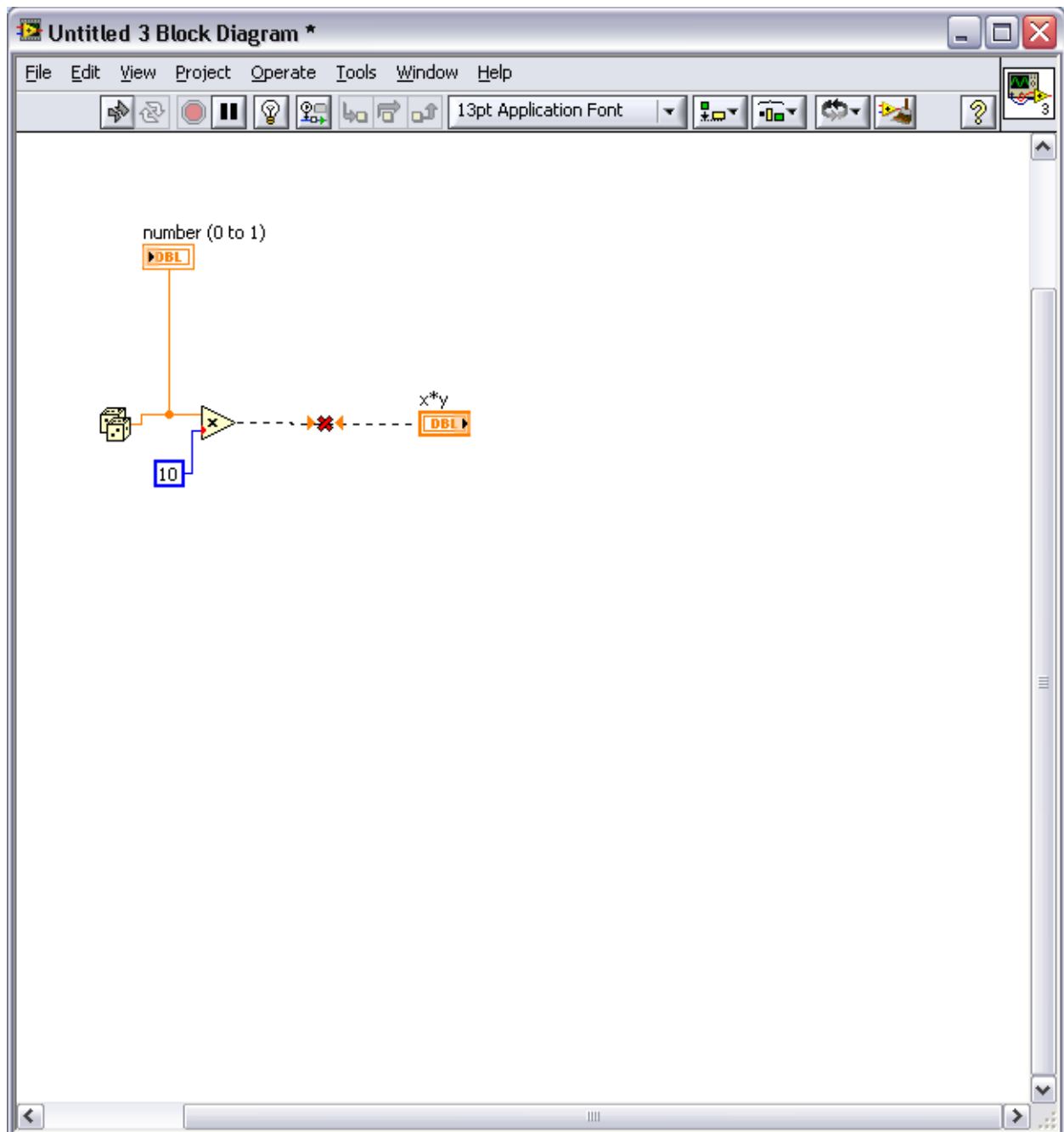
- a. Step Over
- b. Step Into
- c. Step Out
- d. Highlight Execution On/Off
- e. Show/Hide Context Help

When using context help to learn more about a VI, some inputs are bold while others are not. Why are these inputs bold?





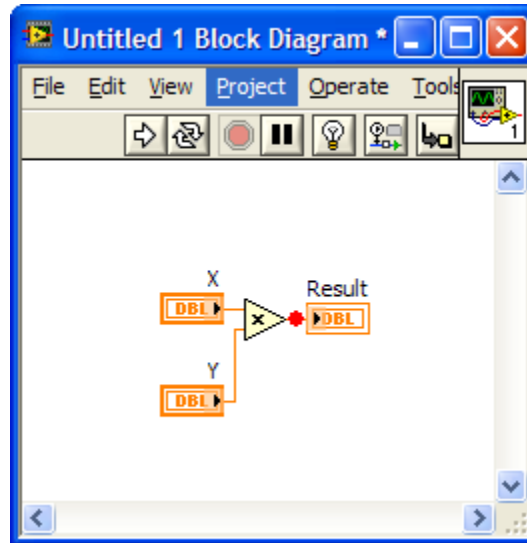
The above VI no longer works, and has a broken run arrow. It worked at one time, but would take close to 100% of the computer's resources when running. A general approach to debugging and fixing this VI would be to first _____, followed by clicking the _____. With that knowledge it should be possible to make changes and run the VI. Finally, in order to reduce the use of computer resources it would be beneficial to add a _____ function inside the while loop. It would also be good programming practice to replace the Boolean constant with a _____.



If you created this block diagram, what would be the two indications that there is a problem?

Based on this block diagram, identify the problem.

The following code multiplies two numbers together and displays the answer in the result indicator:



When this code is run, the VI seems to pause. How can this be fixed?

Briefly describe the functionality of a shift register.

True or False: During the first iteration of a while loop, the iteration terminal will return 0.

True or False: LabVIEW has built-in functions that can auto-align, auto-distribute, and auto-resize front panel and block diagram objects.

What is the difference between the I16 and U16 data types? Additionally, what is the range of data for each of them?

Tunnels on structures serve what purpose(s)?

- a. Feed data into the structure.
- b. Feed data out of the structure.
- c. Control loop execution.
- d. None of the Above.

Please match the complex number representation to its respective name.

- | | |
|---------------------------|---|
| a. Complex Double (CDB) | 1. Real & imaginary values in 32-bit IEEE format |
| b. Complex Single (CSG) | 2. Real & imaginary values in 64-bit IEEE format |
| c. Complex Extended (CXT) | 3. Real & imaginary values vary based on platform |

Which of the following are valid Loop Structures within the LabVIEW environment? Choose all that apply.

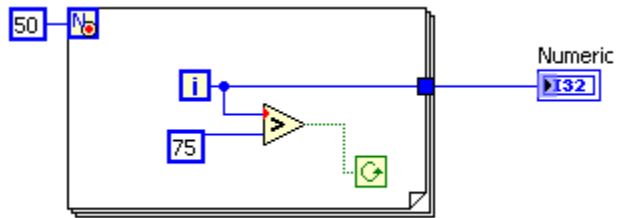
- a. Conditional
- b. For
- c. Timed
- d. Case
- e. Sequence
- f. While

True or False: The Wait Until Next ms Multiple function waits until the millisecond counter counts to an amount equal to the input you specify.

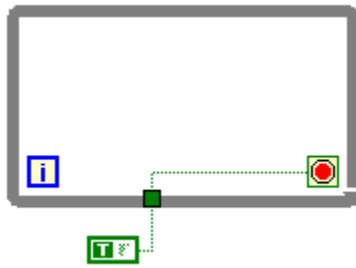
From the following, select some good design techniques for LabVIEW programming. Choose all that apply.

- a. Labels and Captions
- b. Use flamboyant colors
- c. Spacing and alignment
- d. Text and fonts
- e. System controls
- f. Nested loops and structures
- g. Menus
- h. Decorations
- i. Automatic resizing of objects

What will the indicator display after this program has run?



How many times will this loop execute?



- a. 1
- b. 0
- c. Infinite

True or False: Captions appear on the block diagram.

When LabVIEW coerces data, LabVIEW places what kind of indication to shown that conversion has taken place?

- a. A red wire going into the terminal where conversion is occurring.
- b. A red dot on the terminal where conversion is occurring.
- c. LabVIEW produces an error saying that it cannot coerce data.
- d. LabVIEW does not indicate coercion but simply performs it.

Default values for controls can be changed to different values by what methods?

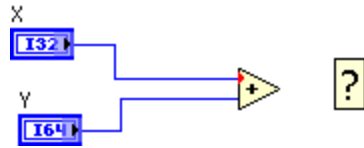
- a. Save the VI once the value has been changed.
- b. Right-clicking on the control in the block diagram and then selecting Data Operations>>Make Current Value Default.
- c. Right-clicking on the control and changing it to a constant
- d. None of the above.

Which of the following are possible front panel design options?

- a. Force the VI to behave like a dialog box
- b. Choose to hide all labels
- c. Force all front panel objects to rearrange when you resize the window
- d. All of the above

Which of the following characteristics describe a While Loop. Choose all that apply.

- a. Acts as in “if statement”
- b. Similar to a Do Loop or Repeat-Until Loop in text based
- c. Iterates a set amount of times
- d. Executes a sub-diagram until a condition occurs
- e. Always executes at least once



X is an integer with representation I32.

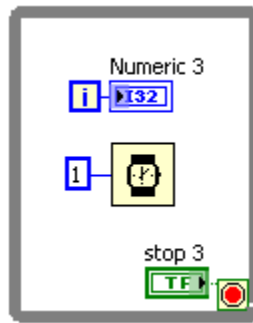
Y is an integer with representation I64.

What will be the representation of $x+y$?

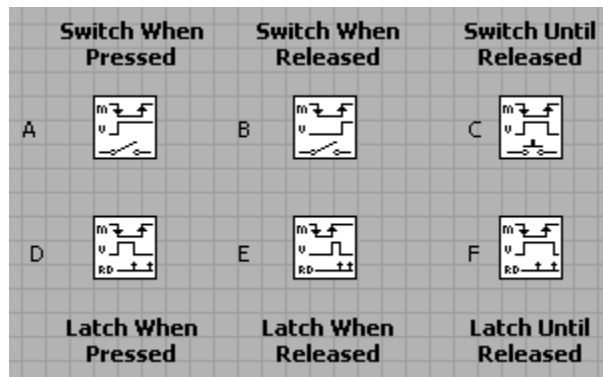
Match the Following Numeric Data Types to their corresponding storage size.

- | | |
|------------|------------------------------------|
| a. 16 bits | 1) Single Precision Floating Point |
| b. 32 bits | 2) Double Precision Floating Point |
| c. 32 bits | 3) Byte Integer |
| d. 8 bits | 4) Word Integer |
| e. 64 bits | 5) Long Integer |

What is the purpose of the wait function in the VI below? Hint: Think in terms of performance.



Please match each Boolean mechanical action to the way it operates.



_____ The state is changed when the button is pressed. It remains pressed until button is pressed again.

_____ The state is changed when the button is released. Change back when value is read.

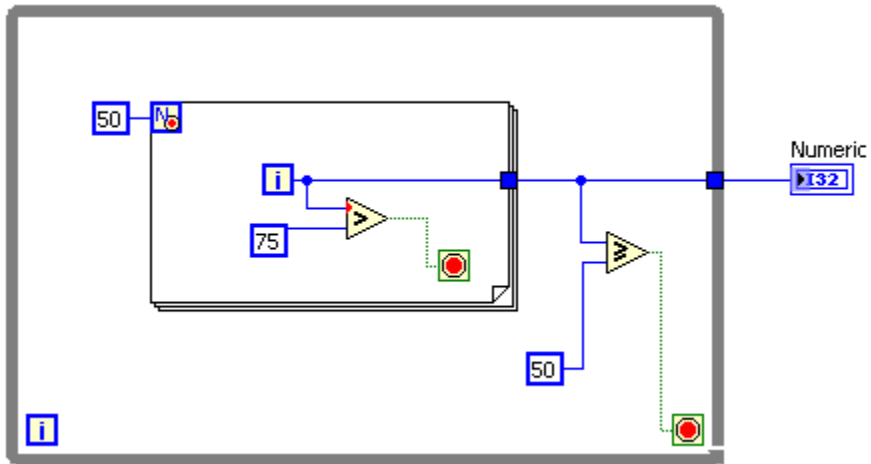
_____ The state is changed when the button is pressed. Continue to read until button is released.

_____ The state is changed when the button is released. Do not read until mouse releases. Continue to read until button is pressed again.

_____ The state is changed when the button is released. Continue to read until button is released.

_____ The state is changed when the button is released. Continue to read until button is released.
Always reads a value.

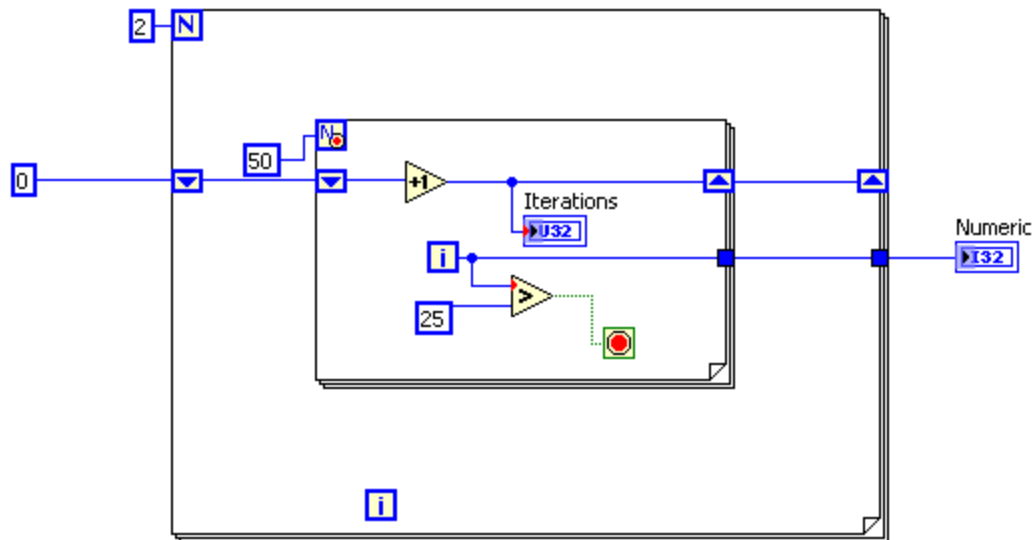
What number will be displayed in Numeric after the program completes



- a. 1
- b. 2
- c. 49
- d. 50

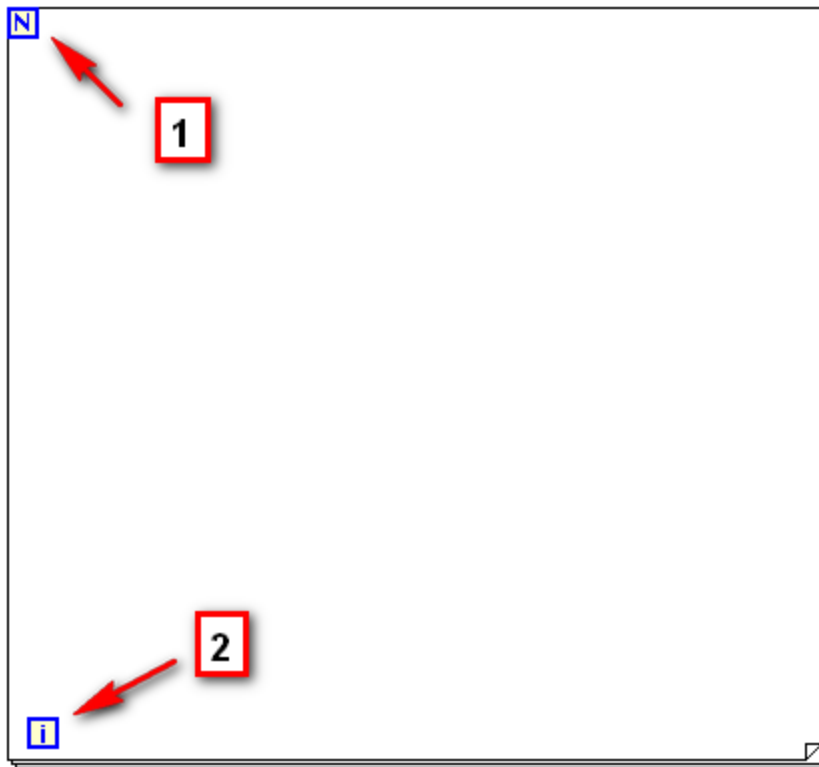
The loop is infinite, and the program will not complete

After the program completes, what will be displayed in Iterations and Numeric Indicators? (Iterations, Numeric)



- a. 52, 25
- b. 54, 26
- c. 50, 25
- d. 100, 49

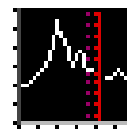
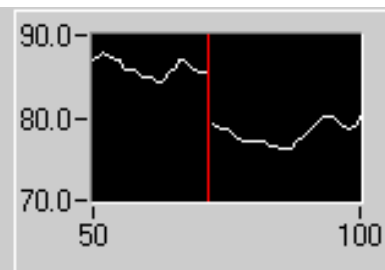
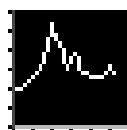
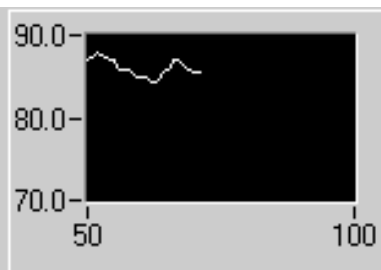
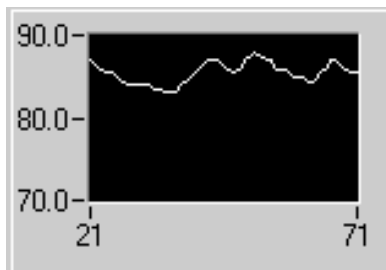
Describe below how a While Loop can be used for handling errors by indicating where the error cluster should be wired as well as the effect of utilizing a While Loop in this way.



From the above figure, identify the type of loop as well as label the terminals indicated by numbers 1 and 2. Describe the function of both 1 and 2 and indicate at what value each terminal begins counting.

Match the name of the update mode to each of the following screenshots. The thumbnail image below each is the LabVIEW right-click menu representation of each. (Scope, Sweep, Strip)

a. _____ b. _____ c. _____



Describe the difference between an initialized array and an uninitialized array.

A cluster is similar to a _____ or _____ in text based programming languages.

True or False: You can mix different data types into an array?

True or False: You can index through cluster elements using a for loop?

A LabVIEW Error Cluster contains which of the following elements? Explain the function of each included element.

- a. Timestamp
- b. Status
- c. Code
- d. Index
- e. Description
- f. Source

Which of the following cannot be an element of an array?

- a. File refnums
- b. Queues
- c. Strings
- d. .Net Container

A cluster already contains a string control. Which of the following choices cannot be added to this existing cluster? Choose all that apply.

- a. An additional string control
- b. A string indicator
- c. A numeric control
- d. A time stamp control
- e. A time stamp indicator

What is the benefit of using clusters? Choose all that apply.

- a. Enables faster data processing
- b. Eliminates wire clutter on the block diagram
- c. Reduces the number of connector pane terminals
- d. Can be used in place of an array

Select the ways to make a custom control. Choose all that apply.

- a. Right-click on the front panel control or indicator and select **Advanced>>Customize**.
- b. Right-click on a block diagram control or indicator and select **Advanced>>Customize**.
- c. Select a front panel control or indicator and select **Edit>>Customize Control** from the menu bar.
- d. Use the **New>>Control** from the project explorer.
- e. Right-click anywhere on the front panel and select **Advanced>>Customize**.
- f. Double-click on a control or indicator to open its properties box.

If you enable auto-indexing for more than one tunnel or if you wire the count terminal, the actual number of iterations becomes the _____ of the choices.

- a. Greater
- b. Smaller
- c. You cannot do this in LabVIEW.
- d. LabVIEW will not display any error, but this function has an indeterminate output.

Which of the following is true about type defined custom controls?

- a. If you change an instance of a type defined custom control in one VI, you will need to change all others to match it.
- b. If you change the data type of the .ctl file of the control/indicator then all instances will be changed that are still linked to that .ctl control/indicator.
- c. If you change the default value of a type defined custom control, it will change the default value for all instances of that control.
- d. If you change the data range of a type defined custom control, it will change the data range for all instances of that control.

Select appropriate answer(s): You cannot create an array of arrays. However, to accomplish a similar end result, you can...

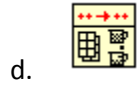
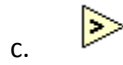
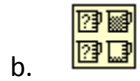
- a. Use a multidimensional array.
- b. Use a “Flat Sequence Structure” with a 1-D array in each of the sequence panels.
- c. Create a nested, auto-indexing “For Loop” with a “String to Byte Array” VI within it.
- d. Create an array of clusters where each cluster contains one or more arrays.

A _____ array contains both rows and columns?

You are planning on creating a new VI with a team. You are in charge of the initial planning, such as defining the inputs and outputs. Your VI will use many similar inputs but may undergo many revisions from your teammates. These revisions would most likely include a change of data representation for different inputs. What control type should be used for these inputs?

- a. Control
- b. Type Definition
- c. Strict Type Definition
- d. All are suitable

You have an array that contains values and you need to find the max/min and their associated indexes, which of the following is the best block to use?

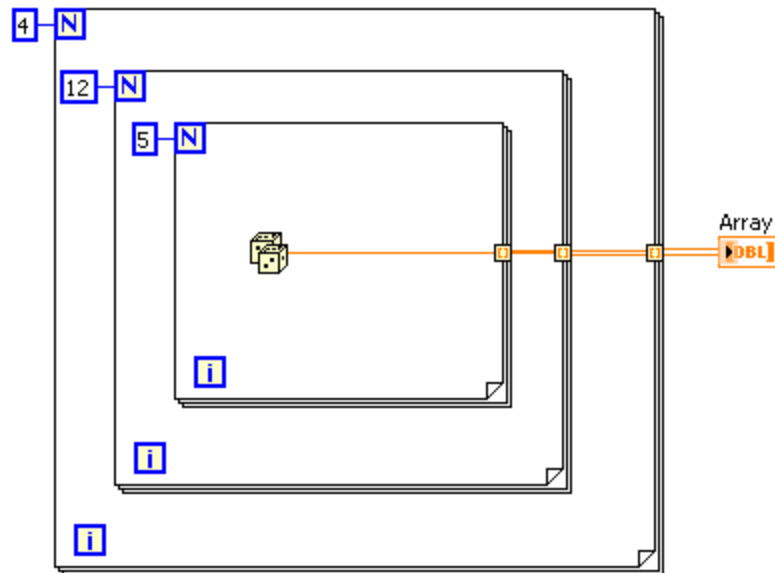


Match the buttons with their names



a. b. c. d. e. f. g. h.

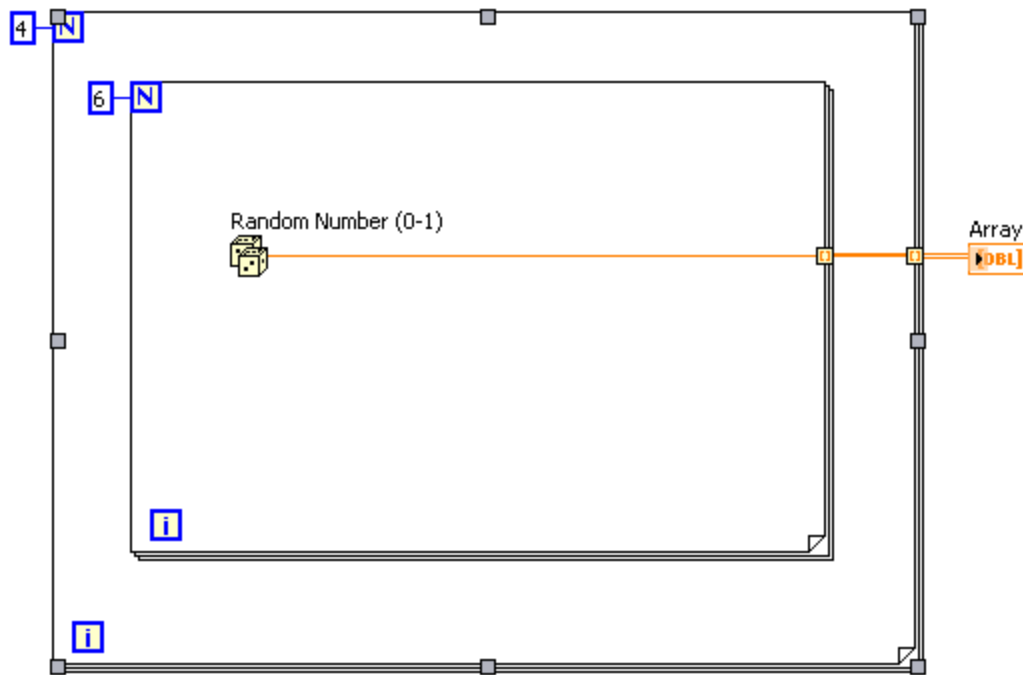
1. _____ Type Definition Status
2. _____ Edit Mode
3. _____ Reorder Objects
4. _____ Align Objects
5. _____ Customize Mode
6. _____ Distribute Objects
7. _____ Text
8. _____ Resize Objects



The above block diagram produces a _____ dimensional array with the dimensions _____. There are _____ columns in this array.



What is significant about the tunnel seen in the figure above? What does this tunnel state mean in terms of how the loop iterates in regard to the array?



What is the dimension of the outputted array? How many rows and how many columns will appear in the array?

Why do high-level file I/O VIs cause a LabVIEW program to run slower if placed in a loop?

True or False: A high-level VI performs open and close operations best when placed in a loop.

When using a Read from Spreadsheet File VI to read an ASCII file with columns of data, it must be _____ delimited in order to be read properly.

In what situations should you use low-level VI's and high-level VI's when writing to a file?

What is the correct order of operations for a typical file I/O operation?

- a. Open File, Read/Write File, Close File, Check for Errors
- b. Open File, Read File, Close File, Check for Errors
- c. Open File, Read/Write File, Check for Errors

Open File, Read File, Close File, Open File, Write File, Close File, Check for Errors

You are developing an application that logs temperature data from 3 different sensors. Each sensor acquires 100 samples one after the other and records the sample to a file immediately after acquiring it. What level of File I/O VIs should be used?

- a. Low Level File I/O
- b. Medium Level File I/O
- c. High Level File I/O

Refnums are required for operations involving which of the following? Choose all that apply.

- a. Outputting data to a waveform graph
- b. Opening a file
- c. Starting a network connection
- d. Accessing a device

List the steps of the file I/O process in the order they occur.

True or False: Disk streaming uses less system resources when performing File I/O functions due to fewer interactions with the operating system.

Choose the three main considerations when deciding to access text files from another application.

- a.* If you need to perform random access read or writes
- b.* If disk space and file I/O speed are not crucial
- c.* If you do not need to perform random access read or writes
- d.* If numeric precision is not important
- e.* If numeric precision is important

Low-level file I/O VIs and functions each perform how many pieces of the file I/O process?

- a. 2 pieces-They perform open and close
- b. 2 pieces-They perform read and write
- c. 1 piece –They each perform only one piece
- d. They perform all of the pieces

Match the following to VIs to their description.

1. Write to Spreadsheet File
 2. Read From Spreadsheet File
 3. Write to Measurement File
 4. Read from Measurement File
-
- a. An Express VI that reads data from a text-based measurement file (.lvm) or a binary measurement file (.tdms)
 - b. Reads a specified number of lines or rows from a numeric text file beginning at a specified character offset and converts the data to a 2D single-precision array of numbers.
 - c. Converts a 2D or 1D array of single-precision numbers to a text string and writes the string to a new ASCII file or appends the string to an existing file.
 - d. An Express VI that writes data to a text-based measurement file (.lvm) or a binary measurement file (.tdms) format.

Please match each file format to its respective description

- | | |
|-----------|--|
| a. Binary | 1. Called a text file and is the standard for most programs |
| b. TDMS | 2. Underlying format of all other file formats |
| c. ASCII | 3. Includes additional information for data such as a time stamp |
| d. LVM | 4. Consists of a properties file and an index file |

Describe what a refnum is and how it is used within LabVIEW.

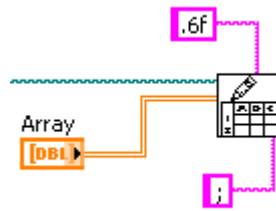
Briefly describe each file type.

- a. Binary
- b. ASCII
- c. LVM
- d. TDMS

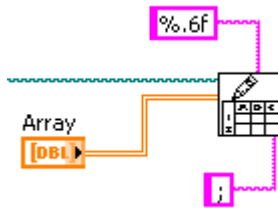
Which of the following describes a refnum? (Select all correct answers)

- a. A unique identifier for an object (file, device, network connection)
- b. A temporary pointer to an open object
- c. A number that identifies the location of an element within an array
- d. The number that is unique to your LabVIEW license

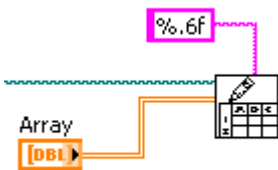
You need to write a 2D array to a semicolon delimited spreadsheet file with 6 digits of precision after the decimal point. Which of the following configuration would be the best to use?



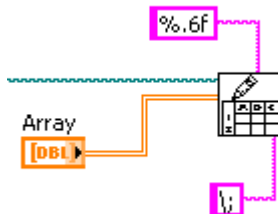
a.



b.

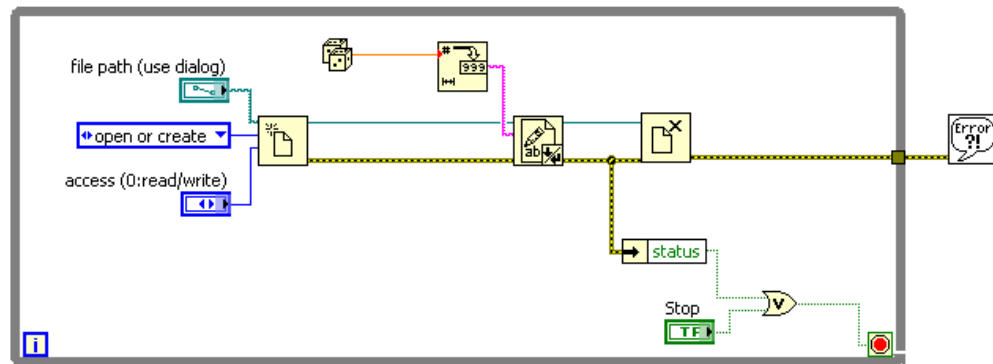
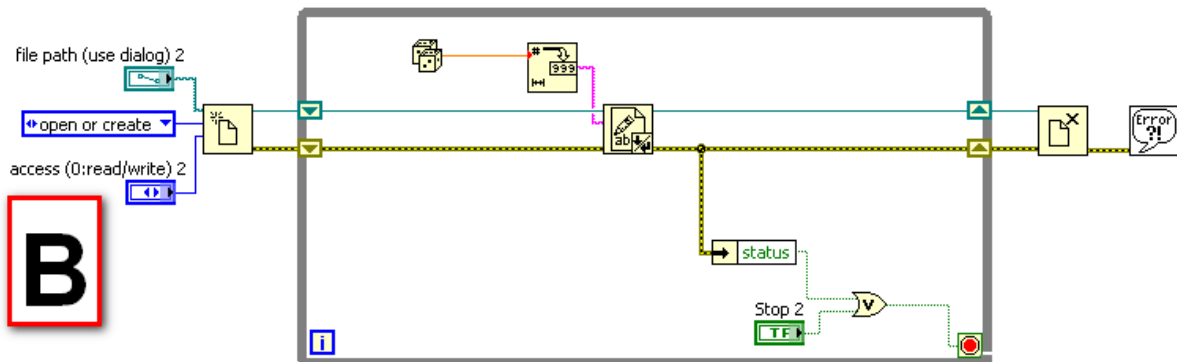


c.

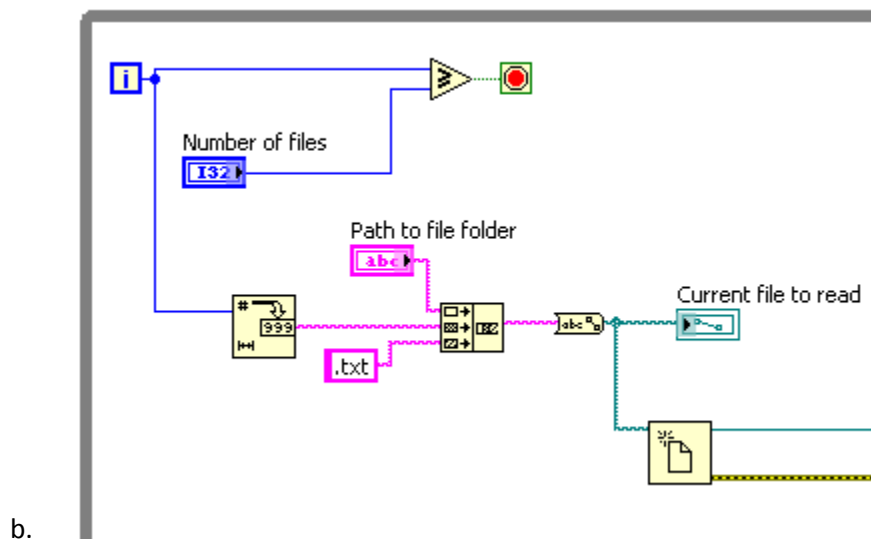
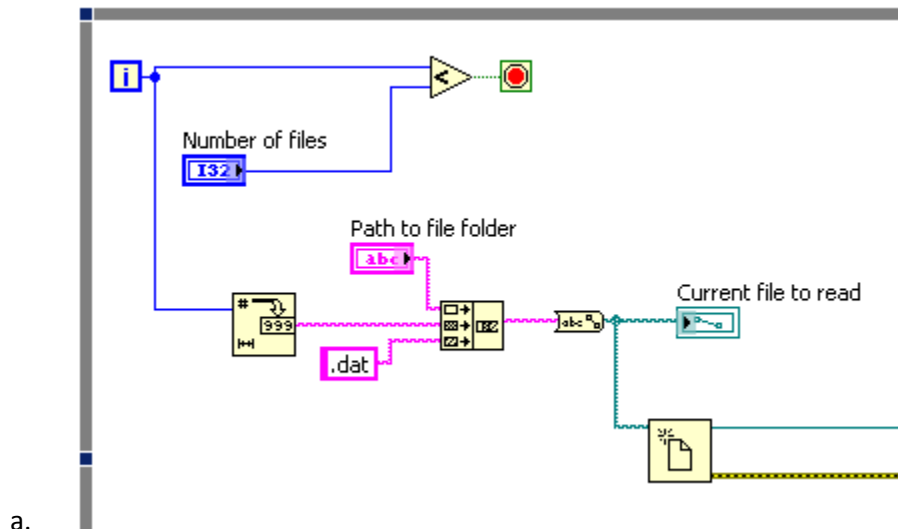


d.

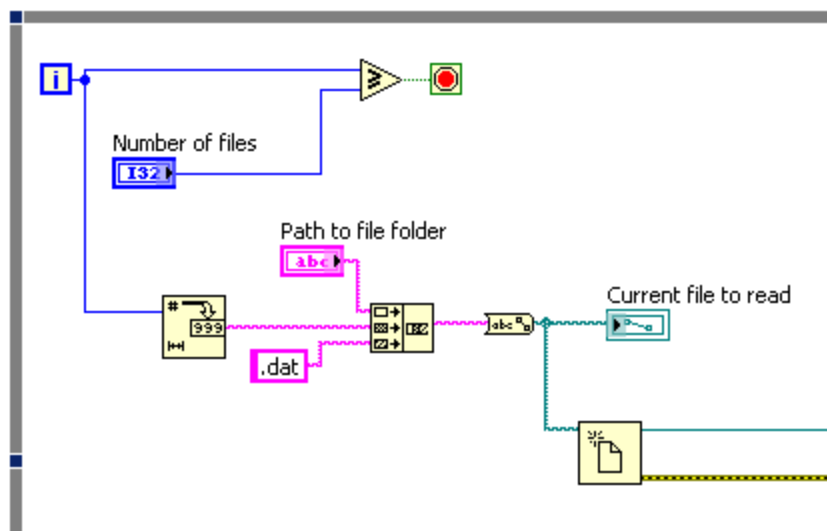
Which picture below (A or B) implements disk streaming? Briefly, what is the benefit of disk streaming?

A**B**

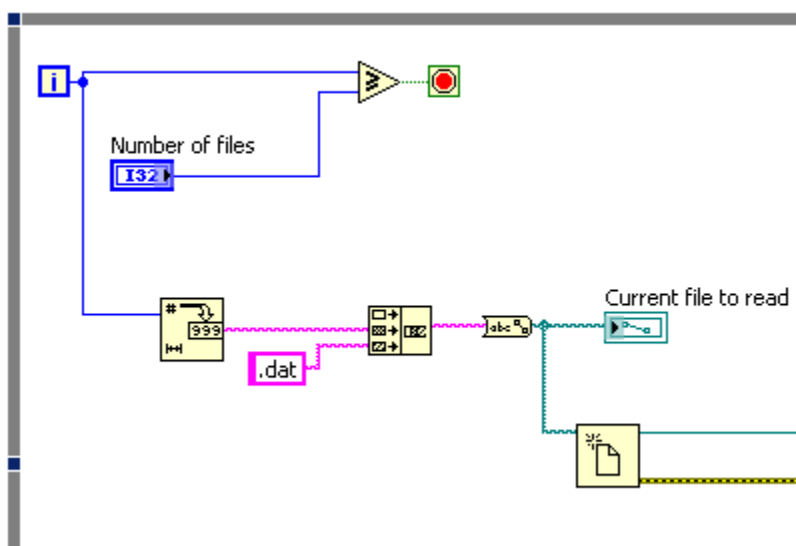
You have multiple ASCII, tab delimited files that you need to read data from for analysis. Luckily, the files are in the same directory and are sequentially labeled (1.dat, 2.dat, 3.dat, etc...). Which of the following choices is a method to open each file sequentially? *Note: Each choice is using a while loop.*



c.



d.



Why is it advantageous to use low-level VI's when writing to a file in a loop?

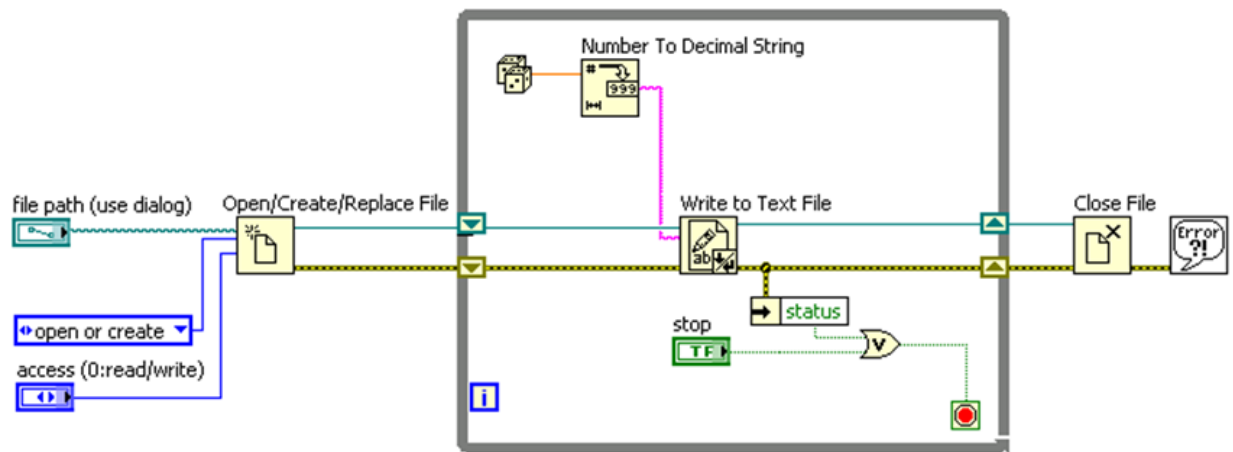


Figure 6-3. Disk Streaming Example

A VI within another VI is called a _____. It corresponds to a _____ in text-based programming languages.

True or False: You must customize the VI icon in order to maintain functionality of that VI when it is used as a subVI.

Why is it good programming practice to create a custom icon for a subVI?

True or False: Creating a subVI can be done by using the Positioning tool and selecting a section of code within your VI and going to **Tools>>Create SubVI**.

If your front panel contains more than 28 controls and indicators that you want to use programmatically, what should you do?

True or False: The connector pane can be accessed by right-clicking the VI icon in the top right-hand corner of the block diagram window.

What is the maximum number of connections on a connector pane?

- a. Infinite-the connector pane automatically adjusts to the number of controls/indicators on the front panel
- b. 36
- c. Twice the number of controls-for every input, there is an output
- d. 28

Which choice below is an efficient option when performing a task frequently?

- a. Run the VI every time that an operation needs to be performed
- b. Copy and paste the operation to every location it needs to be used
- c. It is bad programming practice to have an operation occur more than once
- d. Use subVIs or loops to perform an operation repetitively

True or False: It is best to avoid using error clusters in your subVIs.

Please select all of the suggested practices when using the connector pane.

- a. Use as many terminals as possible
- b. Connect controls (inputs) on the left terminals and indicators (outputs) on the right terminals
- c. Label controls and indicators according to their purposes
- d. Delete all unnecessary terminals

Modularity provides the following advantages.

- a. Breaks up code into manageable pieces.
- b. Makes code easier to understand.
- c. Prevents viewing of lowest level functions
- d. Makes it hard for other coders to modify your code.

How is the front panel of a subVI accessed?

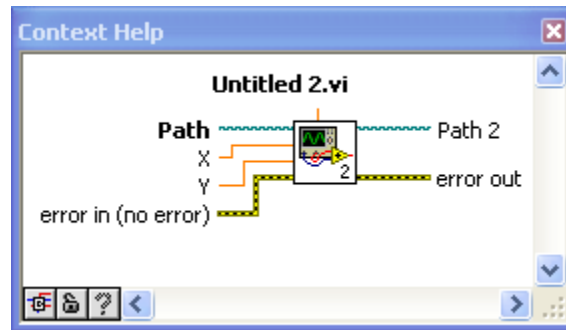
- a. Go to **View >> Select subVI >> See Front Panel**
- b. Double-click the subVI
- c. Select the subVI and then go to **Window >> Show Front Panel**
- d. Right-click the subVI and select **Open Front Panel**

A subVI is typically used when:

- a. An operation is performed only once
- b. An operation is performed repetitively
- c. An operation is performed within a loop
- d. An operation is modified within a VI

True or False: The icon in the upper right hand corner of a VI can only be changed to a pre-existing photo on the machine that the VI was originally developed.

Please match the input terminal types to their characteristics.

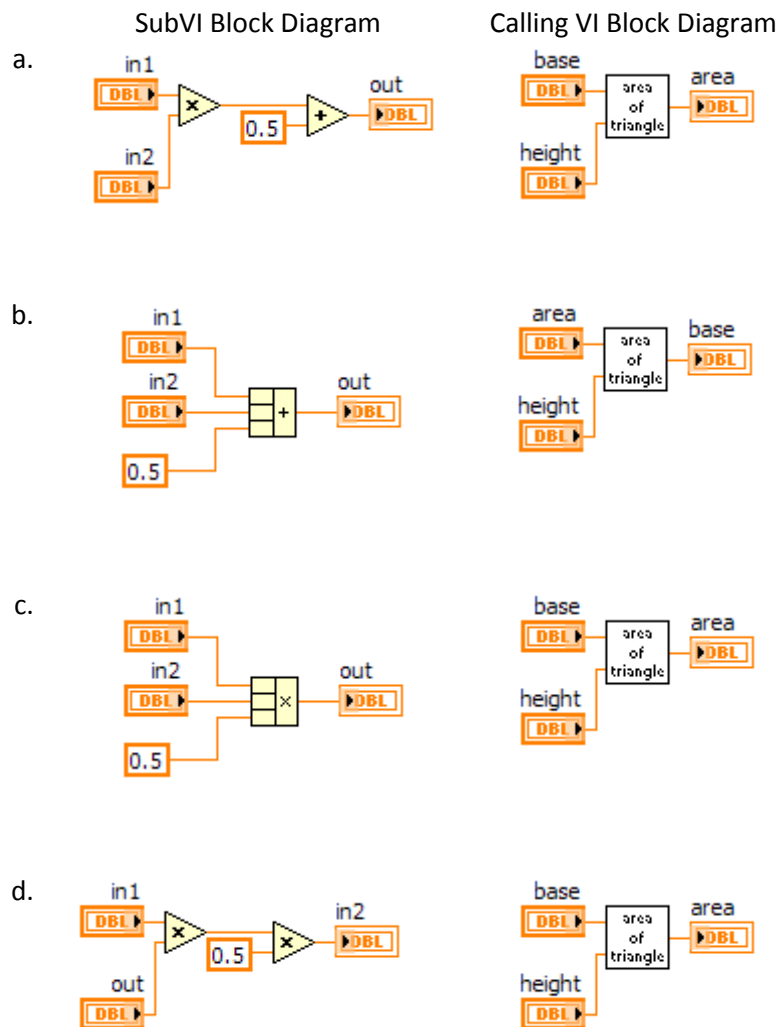


- | | |
|----------------|--|
| a. Required | 1. No errors are thrown but may not execute correctly when not wired |
| b. Recommended | 2. The VI can execute properly when not wired |
| c. Optional | 3. When not wired, the run arrow is broken. |

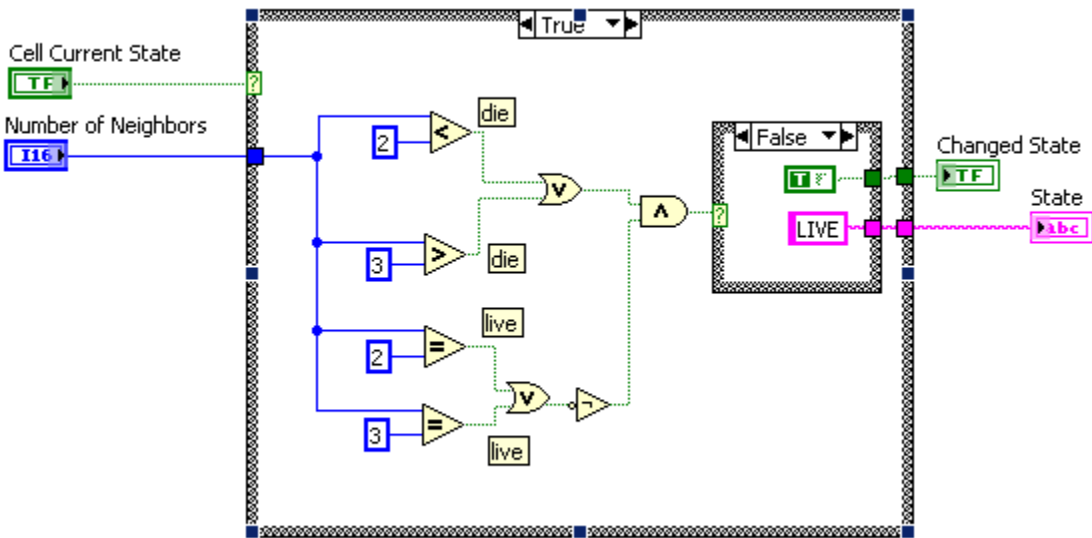
The following Calling Program Code and Function Code are shown below:

Function Code	Calling Program Code
<pre>function triangle_area(in1, in2, out) { out = 0.5 * in1 * in2; }</pre>	<pre>main { triangle_area(base, height, area) }</pre>

What is the correct implementation of the SubVI?

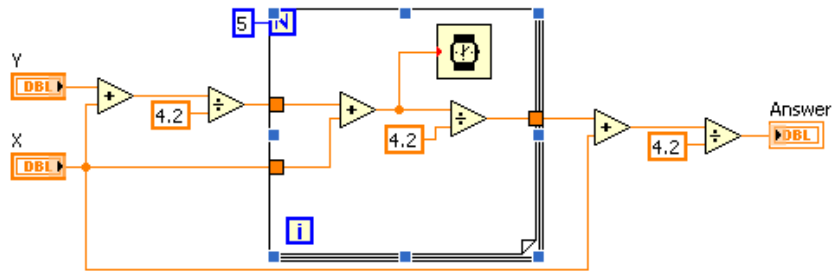


Which of the following is the best connector pane layout for this subVI?

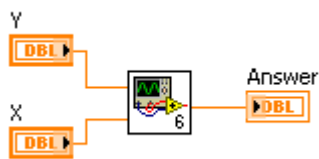


- a.
- b.
- c.
- d.

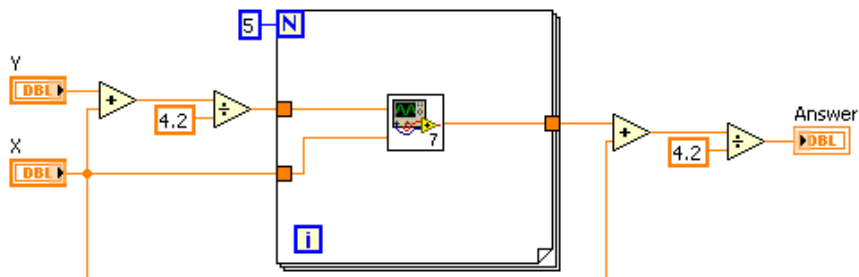
Please select the best use of a subVI for the following code.



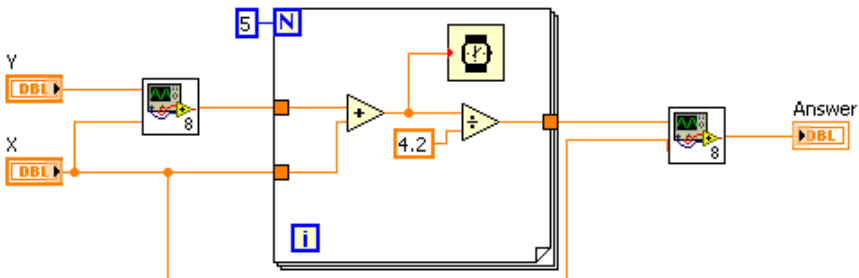
a.



b.



c.



d.

Please name at least four bus structures that different DAQ devices support.

You want to have a warning light on when a particular sequence happens in your system. You should use Generate _____ task timing.

- a. 1 Sample
- b. n Samples
- c. Continuously

You are developing a VI that tests an oscilloscope. You need to send a 1 kHz AC signal when the user presses an external button.

Should you use analog input measurement or analog output generation?

Should you acquire/generate 1 sample, n samples, or acquire/generate continuously?

If you are acquiring/generating n or more samples, what other parameters do you need to specify?

Is a task trigger required?

What is the communicating medium between the device and the application software?

- a. The cable
- b. The VI created in software
- c. The driver engine
- d. The device configures itself to communicate

True or False: A 4-bit counter can count up to 16.

Which of the following terms apply to the state of a digital signal? Choose all that apply.

- a. Red and green
- b. On and off
- c. Go and stop
- d. High and low
- e. + and –
- f. 1 and 0

What is the highest value a 24-bit counter can count to? (Show the formula you use clearly)

- a. 16777215
- b. 16777216
- c. 8388608
- d. 24

Please select all functions provided by the DAQ Signal Accessory from the list below.

- a. Analog Input
- b. Function Generator
- c. Packaged DAQ assistant
- d. Digital Trigger

NI-DAQmx is supported on what operating systems?

- a. Windows
- b. Linux
- c. Mac OS
- d. Both A and B
- e. Both B and C
- f. None of the above.

Please select all of the advantages of using the DAQmx drivers over Traditional NI-DAQ.

- a. Traditional NI-DAQ is packaged with it
- b. Increased performance
- c. DAQ Assistant is included for configuring tasks and channels
- d. Simpler API

You have a 5V peak-to-peak square wave you are trying to view on a test panel in MAX but all that is appearing is a flat line at 0V. Which of the following could be possible problems?

- a. LabVIEW is currently open, but not running a VI.
- b. You are sampling the square wave too quickly.
- c. The square wave source is not connected to the data acquisition device.
- d. Wire is connected to different channel than the one you are viewing.
- e. You have an incompatible version of DAQmx installed.

List the three parts to every DAQ system. Also explain how data flows throughout the system.

The use of Traditional NI-DAQ is required when

- a. Porting an old application to NI-DAQmx.
- b. You are using Windows Vista.
- c. Doing data acquisition with any DAQ device (new or old).
- d. Using a version of LabVIEW earlier than version 7.0.

Why should you use Measurement & Automation Explorer (MAX) when installing a DAQ device?

- a. It cleans up the DAQ device installation files
- b. It rewrites the registry files to be more efficient
- c. It allows 3rd party software to interface with other NI programs
- d. It completes the device configuration and assigns a device number to the device.

A data acquisition system uses a DAQ device to pass a _____ electrical signal to a computer for _____ analysis and data _____.

Match the counter parts to their description.

- a. Count Register
- b. Source
- c. Gate
- d. Output

- 1.____ An input signal that determines if an active edge on the source changes the count
- 2.____ An input signal that can change the current count
- 3.____ Stores the current count of the counter
- 4.____ An output signal that produces pulses

Which of the following timing methods can run the fastest and is the most accurate?

- a. Sample clock
- b. Timed Loop
- c. OS Timer

Match the type of acquisition/generation to the case it fits best:

Controlling the speed of a DC motor _____

Sending three pulses after every button press _____

Monitoring the states of 8 switches _____

Taking temperature readings _____

Signaling an LED when a certain limit is reached _____

Determining the number of times a quadrature encoder is turned _____

- a. Analog Input
- b. Analog Output
- c. Digital Input
- d. Digital Output
- e. Counter Input
- f. Counter Output

In Measurement and Automation Explorer you can simulate which of the following DAQ device(s)?

- a. SCXI devices
- b. GPIB Devices
- c. USB devices
- d. PXI Devices

Which of the following statements correctly describes the functionality of an ADC?

- a. The ADC takes in a series of ones and zeroes and converts them into a voltage signal.
- b. A sample clock controls the rate at which the ADC takes snapshots of the input signal.
- c. A benefit of the ADC is that it can convert the input signal without loss of precision.
- d. The ADC samples the digital signal on each rising or falling edge and converts each sample to a series of ones and zeroes.
- e. A digital trigger controls the rate at which the ADC takes snapshots of the analog signal.

You are acquiring some type of data. However, it seems like you are having some incorrect values from the thermocouples you are reading. You are using an unshielded terminal block with 50 terminals. The terminal block is connected to the DAQ card through an unshielded cable. Explain how you would try to get a better, clearer signal.

This panel shows the routes that can be made within this device.

■ Direct Route
■ Indirect Route Through Subsystem

Sources	Destinations	/Dev1/PFI0	/Dev1/PFI1	/Dev1/PFI2	/Dev1/PFI3	/Dev1/PFI4	/Dev1/PFI5	/Dev1/PFI6	/Dev1/PFI7	/Dev1/PFI8	/Dev1/PFI9	/Dev1/RTSI0
/Dev1/PFI9												
/Dev1/RTSI0												
/Dev1/RTSI1												
/Dev1/RTSI2												
/Dev1/RTSI3												
/Dev1/RTSI4												
/Dev1/RTSI5												
/Dev1/RTSI6												
/Dev1/RTSI7												
/Dev1/ai/SampleClock												
/Dev1/ai/StartTrigger												
/Dev1/ai/ReferenceTrigger												
/Dev1/ao/SampleClock												
/Dev1/ao/StartTrigger												
/Dev1/20MHzTimebase												
/Dev1/ai/ConvertClock												
/Dev1/ai/ConvertClockTimebase												
/Dev1/ai/HoldCompleteEvent												
/Dev1/ai/SampleClockTimebase												

Subsystem Used (Hover over cell to see which one is used)
Counter 0

Can Dev1/PFI9 be internally routed to Dev1/PFI6?

Is Dev1/ai/Start Trigger directly or indirectly routed to Dev1/PFI0?

If the mouse was hovering over the top right yellow block, which system is used to internally route Dev1/PFI9 to Dev1/RTSI0?

Can this system be used in other applications when it is used to internally route lines?

What is the data transfer rate of GPIB communication?

What is the character transmission rate of a serial port if the baud rate is set at 9600 and the character length is 12?

In order to achieve the high data transfer rate that the GPIB was designed for, you should limit the number of _____ on the bus, as well as the _____ between devices. Finally, faster data rates can be achieved with the use of _____ devices and controllers.

You have a device that needs to communicate with your computer. The device and the computer are 40 ft. apart. The device has both GPIB and RS 232 Serial ports. The transfer rate of the device is relatively low at about 100 Kb/s. Which communication protocol should you use and why?

Different types of serial communication protocol can have a different number of devices send commands (driver) and receive commands (receiver). What are the maximum number of devices that can be a driver and receiver when using different types of serial communication protocol? Find values for RS232, RS422 and RS485. You may need to use other resources than your book.

True or False: There are buses made to communicate with instruments through Ethernet, USB, or IEEE 1394 (FireWire) ports using Serial or GPIB commands. When using these buses, you need to remember to program them differently than when using a standard serial or GPIB bus.

True or False: The instrument I/O Assistant is a good option when an instrument driver is not available.

RS-232 uses two voltage states _____ and _____.

Specify which voltage is positive and which is negative.

_____ is positive.

_____ is negative.

Complete the following truth table for RS-232:

Signal > _____ Volts = 0

Signal < _____ Volts = 1

VISA is a ____ level API that calls ____ level drivers.

- a. High/Low
- b. Low/High
- c. Low/Low
- d. High/High

True or False: Data Transfer Termination, or just Termination, is necessary to inform all listeners on the GPIB bus that all data has been transferred.

Which of the following drivers does VISA not communicate with?

- a. GPIB
- b. Serial
- c. DAQ
- d. Ethernet

How many instruments can GPIB support?

- a. 1 controller and 5 additional instruments
- b. 1 controller, 4 talkers, and 4 listeners
- c. 1 controller and 14 additional instruments
- d. 1 controller, 5 talkers, and 5 listeners

Instrument driver VIs can be broken down into six categories. Match these categories with their description.

- a. Initialize
- b. Configure
- c. Action/Status
- d. Data
- e. Utility
- f. Close

- _____ Terminates the software connection to the instrument
- _____ Transfers data to or from the instrument
- _____ Commands the instrument to perform an action or update its condition
- _____ Establishes communication with the instrument
- _____ Software routines that configure the instrument to perform specific operations

Under which folder should one copy an instrument driver library folder for them to appear in the function palette for LabVIEW on a Windows based system?

- a. *C:\Program Files\National Instruments\LabVIEW 8.6*
- b. *C:\Program Files\National Instruments\LabVIEW 8.6\instr.lib*
- c. *C:\Program Files\National Instruments\LabVIEW 8.6\instrumentation*
- d. *C:\Program Files\National Instruments\LabVIEW 8.6\vi.lib*

Some devices bypass the serial port or the computer's GPIB device but still communicate with instruments through serial and GPIB commands. What other communication busses can be used

- a. Ethernet
- b. USB
- c. DVI
- d. IEEE 1394

Identify the communication system that each of the following are associated with; choose either GPIB or Serial or both.

- a. `ibwrt` _____
- b. `\r` _____
- c. `\n` _____
- d. `ibread` _____
- e. `*IDN?` _____

You are communicating with a microcontroller via RS-232 and you are trying to receive the string “Hello World” on the serial port on your computer using LabVIEW. However, the string you are receiving is something similar to “¶ ¶”. Which of the following could be possible problems with your system?

- a. Bad connection between microcontroller and computer.
- b. The communication port is not open.
- c. Data communication rate is set incorrectly.
- d. The data rate is set correctly, but the read serial buffer loop is not correctly timed to pull data from the received serial buffer quickly enough.

Please match the each GPIB device category to its definition.

- | | |
|---------------|--------------------------------|
| a. Controller | 1. Defines communication links |
| b. Talker | 2. Reads data from the GPIB |
| c. Listener | 3. Writes data to the GPIB |

Please define the four parameters that must be specified for serial communication.

Baud Rate:

Data Bits:

Parity Bit:

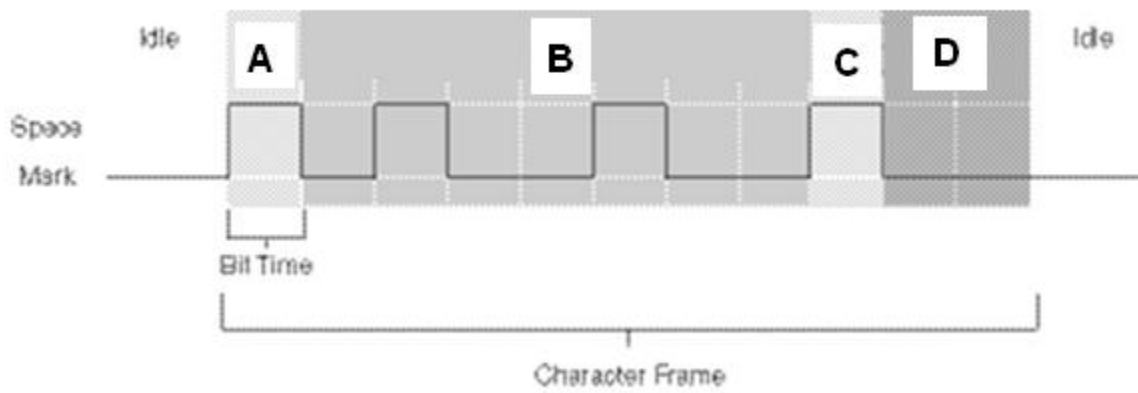
Stop Bits:

Match the characteristics in the right column to the type of instrument control bus in the left column.

1. GPIB
 2. Serial
-
- a. 8-bit parallel communication interface
 - b. Data transfer rate of 1Mbyte/s and higher
 - c. Uses a transmitter to send data one bit at a time
 - d. Data sent over a single communication line
 - e. Use this method when data transfer rates are low
 - f. Categorizes devices as controllers, talkers, or listeners
 - g. Each device has a unique primary address between 0 and 30
 - h. Must specify baud rate, number of bits, parity bit, and number of stop bits

This tests basic knowledge of GPIB and Serial and tests knowledge of the difference between them

Match the bits to their respective position on the character frame.



- ___ Data bit(s)
- ___ Stop bit(s)
- ___ Start bit(s)
- ___ Parity bit(s)

In the _____ palette one can find VIs for serial communication.

In the _____palette one can find VIs, and sometimes examples, for instrument drivers.

True or False: A state machine performs an action for each state in a transition diagram?

Describe the difference between a Moore machine and a Mealy machine. Which type does LabVIEW most commonly implement?

Is it a good idea to utilize a State Machine structure in a VI instead of a simpler sequence structure even if that is all that is required for the task? If so, why?

You have a program that utilizes state machine architecture. You made an enumerated type control with each of the states and copied it throughout your program. You later decided to add a case to your program. When you update the control all of the wires that are connected to the copies of the control break. Why does this happen and what would be a solution?

True or False: An advantage of LabVIEW's dataflow programming is that the programmer does not have to be concerned with the proper order of execution of commands; it is handled automatically by the compiler.

Complete the following sentences.

The best method for controlling the initialization and transition of state machines is the _____ type _____. These are widely used as _____ selectors in state machines.

What are the effects (both positive and negative) that result from using sequence structures? Choose all that apply.

- a. Take advantage of the inherent parallelism in LabVIEW
- b. Guarantee the order of execution
- c. Can stop execution part way through the sequence
- d. Prohibit parallel operations
- e. Cannot stop the execution part way through the sequence

What are the reasons to avoid overusing sequence structures? Choose all that apply.

- a. Sequence structures prohibit parallel operations
- b. Sequence structures force the operation of block diagram objects
- c. You cannot stop a sequence structure partway through
- d. Sequence structures hide code

Pick the methods used to transition among states. Choose all that apply.

- a. Sequence structure
- b. Creating a control
- c. Case structure
- d. Transition array
- e. Transition cluster
- f. State Diagram Toolkit

Choose the answer choice which describes an attribute of State Programming.

- a. Nothing in the code can be changed
- b. Programming will not rely on conditions
- c. The program will run completely and cannot be stopped before the end of the sequence
- d. Some items in the sequence can be set to execute only when certain conditions are met

What is the best method for controlling the initialization and transition of a state machine?

- a. Ring
- b. Enumerated Type Control
- c. Bracelet
- d. AI Control
- e. CTR Control

True or False: Parallel tasks can run simultaneously even if they have data dependencies.

Choose four components which are required for a state machine:

- a. Stop Button
- b. Case Structure
- c. Dialog Box
- d. Shift Register
- e. State Functionality Code
- f. Comparison Statement
- g. While Loop

There are many methods to perform sequential tasks in LabVIEW. Which of the following are applicable methods?

- a. Placing each task in separate while loops from left to right in your main VI and wiring them in the order you want them executed.
- b. Use of a sequence structure will force the order of operations.
- c. Placing your tasks in order from top to bottom in your VI.
- d. The use of Error Clusters to control data flow.

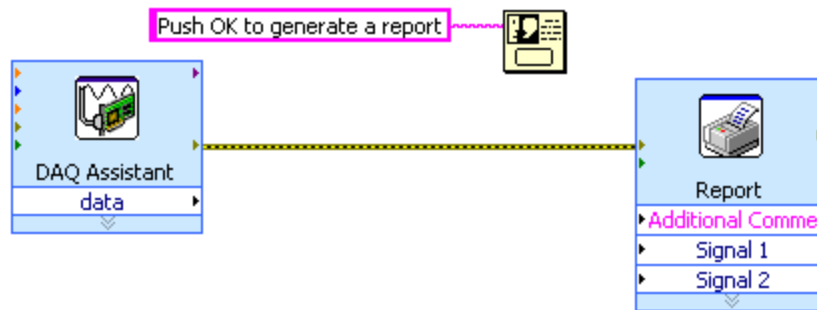
Which of the following is generally considered to be a more appropriate method to incorporate correct execution order of functions or sub-VIs that come without an error cluster on the connector pane?

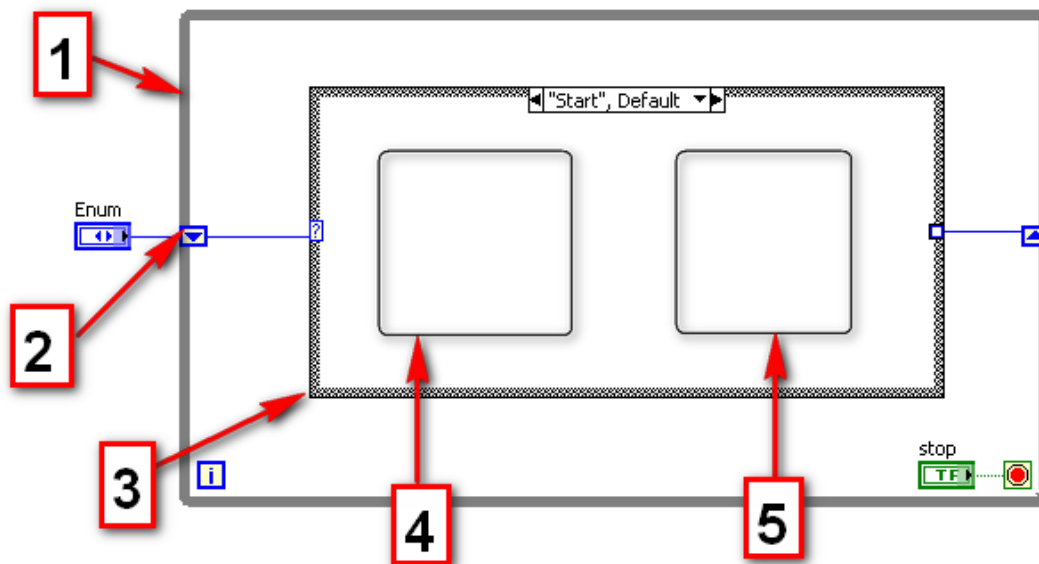
- a. An Error Cluster into a Case Structure
- b. A Sequence Structure

LabVIEW's state machine design pattern template implements an algorithm described by what type of state machine?

- a. Mealy machine
- b. Moore machine
- c. Both A and B
- d. None of the above

Force the One Button Dialog VI to execute between the express VIs. Do this without the use of a sequence structure. Notice that the One Button Dialog VI doesn't use error clusters.





A State Machine Infrastructure has five components which are each identified in the figure above. Label each component of the LabVIEW block diagram. The two empty boxes symbolize where the two types of state machine code should be placed. Give the names for both types of code.

1. _____
2. _____
3. _____
4. _____
5. _____

A Timing / Wait mechanism is usually required within a loop to keep the code from using all of the processor time.

True or False: A Wait (ms) VI wired with a constant of zero has the same effect as no wait VI at all.

Determine whether a state machine or a simple VI architecture is appropriate in each case:

For functional components within larger applications: _____

For dividing a VI into several simpler tasks: _____

For VIs that act as a user interface: _____

For a single task: _____

You have a system that measures a voltage signal at 1000 KHz. For each point that is measured, you want to perform some complex software manipulation. The problem is that the software manipulation takes longer than the time between each sample. What type of loop architecture would best suit this problem?

- a. Master/Slave
- b. Producer/Consumer

Why should you insert a timing function in a continually executing VI?

Each state of the state machine is:

- a. A separate VI
- b. A separate array
- c. A separate while loop
- d. A separate case in a Case Structure

True or False: In a Master/Slave Loop Design, the slave loop must run at the same rate as the master.

_____ are used for communication between producer and consumer loops

A _____ is a memory device that stores temporary data among two devices.

_____ functions allow you to store a set of data that can be passed among multiple loops running _____ or among Vis.

Use the _____ design pattern when you need a VI to respond to user interface controls while simultaneously collecting data.

Use the _____ design pattern when you must acquire multiple sets of data that must be processed in order.

You have a program that you would like to have run at one hour intervals throughout the day. The program takes five minutes to complete. Your friend tells you that you can use the Wait (ms) function and use 3300000 (55 minutes) as the constant. What is a better way to establish a wait time?

Parallelism refers to:

- a. Two things happening side by side
- b. Two things happening at the same time on different computers
- c. Executing multiple tasks at the same time
- d. The front panel and block diagram running at the same time

Choose the benefits of implementing a state machine design pattern from the list below.

- a. Make the block diagram larger and easier to see
- b. Make the block diagram smaller
- c. Each case determines the next state
- d. Executes every frame in sequence

Match the words with their descriptions.

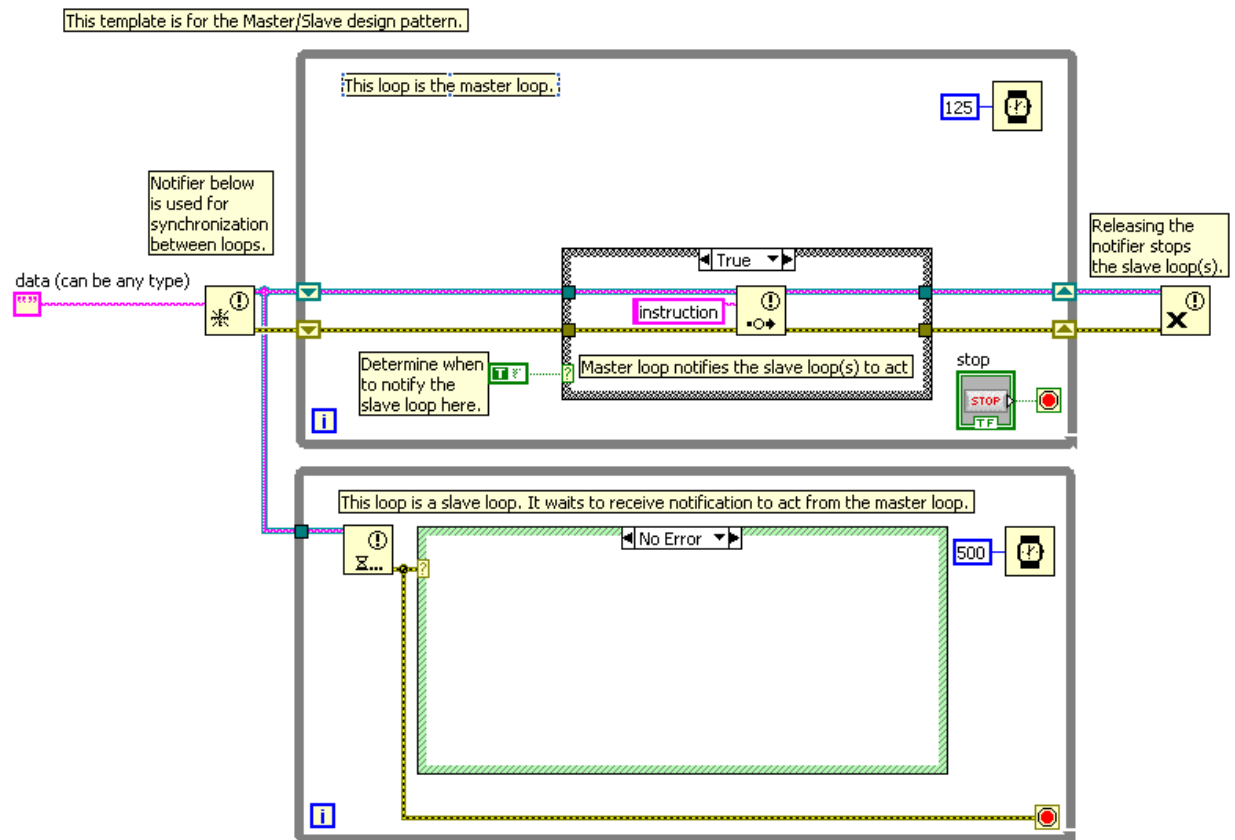
1. Buffers

2. Queues

A. are memory devices that store temporary data among two devices.

B. are functions that allow you to store a set of data that can be passed among multiple loops running simultaneously or among Vis.

Below is a program that uses master/slave architecture. The run arrow is not broken; however, this program will not function correctly. What is wrong with it?



True or False: It is necessary to create a Project File in order to create a Shared Variable.

A structure that uses an uninitialized shift register and a _____ is called a functional _____ variable.

What is another method of accomplishing the same task that a shift register performs in LabVIEW?

Determine if the each of the following require a local or global variable:

Sending a stop Boolean to two while loops running in parallel _____

Sending a stop Boolean to two VIs running in parallel _____

Storing data for access among several VIs _____

Storing data in a front panel control or indicator _____

Updating a numeric indicator if the value is out of range _____

Accessing some acquired data with another VI _____

A Local Variable is accessible from multiple VI's. True or False?

- a. True
- b. False

Please select all of the reasons why it is advantageous to use descriptive labels for controls and indicators.

- a. The code is more readable
- b. Simple identification mistakes can be avoided
- c. Creating a variable is more intuitive
- d. It serves as additional documentation

What are some good techniques to avoid race conditions?

- a. Specifying execution order
- b. Controlling and limiting shared resources
- c. Protecting critical sections within your code
- d. Using local variables instead of global

(1)_____ variables store data in front panels controls and indicators.

(2) _____ variables and (3)_____ variables store data in special repositories that you can access from multiple VIs.

(4)_____ variables store data in While Loop shift registers

Fill in the blanks with the appropriate selection:

- a) Global
- b) Local
- c) Functional global
- d) Single processed shared

To mark a VI as non-reentrant means that...

- a. After it is executed once in the code, that sub-VI cannot be called again until LabVIEW is restarted.
- b. It can only be accessed by one process at a time.
- c. Calls to multiple instances of it can execute in parallel with distinct and separate data storage.

In LabVIEW, what defines the execution order of block diagram elements?

- a. Sequential order of commands
- b. Command list
- c. Flow of data
- d. VI last selected in the block diagram

With specific respect to Producer/Consumer Architecture, Queues can be used to pass data from one loop to another one running in parallel. What happens when the buffer is written to too quickly and overflows? How about when the buffer isn't written to quickly enough and it is empty?

- a. The program will crash if either event occurs.
- b. If consumption is slower than production, producer code will be forced to wait until the consumer has dequeued an element. If consumption is faster than production, the consumer code will be forced to wait until the producer has queued an element.
- c. If consumption is slower than production, a buffer overflow error will occur. If consumption is faster than production, the code will execute the consumer code on the last received data.

Fill in the blank in this sentence.

A _____ provides the elegant implementation of the master/slave design pattern for data transfer because it sends a signal when the data is ready and removes any issues with race conditions.

It is important to use variables correctly in your VI. To initialize a local or global variable properly, verify that it contains the expected data value before the VI runs. If you do not initialize the variable before the VI reads it for the first time, the variable will contain _____.

Finish the sentence.

Explain the difference between Master/Slave and Producer/Consumer loop architecture.

Name one way to protect the critical section of your code and give a brief description of this method.

Which of the following statements about the use of variables in LabVIEW (and other dataflow languages) are true?

- a. Block diagrams can become more difficult to read.
- b. Variables make it easy to share data between multiple VIs running on the same computer.
- c. Variables make it easy to share data between multiple VIs running on different computers across a network.
- d. Variables can cause unexpected VI behavior.
- e. Variables can slow performance.
- f. There are some cases when a variable is the only way to accomplish a task.

What is this a picture of?



- a. Local Variable not associated with a control or indicator
- b. Local Variable that has had its control or indicator deleted
- c. Local Variable that was given a wrong data type
- d. Global Variable that lost its connection between VIs

What is the difference between these local variables?



- a. The top variable is set to read and the bottom is set to write
- b. The top variable is set to write and the bottom variable is set to read
- c. The bottom variable is a cluster of Boolean values
- d. The bottom variable corresponds to an indicator and the top corresponds to a control

True or False: A Local Variable can be written to or read from regardless of whether it is a control or indicator.

Name one good programming technique that will help you avoid race conditions.

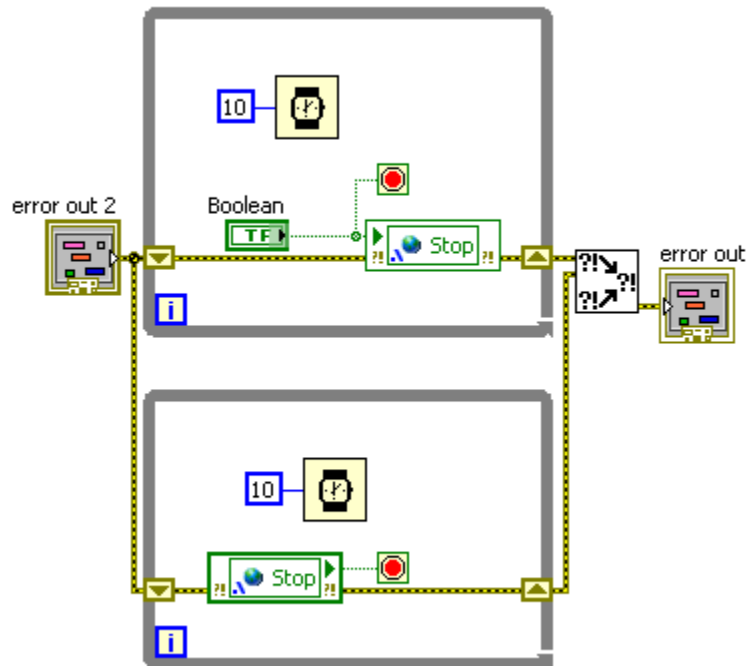
When the user creates a global variable, LabVIEW automatically creates a special global VI which only has a _____.

- a. Block Diagram
- b. Front Panel
- c. File Path
- d. Label

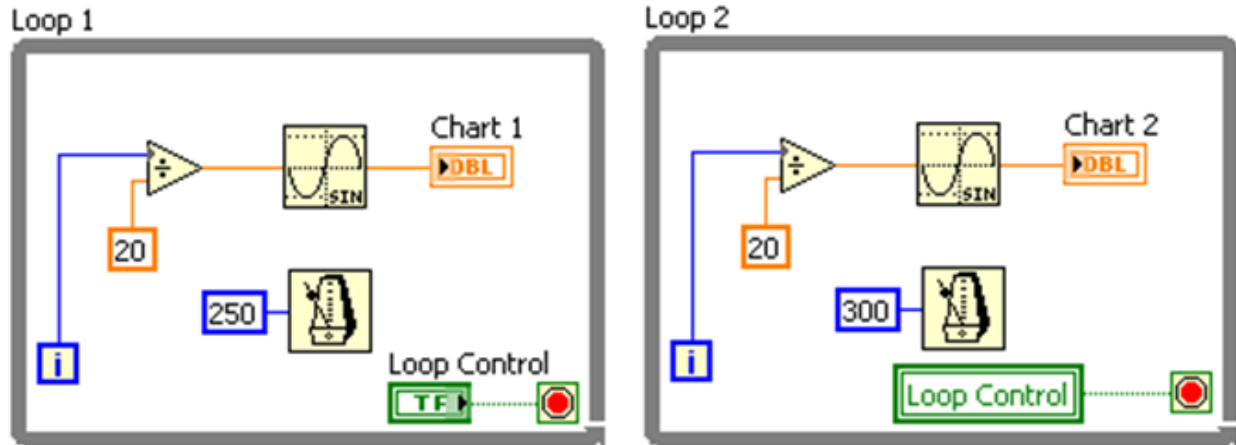
Match the following types of Labview Variable to their usage:

- | | |
|--------------------|---|
| 1) Local Variable | A) Share data among VI's on different computers |
| 2) Global Variable | B) Share data among multiple VI's on one computer |
| 3) Shared Variable | C) Share data within a single VI |

The block diagram below displays a common mistake when using variables. The shared variable `Stop` synchronizes the stop conditions for two loops. Determine the behavior of this code and diagnose the problem and solution.



Which loop will be the first to execute its first iteration?



- a. Loop 1
- b. Loop 2
- c. They will execute in parallel
- d. No way to tell

An event is a(n) _____ notification that something has occurred.

In an _____ program, events that occur during execution directly influence the execution flow. In a _____ program, all execution is predetermined and follows a sequential order.

Should the event structure be located in the producer loop or the consumer loop, if you are using an event structure and the producer / consumer architecture to continuously and asynchronously monitor and update the front panel with user inputs?

Complete the following sentence.

There are two types of user interface events-_____ and _____.

Match your answers from the above sentence to the definitions below.

_____ events are an indication that a user action has already occurred, such as when the user has changed the value of a control.

_____ events inform you that the user has performed an action before LabVIEW processes it, which allows you to customize how the program responds to interactions with the user interface.

A developer is designing a program that uses event structures. The front panel of the program has ten buttons on it, and each button corresponds to an action that the program must execute. The event structure has an event set up to run for each of the buttons. Each of these events takes about one minute to complete. The user wants to be able to tell the program to complete three of these tasks in sequence; however, he or she must wait for each action to complete before he or she can select the next task from the front panel. What should the developer of the program do to fix this issue?

True or False: You can turn off front panel locking for both notify and filter events. This dialog box is found in the edit events dialog box

True or False: You want to make the close button on the front panel of a VI not work and display a message when clicked. You would want to use a filter event.

Dynamic event registration avoids the limitations of static registration by integrating event registration with _____, which allows you to use Application, VI, and control references to specify at run time the objects for which you want to generate events.

- a. The VI Server
- b. MAX
- c. A cluster of global variables

True or False: If you wire a value to the timeout terminal in an event structure, you **MUST** have a timeout event.

Which of the following events are supported by LabVIEW?

- a. A hardware timing signal that determines when data acquisition is complete
- b. A mouse click that starts data acquisition
- c. A property node that signals a change in a variable's value
- d. An external trigger that signals when an error occurs
- e. A key press that exits the VI

True or False: LabVIEW does not support external I/O events.

Please select all advantages of using user interface events.

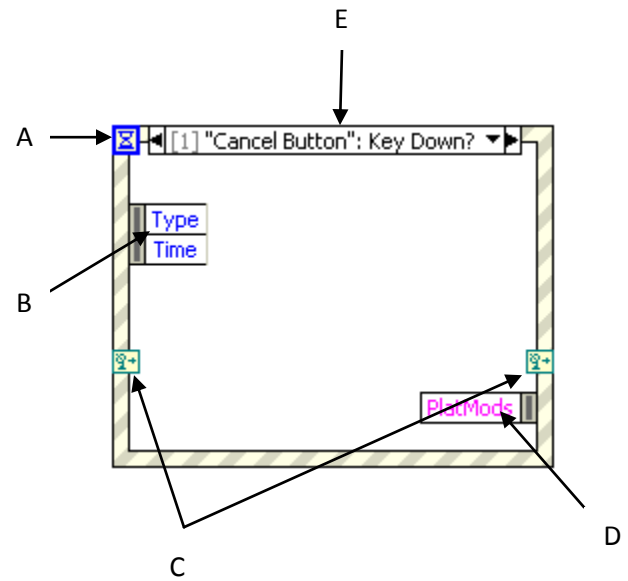
- a. Events allow synchronization with user actions on the front panel
- b. Events are automatically aware of the actions of other programs
- c. Events remove the need to poll the state of front panel objects
- d. Events allow specific event handling based on user actions

True or false: You must wire event structure output tunnels in every case.

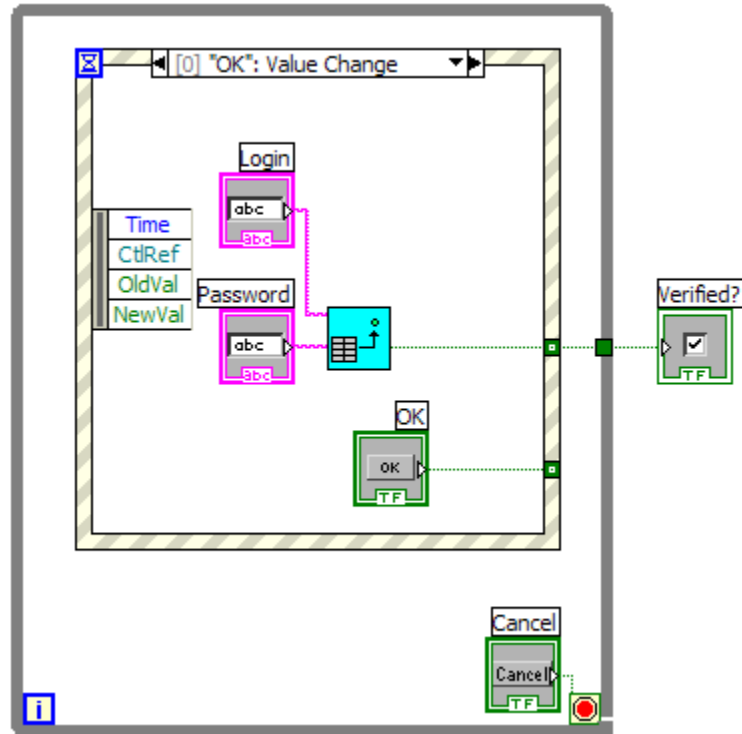
The Event Structure works like a _____ with a built-in _____ on _____ function.

Match the event structure components to the picture.

1. ____ Dynamic Data Terminals
2. ____ Timeout Terminal
3. ____ Event Selector Label
4. ____ Event Data Node
5. ____ Event Filter Node

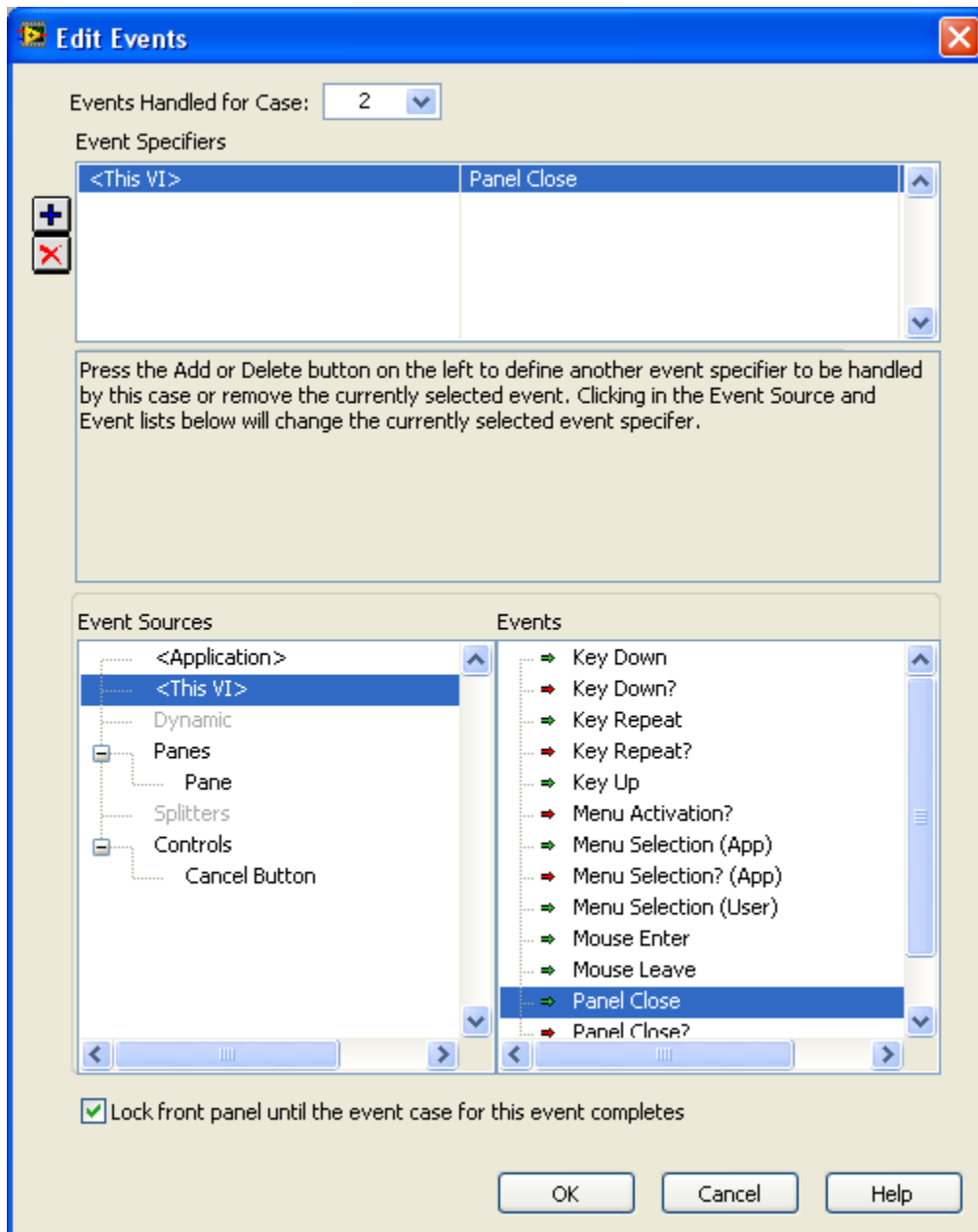


The following code appears to be unresponsive when a user clicks the cancel button:



Explain why this error is occurring and how it can be fixed.

True or False: In the edit events dialog box, the red arrow represent filter events and the green arrow represent notify events.



True or False: Refactored code performs the same function as the inherited code.

Creating well-designed software facilitates rapid _____ and decreases possible _____ .

If the block diagram is not readable, but the VI works, should the VI be rewritten? Why or why not?

The key combination _____ can be used to help align and reorder nodes on a block diagram.

True or False: When refactoring VIs, it is better to make small, incremental changes and test the VI after each change.

Briefly describe the tradeoff between Refactoring a piece of code as opposed to Optimizing its Performance.

Match the following terms to the most appropriate option: Refactoring, Performance Optimization

_____ - makes the VI easier for a computer to process.

_____ - makes the VI easier for a human to understand.

True or False: The block diagram cleanup tool can assist in refactoring a VI?

What problems should be solved by refactoring code?

- a. Overly large block diagram
- b. Poorly named objects
- c. Broken run arrow
- d. Duplicated logic
- e. Unnecessary logic

If possible, the size of a block diagram should be no larger than _____

Which of the following are attributes of good programming practice using LabVIEW?

- a. Using descriptive labels for controls and indicators
- b. Creating custom icons for subVIs
- c. Saving subVIs with descriptive names
- d. Keeping the block diagram to scrolling only one direction
- e. Using subVIs
- f. Placing all controls together and all indicators together on the block diagram

Choose the conditions that might warrant refactoring a VI.

- a. Dataflow moving from left to right.
- b. Dataflow moving from right to left.
- c. Multiple subVIs.
- d. Lack of modularity.
- e. Large white space in block diagram in False case of case structure.
- f. Lack of comments.
- g. Use of Express VIs.
- h. Unnecessary logic (e.g. not using auto indexing on for loops).

Determine a meaningful name for each of the following controls or VIs. Why would creating meaningful names be important to a VI?

- a. A Boolean control that signals when the application has finished acquiring temperature values for 5 minutes
- b. A SubVI that takes a username and password and outputs a true if the password is correct for the username
- c. A VI that takes an array and determines the mean, median, mode and standard deviation of the array values
- d. A graph indicator that displays voltages acquired over 200 samples from a thermocouple

You have inherited a functional VI from a co-worker. You are required to add functionality to this VI, but it is very difficult to understand the code. Please order the following actions in the sequence you would use them to implement your additional functionality and for use in the future. All actions may not be required.

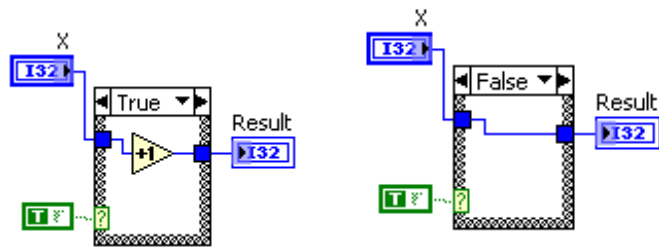
- a. Analyze the code to understand its purpose
- b. Remove unnecessary logic
- c. Program the additional functionality
- d. Shrink the block diagram as much as possible
- e. Relabel controls and indicators with meaningful names
- f. Replace repetitive code with subVIs
- g. Simplify algorithms
- h. Replace sequence structures and local variables with data flow wires

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

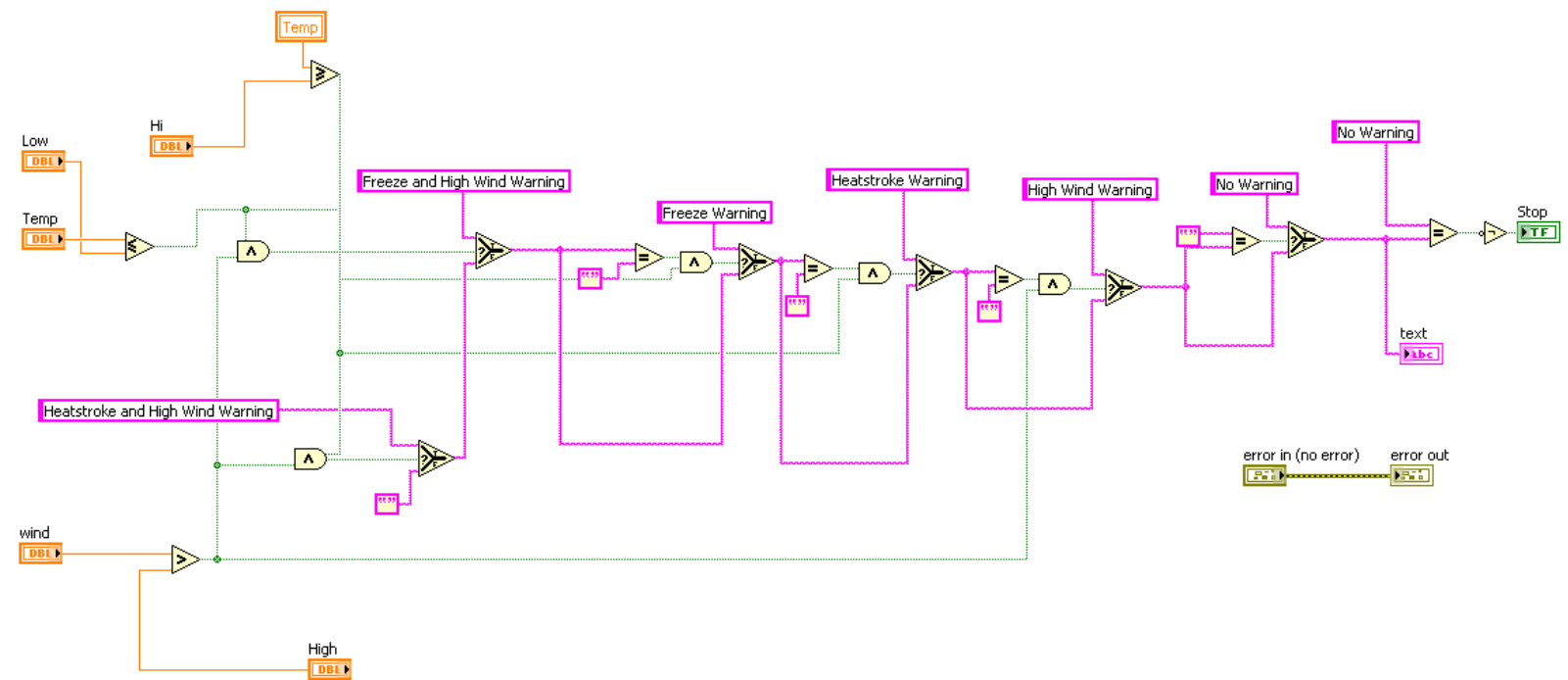
Briefly describe one situation where creating a subVI would improve code design.

You want to increment X when True, do nothing when False, and show the result in the Result indicator.

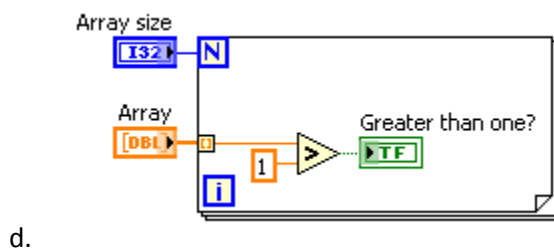
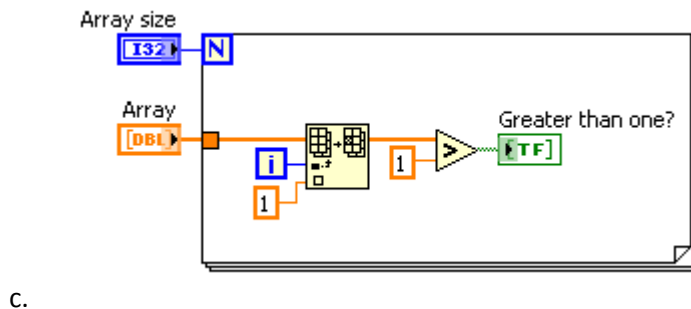
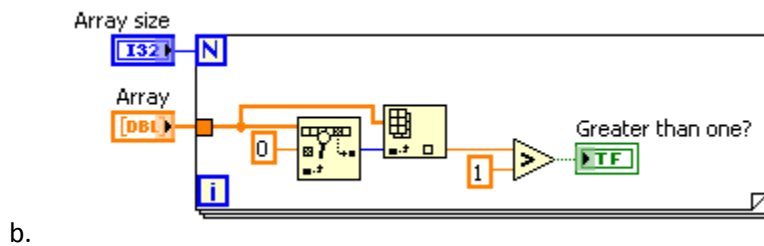
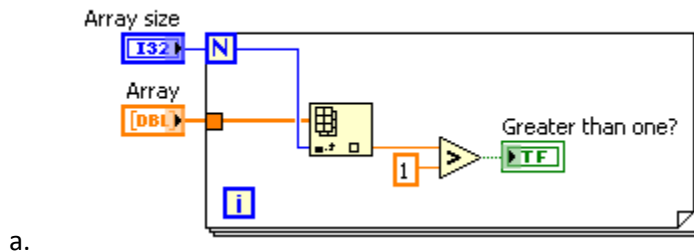
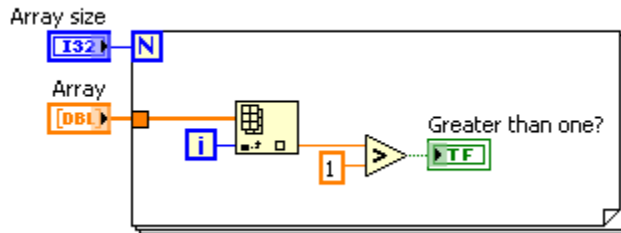
What is wrong with the following VI (True and False cases shown)? How should it be fixed?



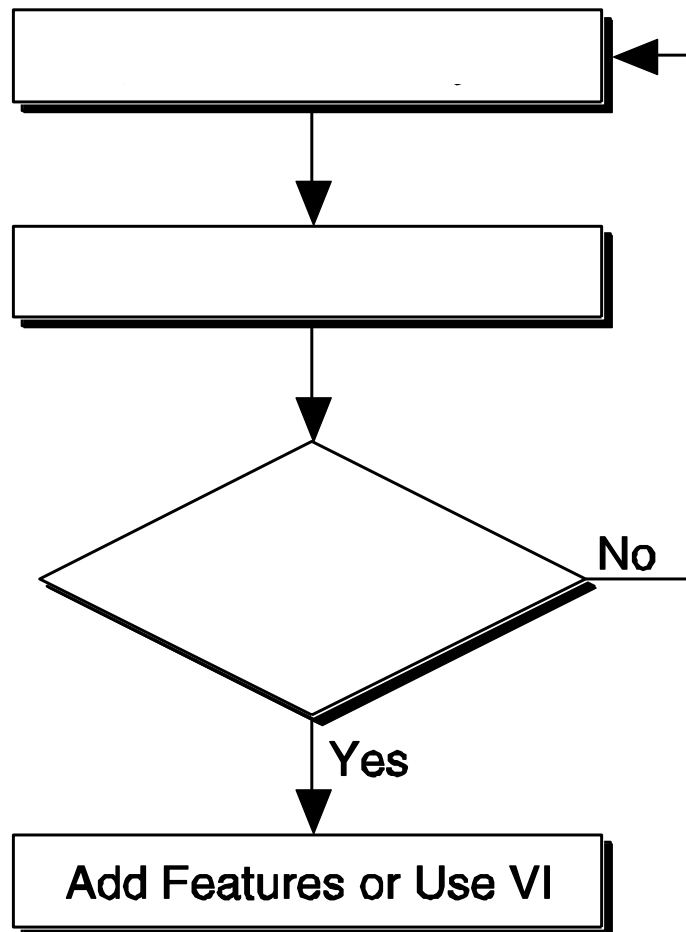
What should be refactored in this block diagram?



Given the following code, which of the following would be a good way to remove the unnecessary indexing logic yet still accomplish the task of indicating that the current indexed element is greater than one?



Please fill in the flow chart below with the proper steps for refactoring a VI.



True or False: Each front panel object is allowed to have one property node associated to it. True or False

The _____ function stops all executing VIs and ends the current instance of LabVIEW.

Illustrate how LabVIEW employs object-oriented programming by giving an example object from a LabVIEW class that you know of.

Determine whether a property node or invoke node would be appropriate in each case:

- _____ Resize a front panel control programmatically
- _____ Center the front panel when the VI runs
- _____ Hide a graph before data acquisition
- _____ Make an LED begin blinking when an invalid string is entered
- _____ Export an image of a graph indicator
- _____ Reinitialize all front panel controls to their default value

True or False: You can change the color of decorations programmatically using properties nodes.

Choose all that apply to LabVIEW VI Server Architecture.

- a. It is an object-oriented feature of LabVIEW
- b. It is a JAVA feature of LabVIEW
- c. Invoke and properties nodes use the VI Server
- d. Provides programmatic access to LabVIEW
- e. Provide dataflow programming for LabVIEW
- f. Only works on Window versions of LabVIEW

When a property node is placed in a subVI, which of the following is true? Choose all that apply.

- a) The front panel object that the property node is linked to is no longer seen on the front panel
- b) A copy of the property node is placed in the subVI
- c) A control reference is needed to explicitly link the property node
- d) One of the above
- e) Two of the above
- f) None of the above

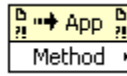
True or False: Property nodes execute top to bottom.

Please select the correct statements regarding the characteristics of generic and specific refnum classes.

- a. A specific refnum class will only have properties specific to that class
- b. Both generic and specific refnum classes share some properties
- c. Specific refnum classes have more properties available than generic classes
- d. A generic refnum class is more restrictive than a specific refnum class

Explain the purpose of property nodes.

What is the name of this block diagram object? Hint: It appears this way when first dropped into the block diagram, before it is wired to a control reference.

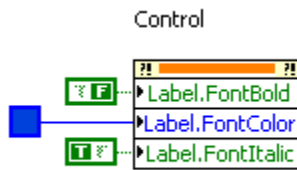


- a. Formula Node
- b. Script Node
- c. Invoke Node
- d. Property Node
- e. Constructor Node

Which of the following statements are true? Choose all that apply.

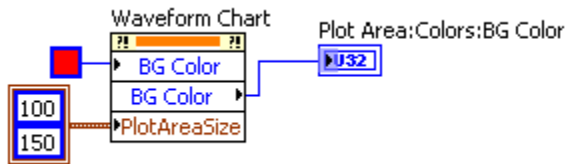
- a. A class is part of an object
- b. An object is a part of a class
- c. Objects can have methods and properties
- d. Properties are attributes of an object
- e. Methods are specific to objects
- f. Properties and methods are defined in a class

This is a property node for a front panel control. What will this node do?



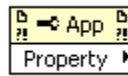
- a. Change the control label font to bold, italic and the color blue
- b. Change the control label font to italic and the color blue
- c. Nothing, there is no wire at the top of the property node for the reference.
- d. Change the text of the control to italic and the color blue

What does this property node do?

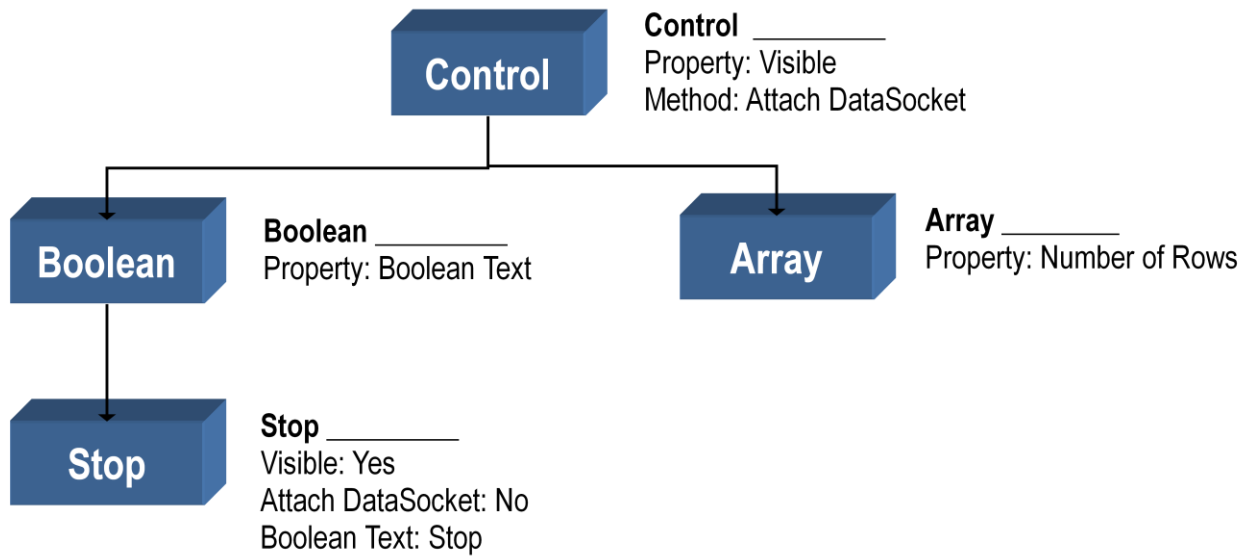


- a. Changes the background to red, displays the background color as an integer, changes the width of the display to 100 and the height to 150.
- b. Changes the background to red, displays the background color as an integer, changes the width of the display to 150 and the height to 100.
- c. Changes the background to red, displays the background color as a color box, changes the width of the display to 150 and the height to 100.
- d. Changes the background to red, displays the background color as a color box, changes the width of the display to 100 and the height to 150.

What is the name of this block diagram object? Hint: It appears this way when first dropped into the block diagram, before it is wired to a control reference.



Please fill in whether a blue box contains a Class, Sub-Class, or Object



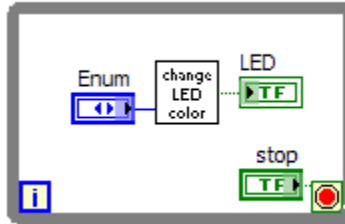
How can you change a property node from read to write?

Which of these options are available when creating a method for a VI class?

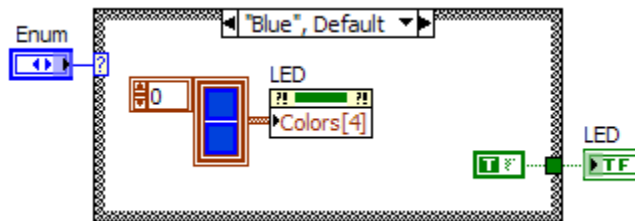
- a. VI to HTML
- b. VI to RTF
- c. VI to printer
- d. VI to text
- e. Block diagram to printer
- f. Panel to printer

The following code changes the color of an LED based on an enumeration of four colors (Blue, Green, Yellow, Red):

Main Code



Change LED Color SubVI Code



When this code is run, the LED on the front panel fails to change color for every value of the enumeration. Explain why this error occurs and how to fix it.

The ____ VI is one way to view data within TDMS files.

TDMS stands for “Technical Data _____ Streaming”

Why should one be aware of the endianness of a binary file?

The ____ VI reads TDMS files and outputs the group and channel names as well as the data from the TDMS file.

True or False: You can read and write from a TDMS file concurrently?

Which of the following are properties of datalog files? Choose all that apply.

- a. Number of Records
- b. Channel Grouping
- c. Set properties
- d. The Record(s)
- e. Current read position
- f. Data output

What are the accepted data types when writing to a binary file? Chose all that apply.

- a. Double
- b. Integer
- c. Boolean
- d. Waveform
- e. Dynamic

True or False: TDMS is a data model created by National Instruments hence it is not possible to create third party programs to write and read TDMS files.

True or False: The .tdms_index can be regenerated from the .tdms file, but the converse cannot be done (can't recreate .tdms from .tdms_index).

Each character in an ASCII string takes up exactly _____ of memory. Choose amongst the following to fill in the blank.

- a. 4 bytes
- b. 1 bit
- c. 1 byte
- d. 8 bytes
- e. 4 bits
- f. 1 nibble
- g. 1 megabyte

Which of the following file formats is the most compact and fastest for storing data?

- a. ASCII
- b. TMDS
- c. Binary
- d. PDF

Compare and contrast when to use text and binary files.

What is best file type to use when collaborating with multiple people with different data analysis software (non-NI)?

- a. Tab-delimited ASCII
- b. Custom binary format
- c. TDMS
- d. Datalog

True or False: All files written to your computer's hard drive are a series of binary bits.

What does TDMS stand for?

Which of the following best describes the principles of datalog files?

- a. Datalog files are best used to store arrays of clusters because they can store data in either binary or ASCII format
- b. Datalog files are best used to store arrays of data logs because they provide efficient storage and random access
- c. Datalog files are best used to store arrays of clusters but if you lose the definition of the cluster, the files becomes difficult to decode
- d. Datalog files are best used to store arrays of clusters because they are easily accessible in every environment including LabVIEW

Fill in the blanks in the following paragraph:

When reading a binary file, there are two methods of accessing data; _____ and _____ access.

Using the _____ access method, you read each item in order, starting at the beginning of a file. Alternately, in the _____ access method, you access data at an arbitrary point within the file.

Match each data type to its binary representation in LabVIEW:

Boolean _____
String _____
Double Precision Numeric _____
Array Header _____
Multi-byte integer _____

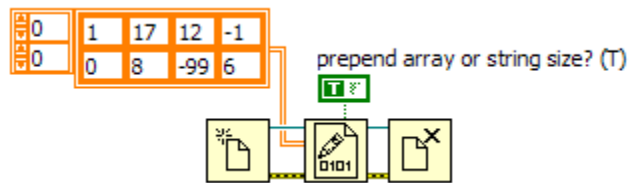
- a. 32-bit integer
- b. Little Endian or Big Endian Bytes
- c. 8-bit value
- d. 64-bit value
- e. A series of unsigned 8-bit integers

You are using LabVIEW to collect temperature data from multiple sensors. You are asked to run a 1 hour test everyday for one week. You decide you need to log the data in a file that can be later used for analysis. Which file format is best to use? Why? (Choose from text, binary, datalog, or TDMS)

Compare and contrast text (ASCII) files and binary files.

The TDMS file format contains two files, the .tdms_index file and the .tdms file. Explain the purposes and properties of each file. Also include any information pertaining to the sharing and distribution of these files.

The following code writes a 2D array of double precision numbers to a binary file:



If the binary file is then read with a byte offset of 40, what is the first value that is read?

- a. -1
- b. 0
- c. 1
- d. 6
- e. None of the above, the byte offset is too large

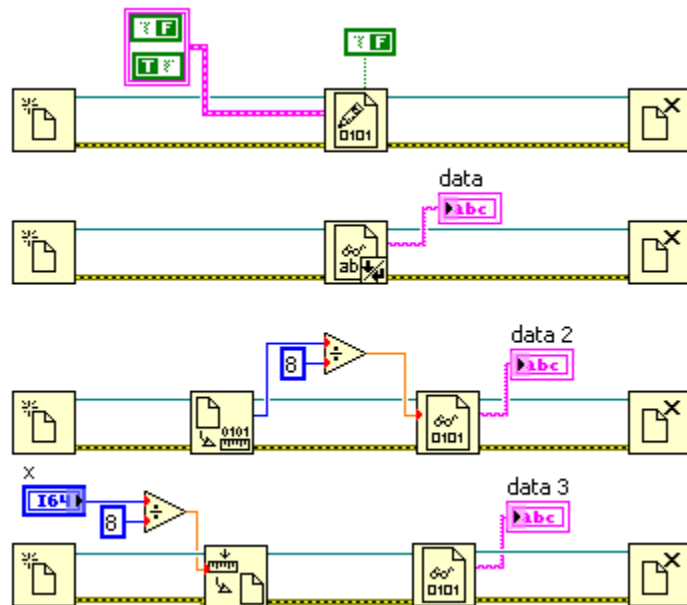
Please match the file types and uses to their respective code.

a. Read Binary File

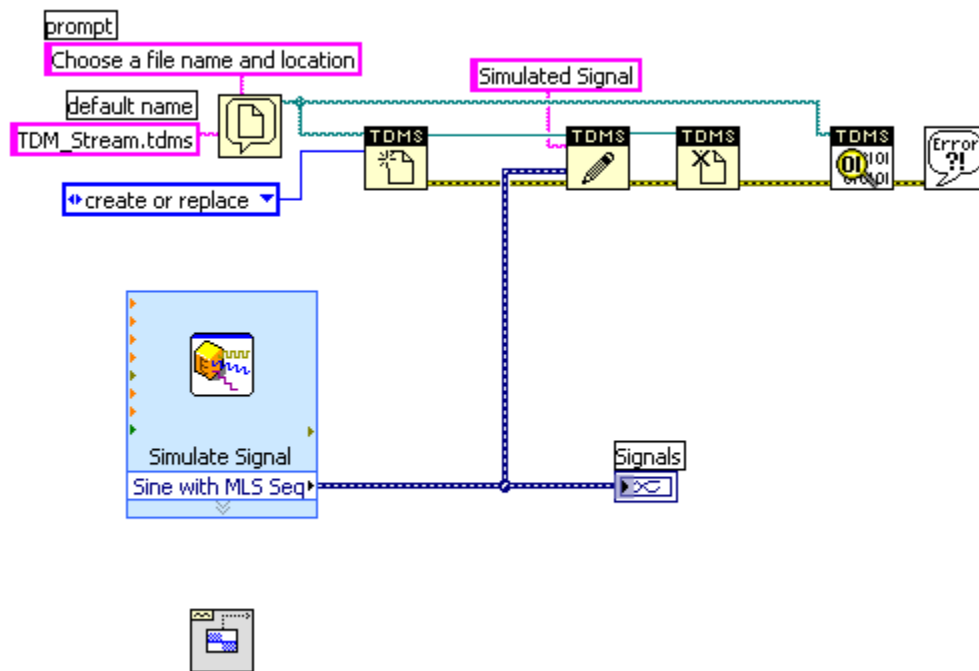
b. Random Access

c. Read ASCII File

d. Sequential Read



Modify the block diagram below to add the output of the Square Waveform.vi block to the TDMS file as an additional channel.



How do you force VI programmers to leave revision comments on a VI they are editing?

What are relative paths and why are they an important consideration when building applications for distribution?

Your application requires that you have a very simple standalone program to log data from a USB-6008 on a computer with no National Instruments products installed, what should be included in your installer?

What is the main step that needs to be taken before being able to building an executable?

Using constants for file names can be a bad idea when building executables. Why is this a bad idea?

For large installers, it is possible to split an installer across multiple types of media such as CDs or DVDs. This option is located in the _____ category of _____, which is reached from the project explorer.

True or False: You can view the block diagram of an executable made from LabVIEW?

The VI Hierarchy is helpful for maintaining an organized view of your VI. Please select all attributes of the VI Hierarchy.

- a. Accessed from View > VI Hierarchy
- b. Shows all connections between VIs and subVIs as well as the additional functions they use
- c. Shows files that the VI has written to or read from
- d. Shows globals and type definitions

What versions of LabVIEW can build executables?

- a. Base
- b. Full
- c. Professional
- d. Developer Suite

In a stand-alone application, the top-level VI is usually tasked with quitting LabVIEW when the program is finished running. What is the easiest method of doing this?

- a. Issuing a “Quit” command to the LabVIEW .dll from the top-level VI.
- b. Placing a “True” Boolean constant wired to a Close.LabVIEW property node on the top-level VI.
- c. Call the “Quit LabVIEW” function on the block diagram of the top-level VI.

You are planning on building an installer to use on multiple computers. These computers will not have LabVIEW installed on them. What must you include as an additional installer?

- a. The original VI
- b. Full version of LabVIEW
- c. LabVIEW Run-Time Engine
- d. The built in sub VIs that come with LabVIEW

Which of the following choices describe the most compelling situation to create an Installer instead of simply compiling your VI to an executable file?

- a. The need to distribute your application to a system that does not have LabVIEW installed.
- b. The program contains many VIs.
- c. The entire Block diagram of the main VI cannot be seen without scrolling its window.
- d. The program uses one or more libraries.

What is required for running a stand-alone LabVIEW application?

When using a custom scale in your DAQ Assistant, does the Application Builder automatically include the scale used or do you have to manually add it to the builder?

True or False: In order to run an application, LabVIEW must be installed.

You created a stand-alone LabVIEW application. The application runs without warnings and functions as it should. However, the top level front panel remains open even after the application has finished processing. How can you fix this situation?

Which of the following are true about the VI Revision History?

- a. You can view the development history of the VI by selecting Tools » VI Revision History
- b. Revision numbers increment every time you save the VI
- c. You can set Revision History options for specific VIs
- d. Revision numbers for a VI always start at 1