Lesson 2
Navigating LabVIEW

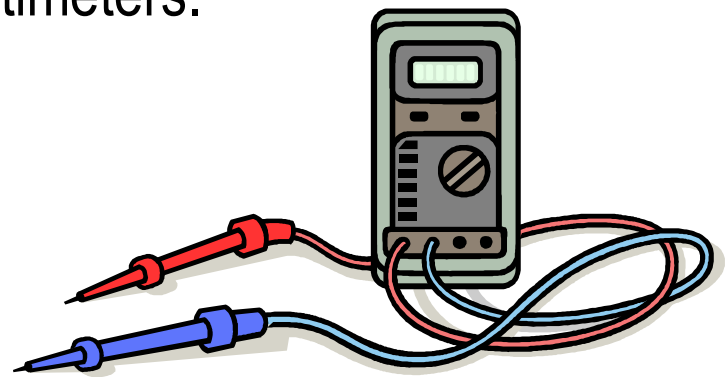
TOPICS

A. Virtual Instruments (VIs)
B. Parts of a VI
C. Starting a VI
D. Project Explorer
E. Front Panel
F. Block Diagram
G. Searching for Controls, VIs and Functions
H. Selecting a Tool
I. Dataflow
J. Building a Simple VI

A. Virtual Instruments (VIs)

Virtual Instrument (VI) – A LabVIEW program

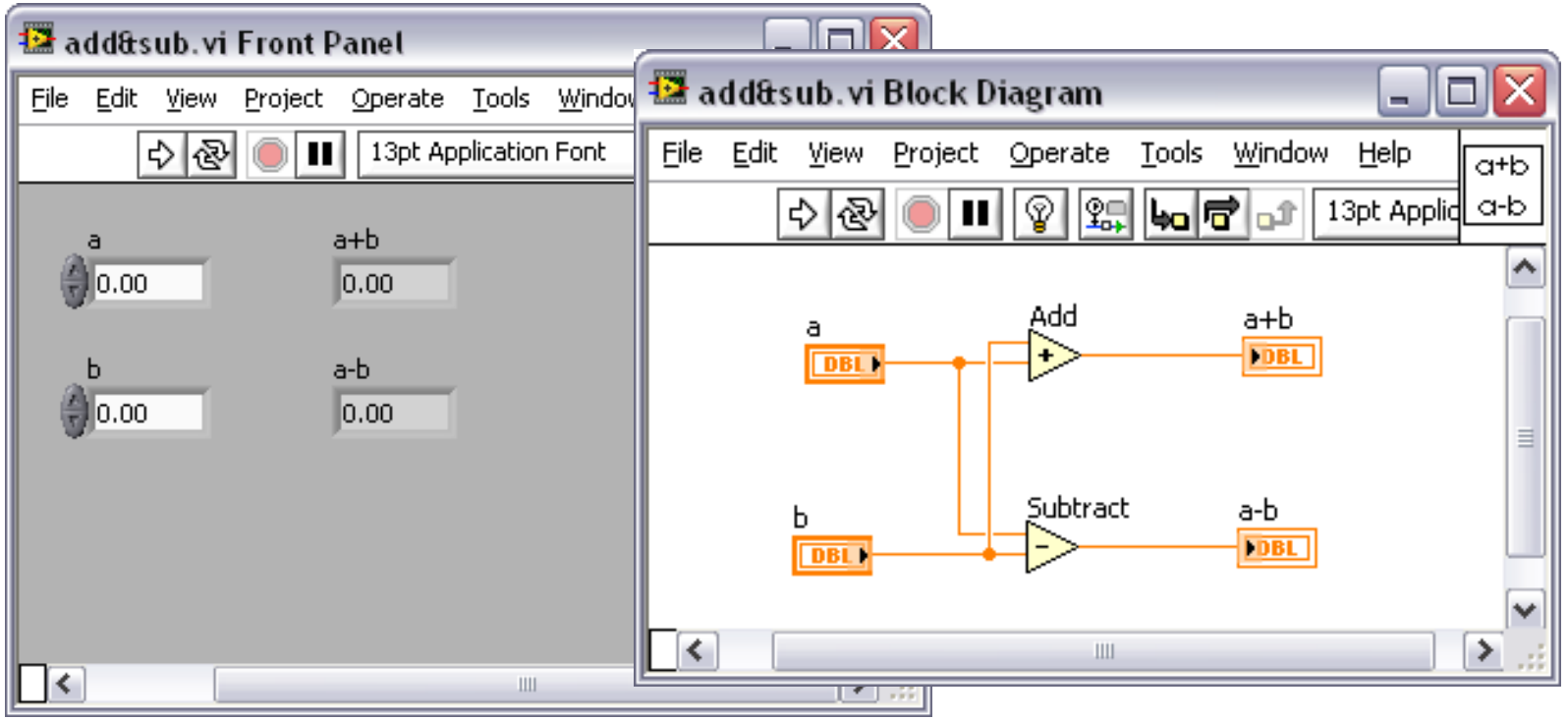
The appearance and operation of VIs imitate physical instruments, such as oscilloscopes and digital multimeters.



B. Parts of a VI

LabVIEW VIs contain three main components:

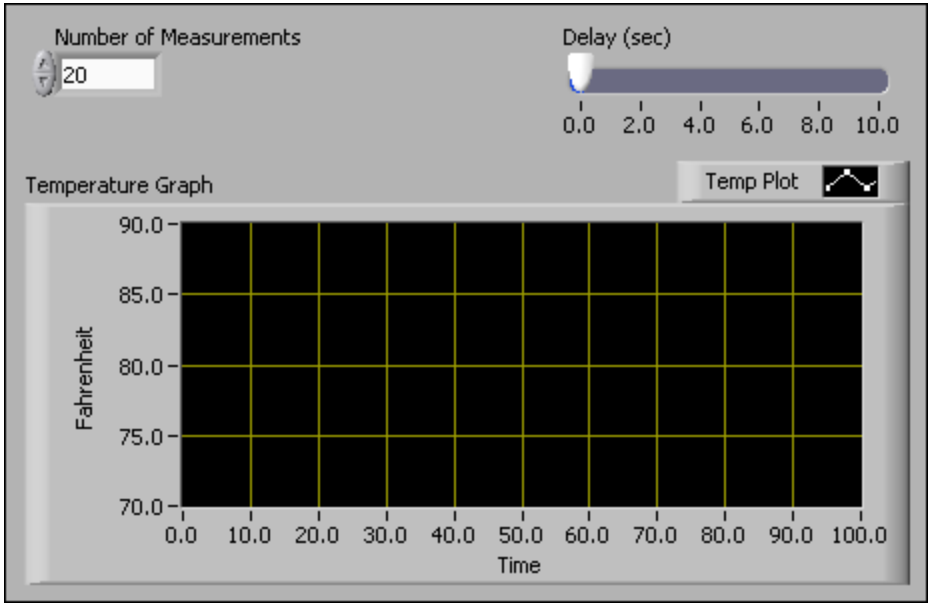
1. Front Panel 2. Block Diagram 3. Icon/Connector Pane



B. Parts of a VI – Front Panel

Front Panel – User interface for the VI

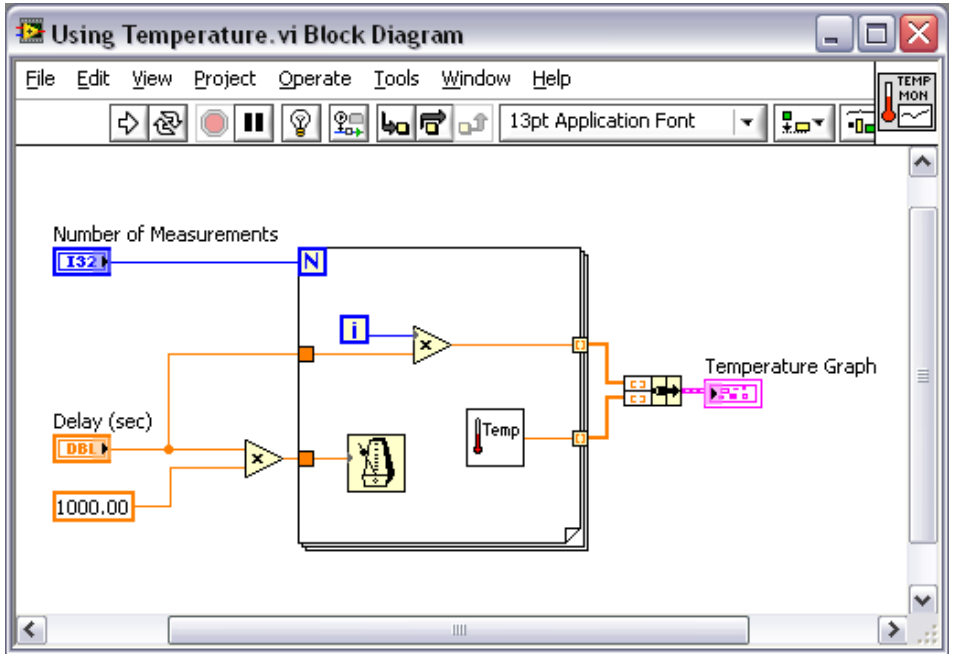
You build the front panel with controls (inputs) and indicators (outputs)



B. Parts of a VI – Block Diagram

Block Diagram – Contains the graphical source code

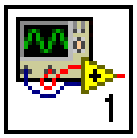
Front panel objects appear as terminals on the block diagram



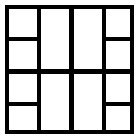
B. Parts of a VI – Icon/Connector Pane

- Icon: graphical representation of a VI
- Connector Pane: map of the inputs and outputs of a VI
- Icons and connector panes are necessary to use a VI as a subVI
  - A subVI is a VI that is inside of another VI
  - Similar to a function in a text-based programming language

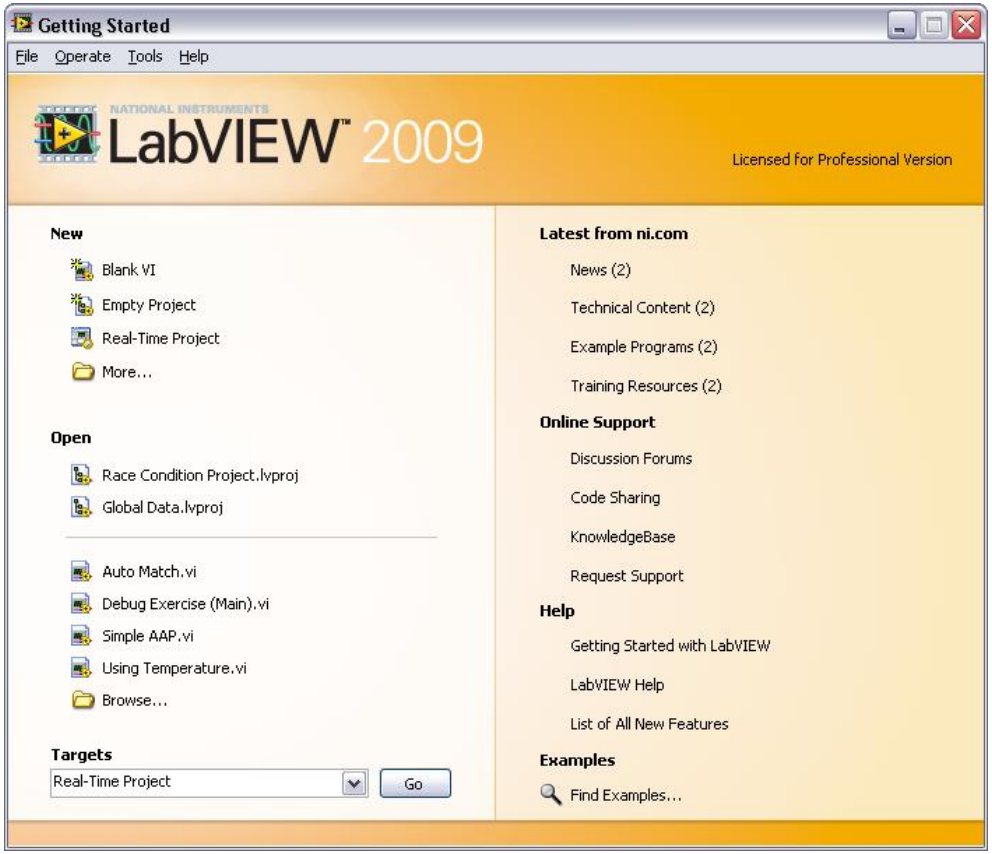
Icon



Connector Pane



C. Starting a VI



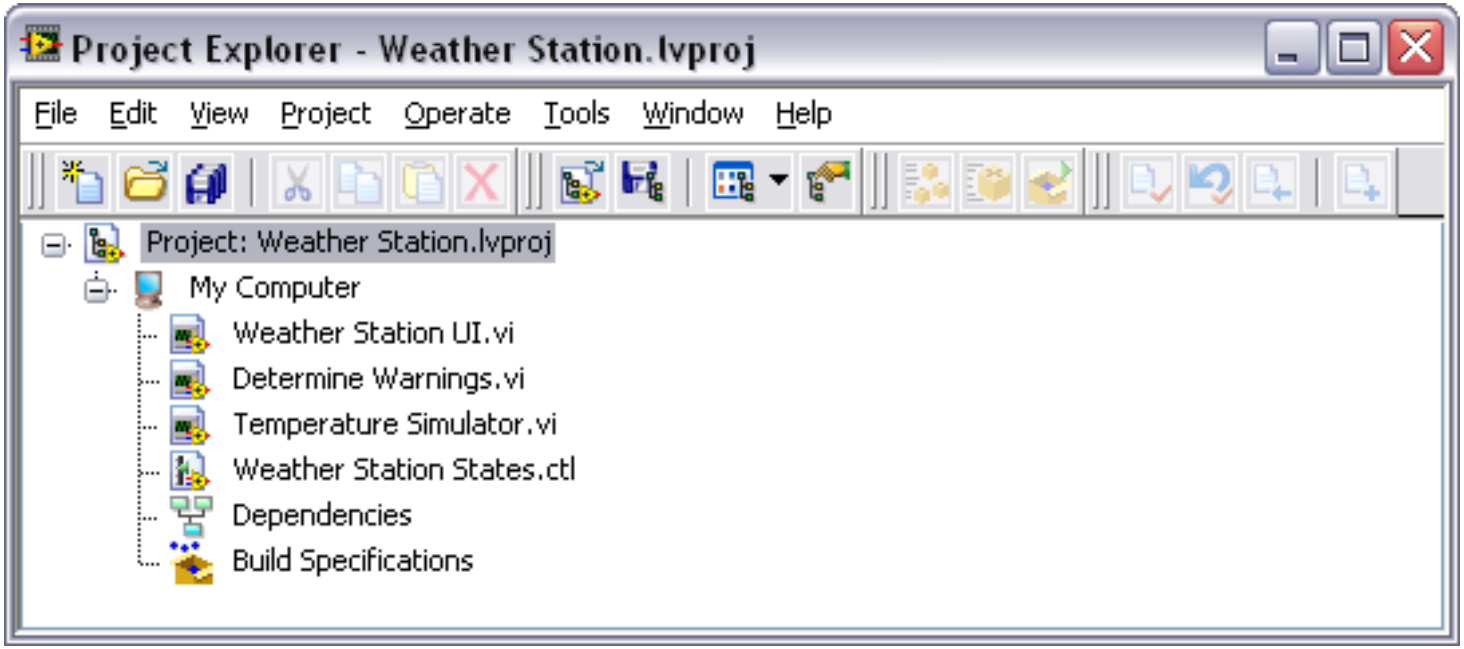
Demonstrate using the **Getting Started** dialog box and the **New** dialog box to start a VI.

DEMONSTRATION

D. Project Explorer

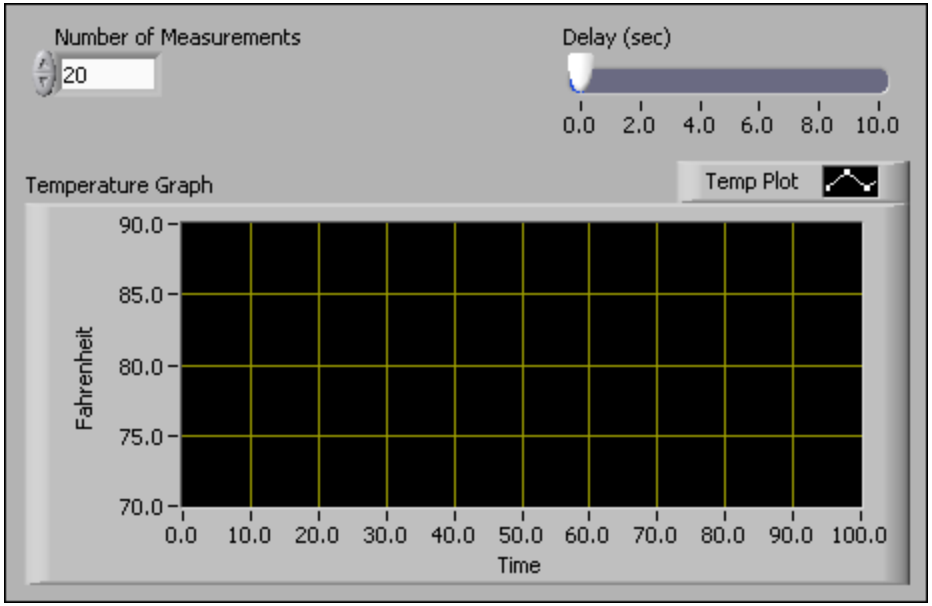
Use LabVIEW Projects to:

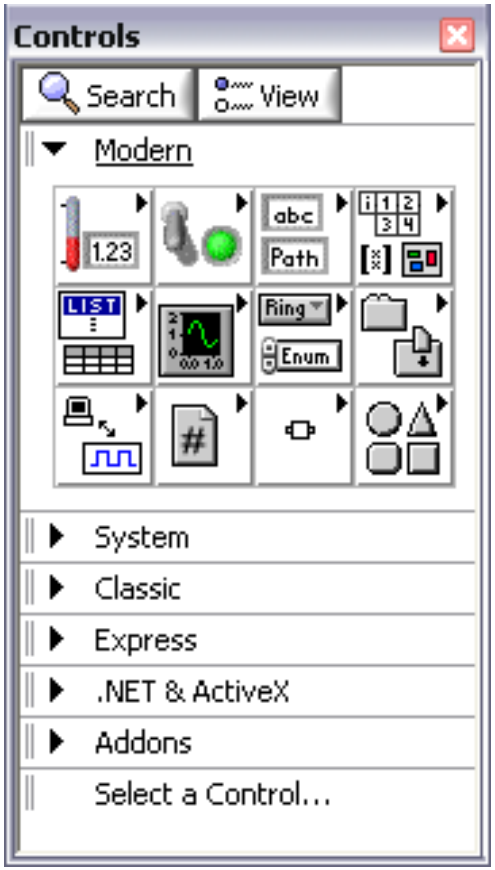
- Group LabVIEW files and non-LabVIEW files
- Create build specifications
- Deploy or download files to targets



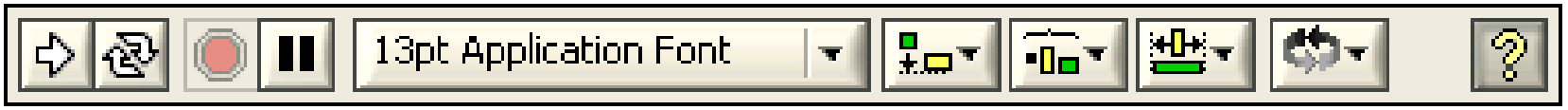
E. Front Panel – Controls Palette

- Contains the controls and indicators you use to create the front panel
- Access from the front panel by selecting **View»Controls Palette**





E. Front Panel – Front Panel Toolbar

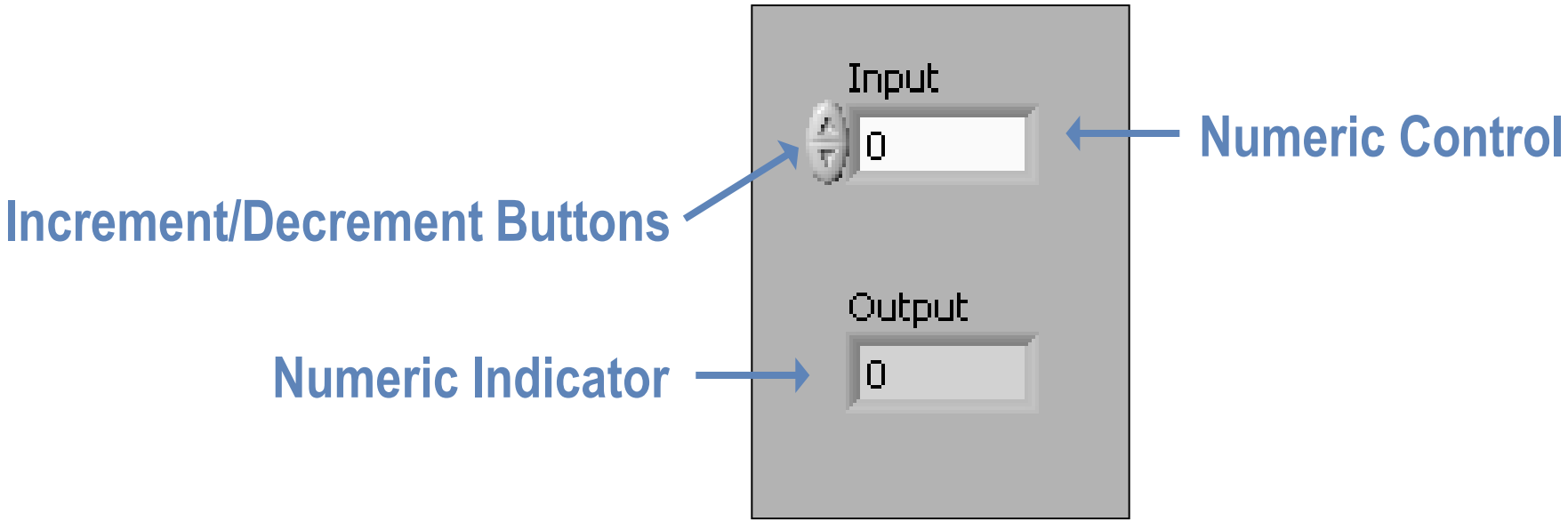


E. Front Panel – Controls & Indicators

- Controls
  - Knobs, push buttons, dials, and other input devices
  - Simulate instrument input devices and supply data to the block diagram of the VI
- Indicators
  - Graphs, LEDs, and other displays
  - Simulate instrument output devices and display data the block diagram acquires or generates

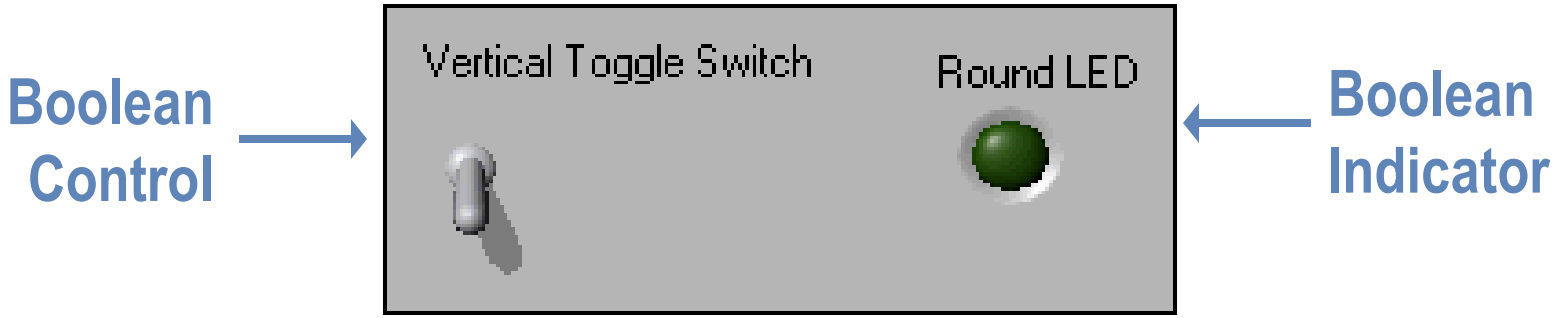
E. Front Panel – Numeric Controls/Indicators

The numeric data type can represent numbers of various types, such as integer or real



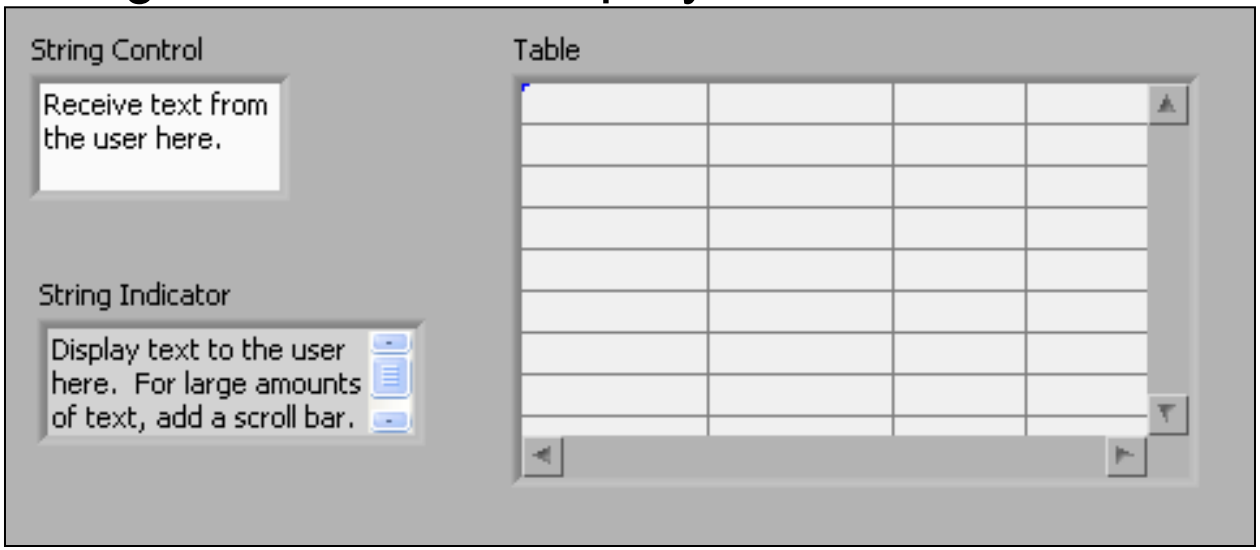
E. Front Panel – Boolean Controls/Indicators

- The Boolean data type represents data that only has two parts, such as True and False or On and Off
- Use Boolean controls and indicators to enter and display Boolean (True or False) values
- Boolean objects simulate switches, push buttons, and LEDs



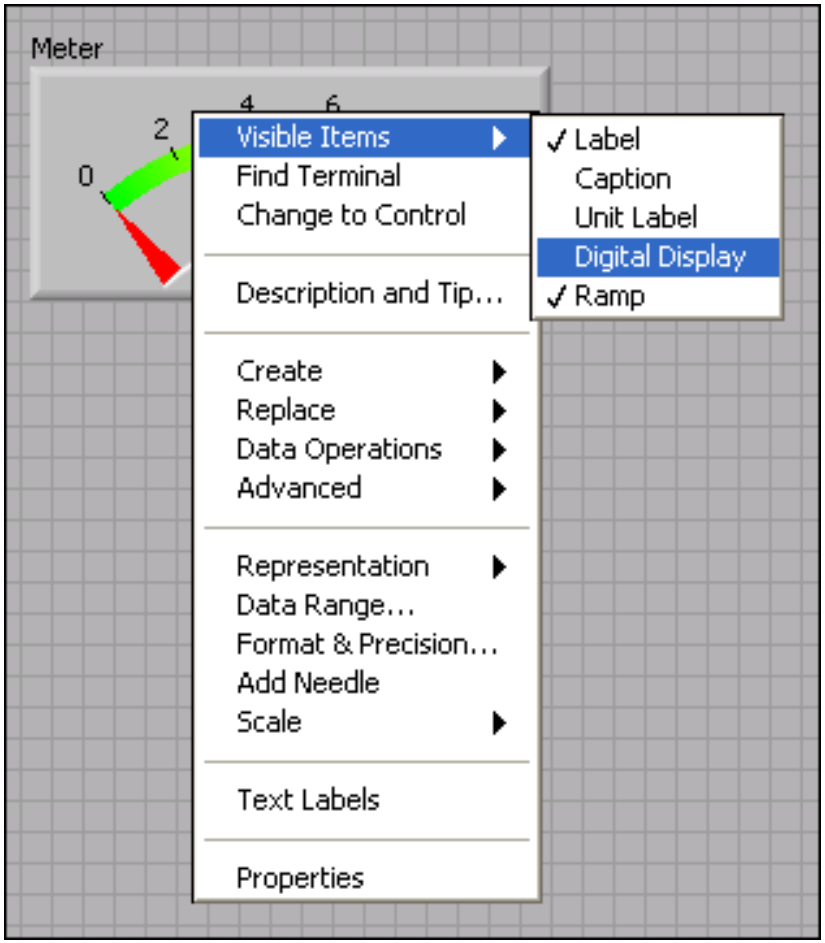
E. Front Panel – Strings

- The string data type is a sequence of ASCII characters
- Use string controls to receive text from the user such as a password or user name
- Use string indicators to display text to the user



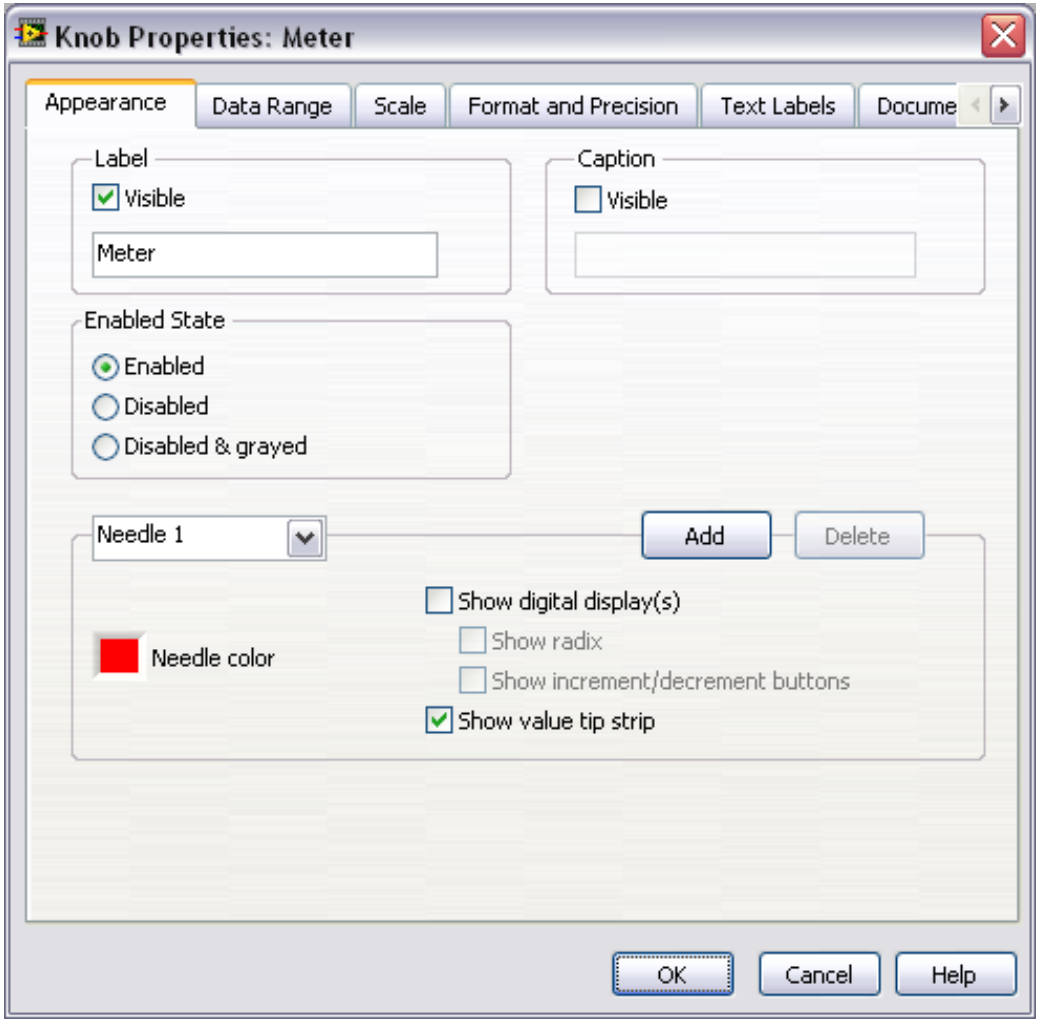
E. Front Panel – Shortcut Menus

- All LabVIEW objects have associated shortcut menus
- As you create a VI, use the shortcut menu items to change the look or behavior of front panel and block diagram objects
- To access the shortcut menu, right-click the object



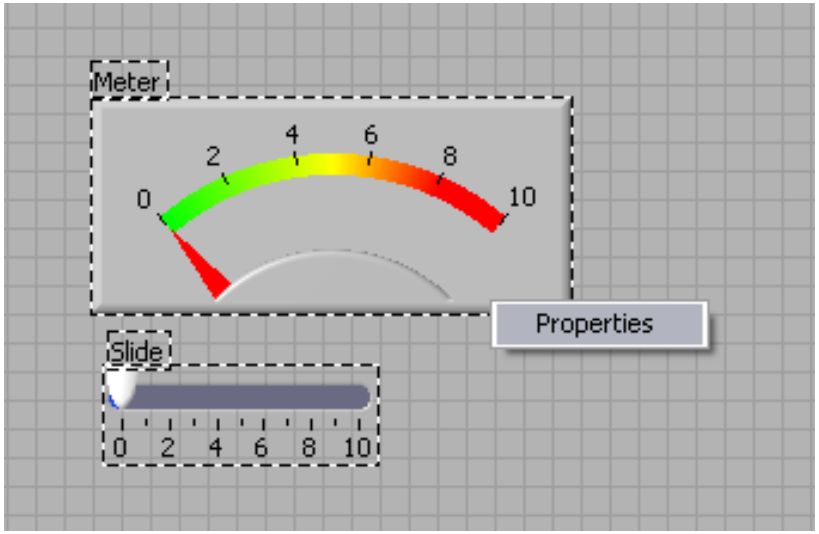
E. Front Panel – Property Dialog Box

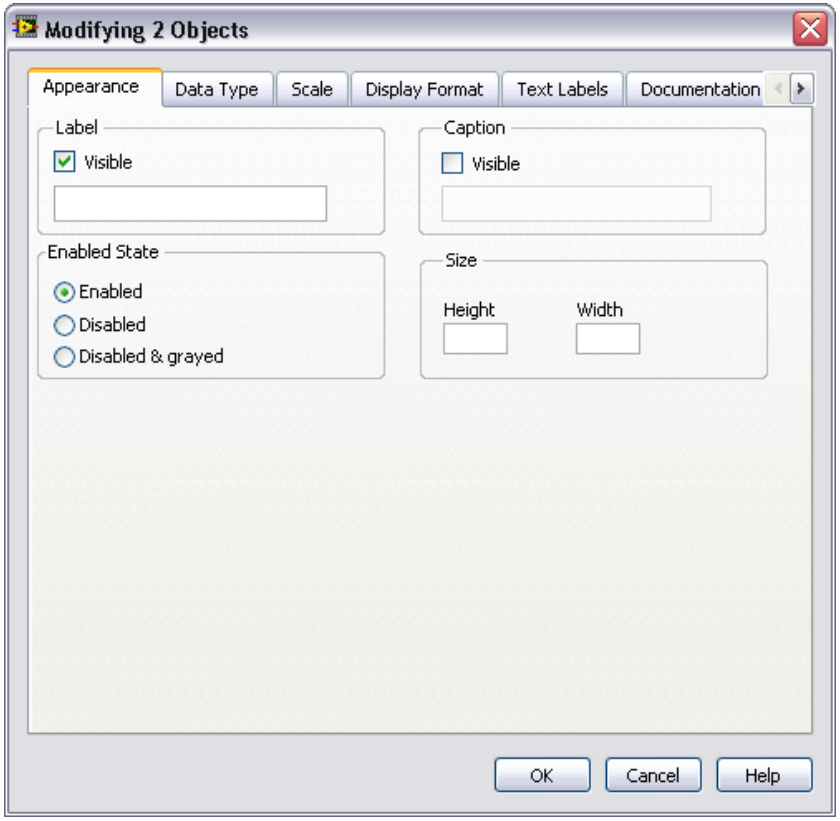
- Right-click a front panel object and select Properties to display
- The options available on the property dialog box are similar to the options available on the shortcut menu for that object



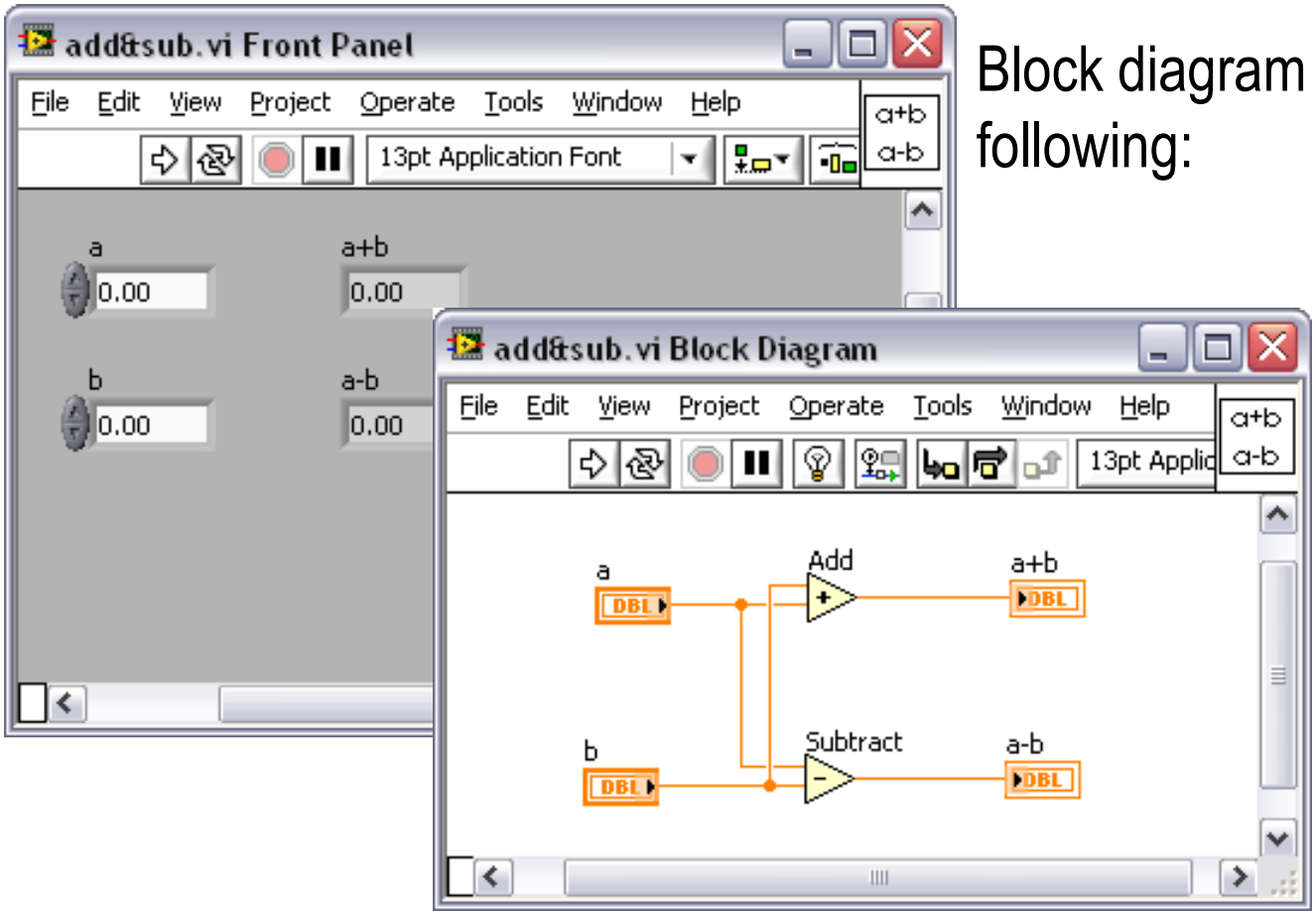
E. Front Panel – Configure Multiple Objects

- Select multiple objects to simultaneously configure shared properties





F. Block Diagram

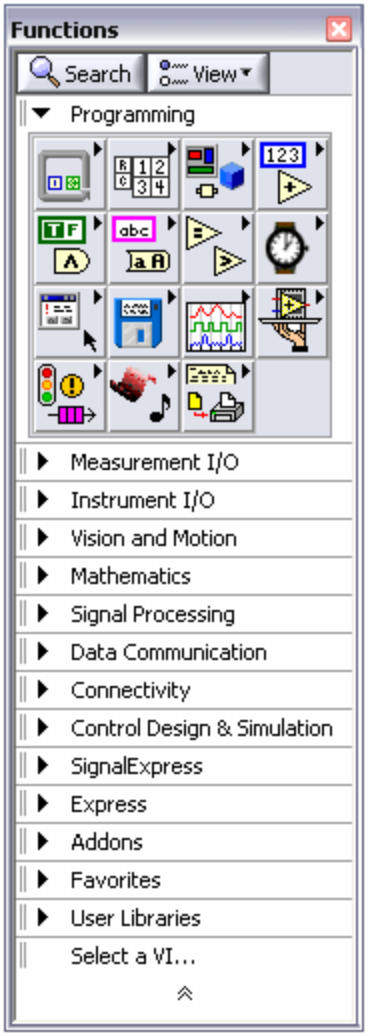


Block diagram objects include the following:

- Terminals
- SubVIs
- Functions
- Constants
- Structures
- Wires

F. Block Diagram – Functions Palette

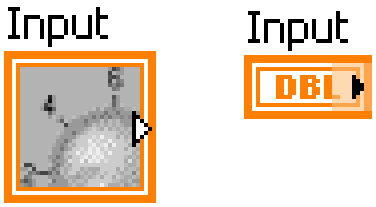
Contains the VIs, functions, and constants you use to create the block diagram



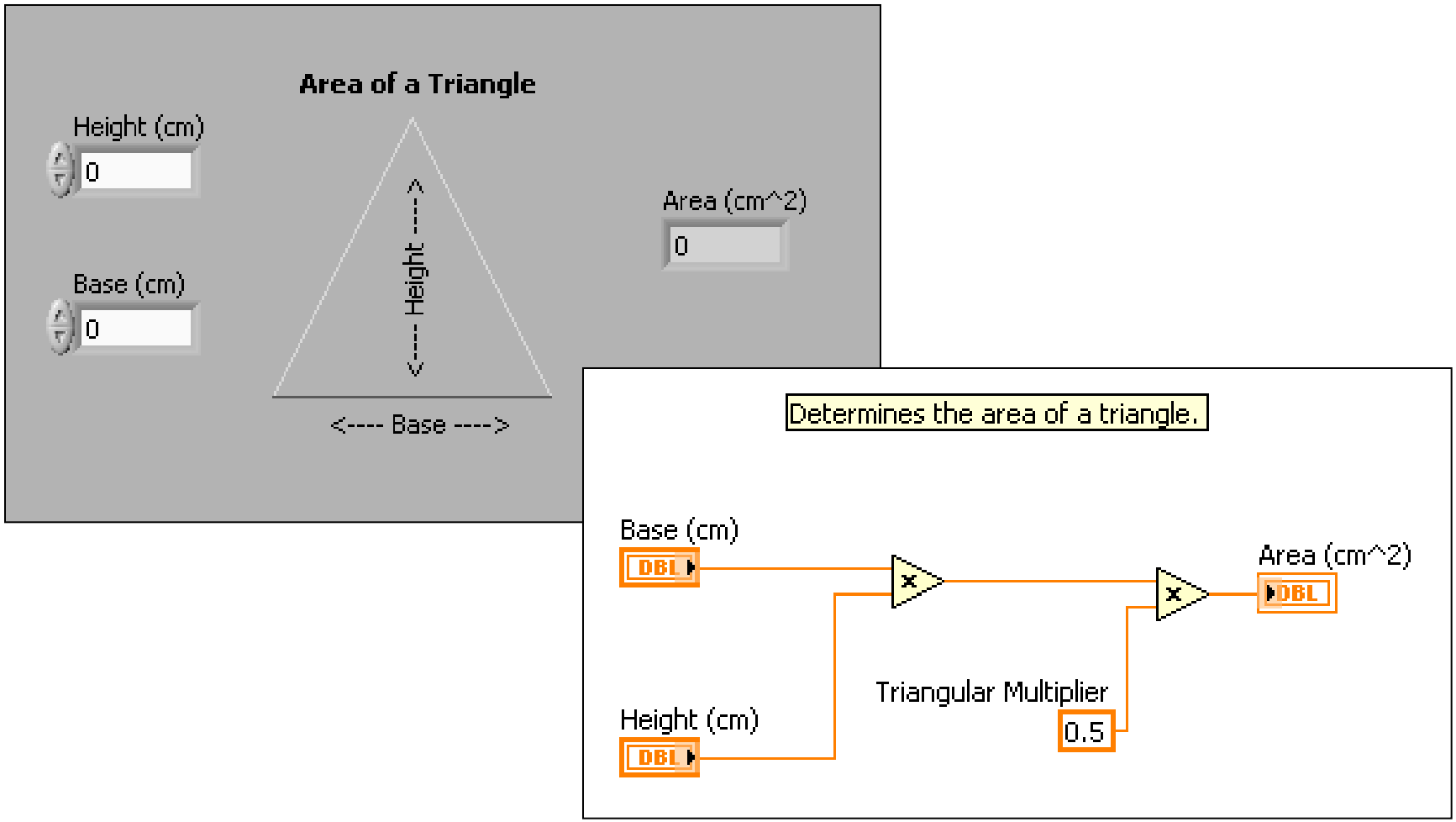
F. Block Diagram – Block Diagram Toolbar

F. Block Diagram – Terminals

- Terminals are:
  - Block diagram appearance of front panel objects
  - Entry and exit ports that exchange information between the front panel and block diagram
  - Analogous to parameters and constants in text-based programming languages
- Change the view type of a terminal by toggling the **View as Icon** selection from the context menu

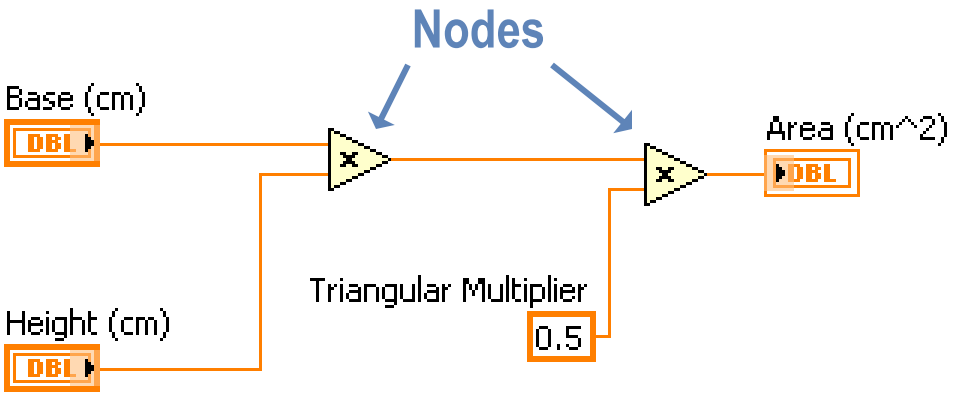


F. Block Diagram Terminals

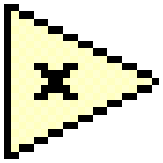


F. Block Diagram – Nodes

- Objects on the block diagram that have inputs and/or outputs and perform operations when a VI runs
- Analogous to statements, operators, functions, and subroutines in text-based programming languages
- Nodes can be functions, subVIs, or structures

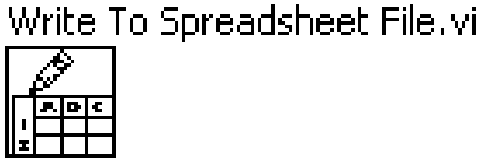


F. Block Diagram – Function Nodes



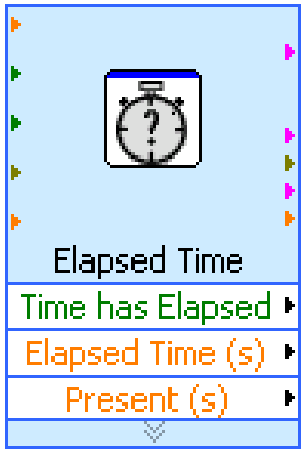
- Fundamental operating elements of LabVIEW
- Do not have front panels or block diagrams, but do have connector panes
- Double-clicking a function only selects the function – does not open it like a VI
- Has a pale yellow background on its icon

F. Block Diagram – SubVI Nodes



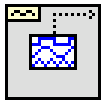
- SubVI: VIs that you build to use inside of another VI
- Any VI has the potential to be used as a subVI
- When you double-click a subVI on the block diagram, you can view the front panel and block diagram of the subVI
  - The upper right corner of the front panel and block diagram displays the icon for the current VI
  - This is the icon that appears when you place the VI on a block diagram as a subVI

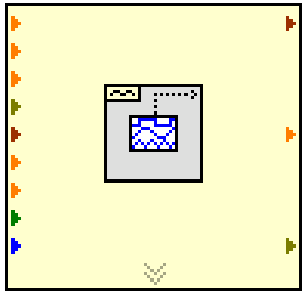
F. Block Diagram – SubVI Nodes

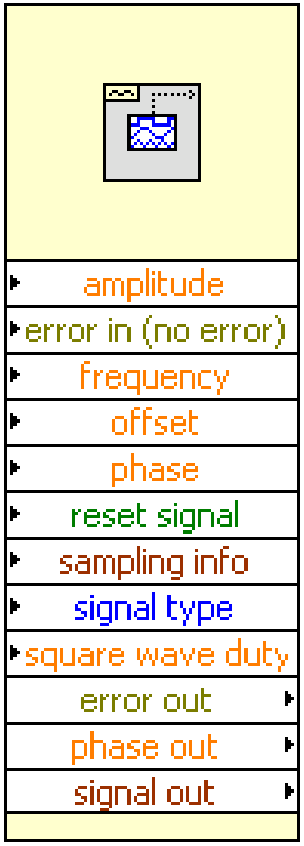


- Express VIs are a special type of subVI
  - Require minimal wiring because you configure them with dialog boxes
  - Save the configuration of an Express VI as a subVI
- Icons for Express VIs appear on the block diagram as icons surrounded by a blue field

F. Block Diagram – Icons/Expandable Nodes







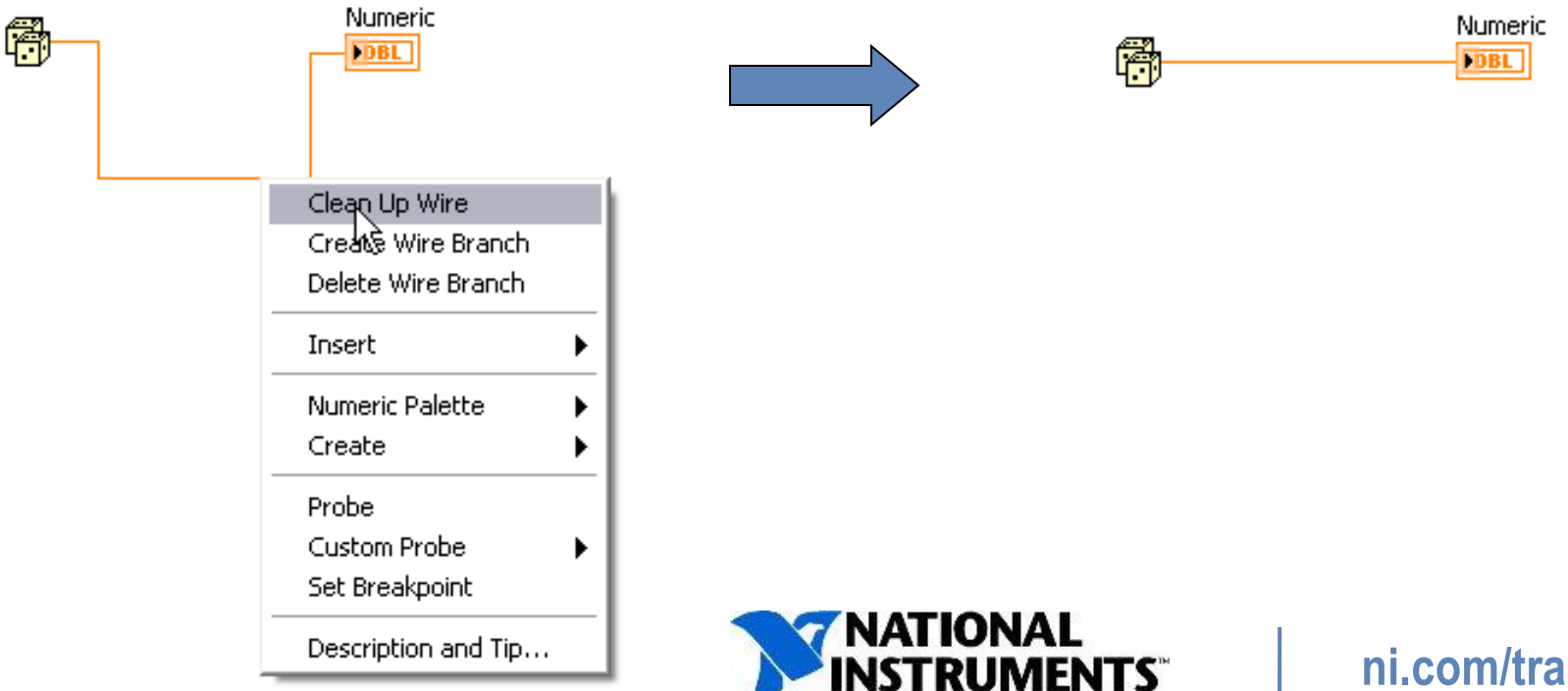
F. Block Diagram – Wires

- Transfer data between block diagram objects through wires
- Wires are different colors, styles, and thicknesses, depending on their data types
- A broken wire appears as a dashed black line with a red X in the middle

	DBL Numeric	Integer Numeric	String
Scalar			
1D Array			
2D Array			

F. Block Diagram – Wiring Tips

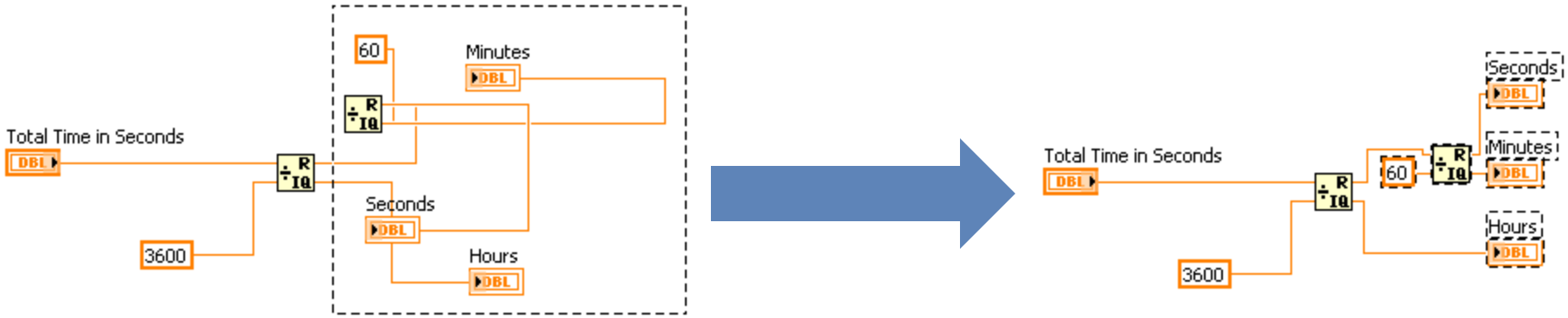
- Press <Ctrl>-B to delete all broken wires
- Right-click and select **Clean Up Wire** to reroute the wire



F. Block Diagram – Wiring Tips

Use the Clean Up Diagram tool to reroute multiple wires and objects to improve readability

1. Select a section of your block diagram
2. Click the Clean Up Diagram button on the block diagram toolbar



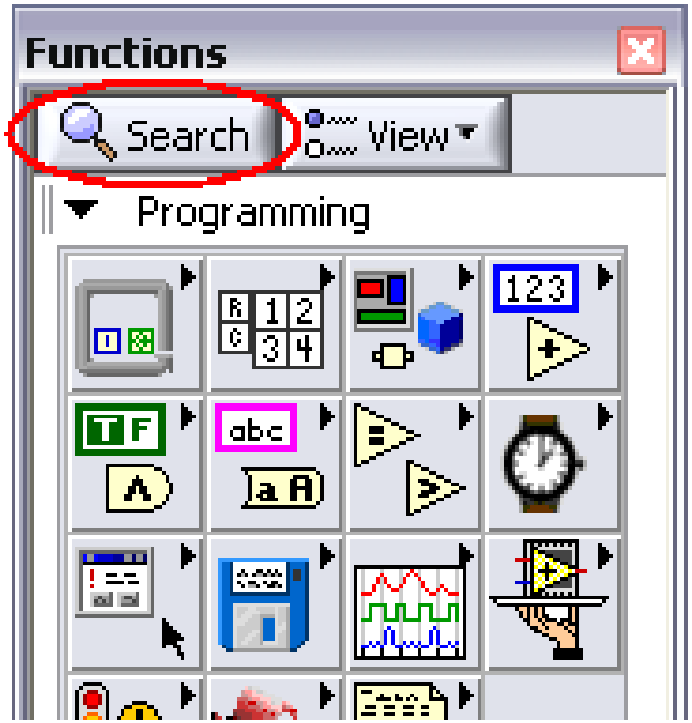
Exercise 2-1
Concept: Exploring a VI

Identify the parts of an existing VI.

GOAL

G. Searching for Controls, VIs & Functions

Find controls, functions, and VIs using the **Search** button on the **Controls** and **Functions** palette.



Exercise 2-2
Concept: Navigating Palettes

Learn to use the palettes and search for controls, functions and VIs.

GOAL

H. Selecting A Tool

- Create, modify, and debug VIs using the tools provided by LabVIEW
- A tool is a special operating mode of the mouse cursor
- The operating mode of the cursor corresponds to the icon of the tool selected
- When using the Automatic Tool Selection, LabVIEW chooses which tool to select based on the current location of the mouse

Exercise 2-3
Concept: Selecting A Tool

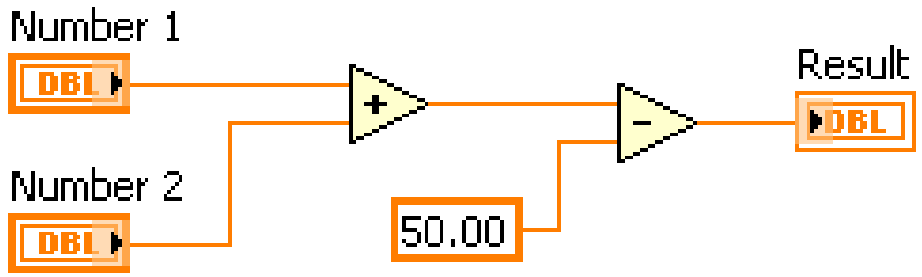
Gain experience using the Automatic Tool Selection to select which tool to use.

GOAL

I. Dataflow

LabVIEW follows a dataflow model for running VIs

- A node executes only when data are available at all of its input terminals
- A node supplies data to the output terminals only when the node finishes execution



I. Dataflow – Quiz

Which node executes first?

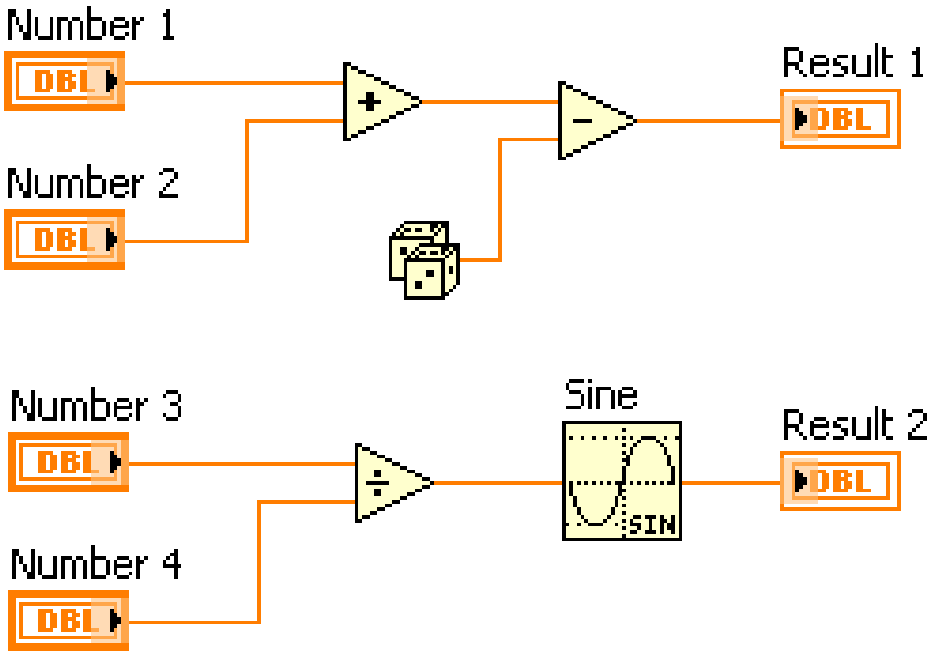
a) Add

b) Subtract

c) Random Number

d) Divide

e) Sine



I. Dataflow – Quiz Answers

NO CORRECT ANSWER

Which node executes first?

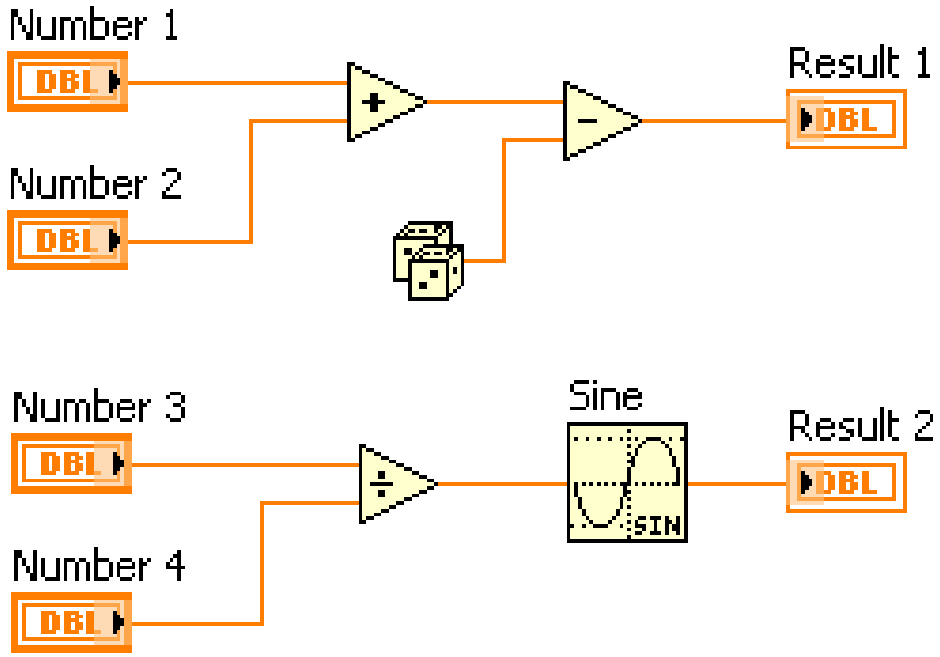
a) Add – possibly

b) Subtract – definitely not

c) Random Number – possibly

d) Divide – possibly

e) Sine – definitely not

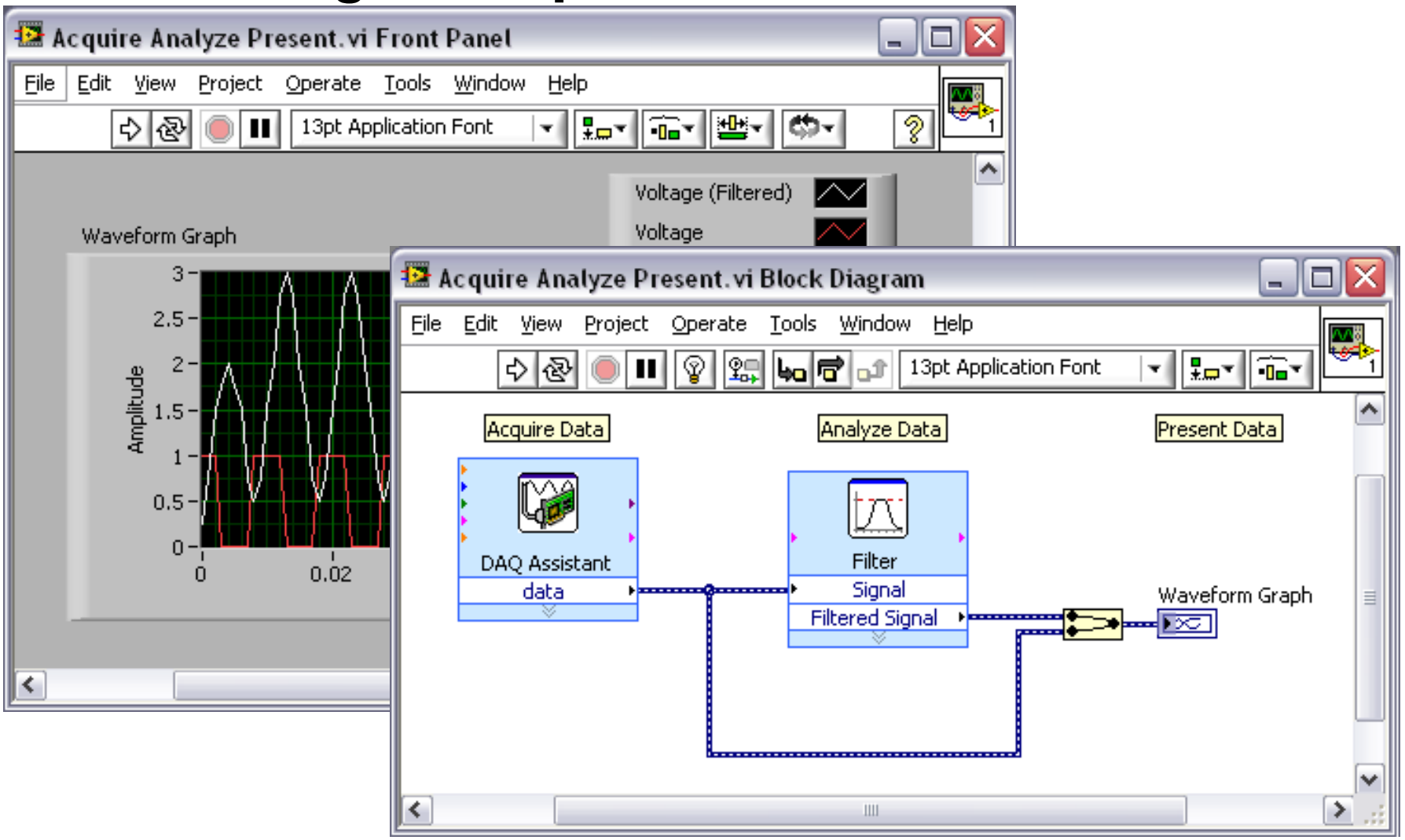


Exercise 2-4
Concept: Dataflow

Understand how dataflow determines the execution order in a VI.

GOAL

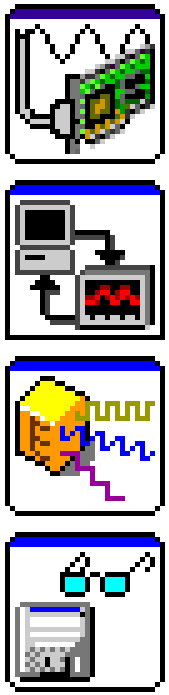
J. Building a Simple VI



J. Building a Simple VI – Acquire

Acquire Express VIs:

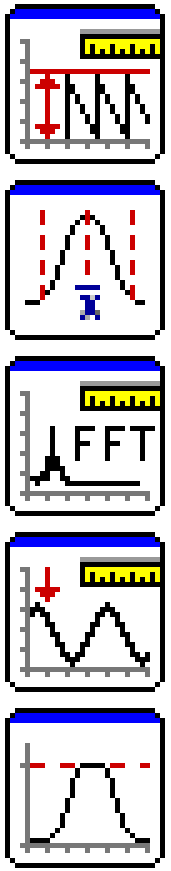
- DAQ Assistant Express VI
- Instrument I/O Assistant Express VI
- Simulate Signal Express VI
- Read from Measurement File Express VI



J. Building a Simple VI – Analyze

Analyze Express VIs:

- Amplitude and Level Measurements Express VI
- Statistics Express VI
- Spectral Measurements Express VI
- Tone Measurements Express VI
- Filter Express VI



J. Building a Simple VI – Present

- Present tasks are Express VIs that perform a function or indicators that present data on the front panel of the VI
- Indicators include the Waveform Chart, the Waveform Graph, and the XY Graph
- Express VIs include the Write to Measurement File Express VI, Build Text Express VI, DAQ Assistant Express VI, and the Instrument I/O Assistant Express VI

J. Building A Simple VI – Running

1. Place Express VI on the block diagram
2. Configure the dialog box that opens
3. Wire Express VIs together
4. Save and run the VI

The Run button appears broken when the VI you are creating or editing contains errors

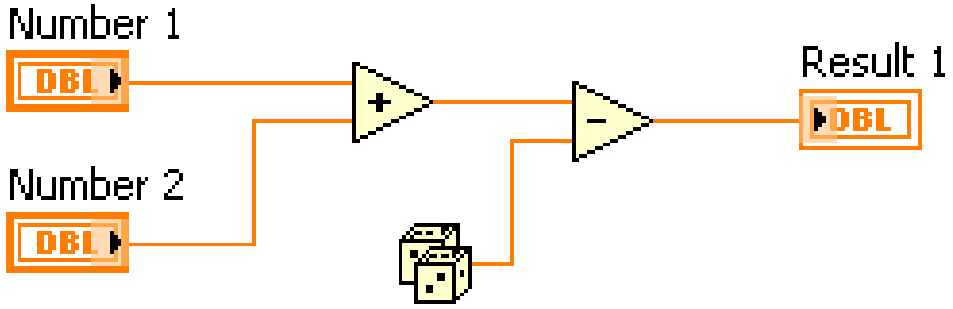
Exercise 2-5
Simple Acquire, Analyze, and Present VI

Create a simple VI that acquires data, analyzes data, and presents the results.

GOAL

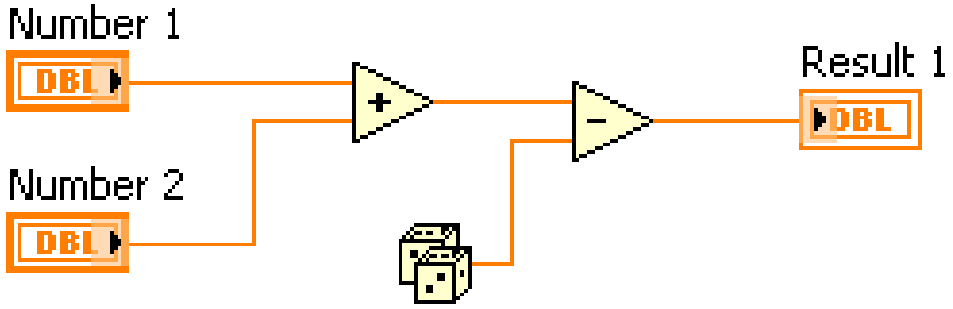
Summary—Quiz

1. Which function executes first:
   Add or Subtract?
   a) Add
   b) Subtract
   c) Unknown



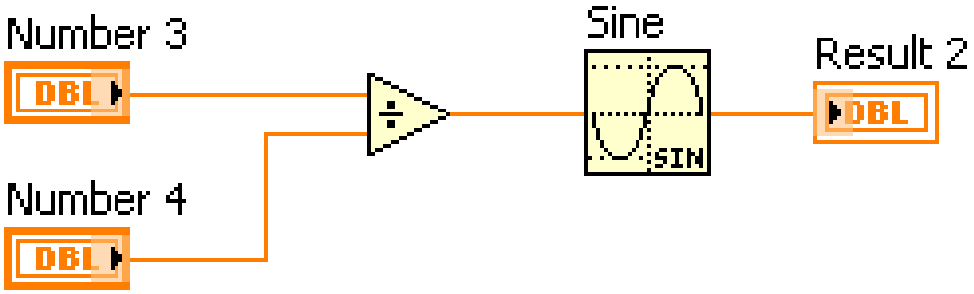
Summary—Quiz Answer

1. Which function executes first:
   Add or Subtract?
   - **a) Add**
   - b) Subtract
   - c) Unknown



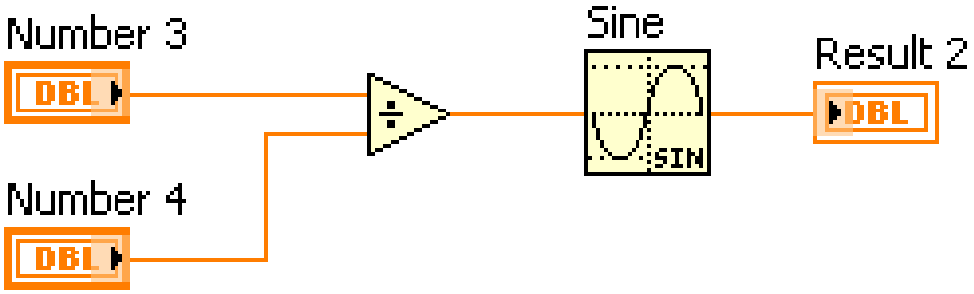
Summary—Quiz

2. Which function executes first:
   Sine or Divide?
   a) Sine
   b) Divide
   c) Unknown



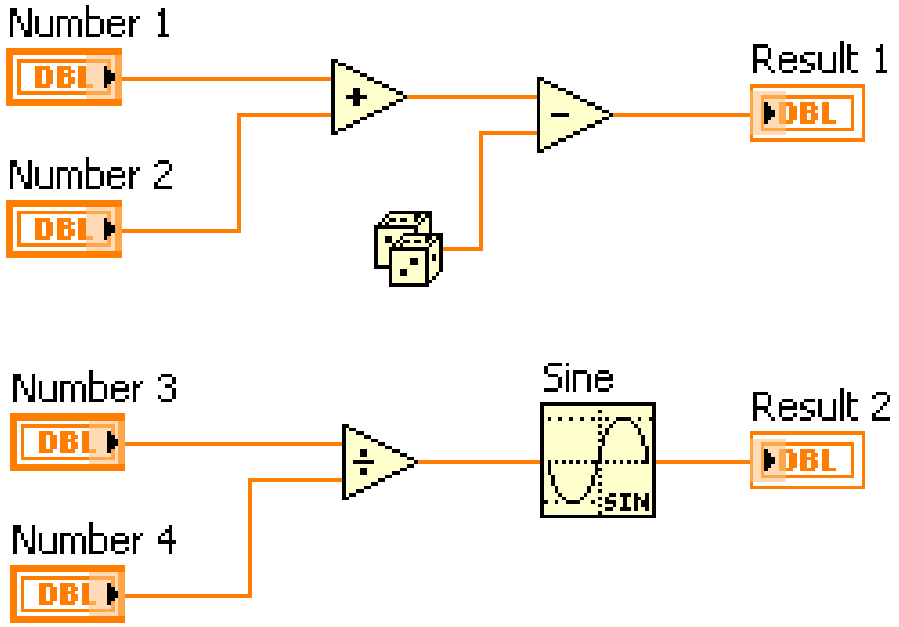
Summary—Quiz Answer

2. Which function executes first: Sine or Divide?
   a) Sine
   b) Divide
   c) Unknown



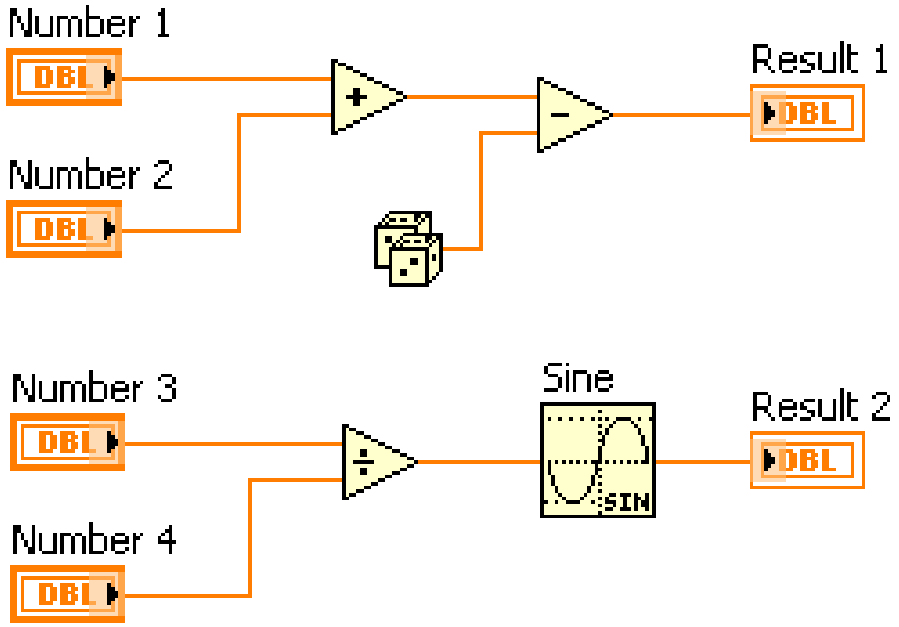
Summary—Quiz

3. Which of the following functions executes first: Random Number, Add or Divide?
   a) Random Number
   b) Divide
   c) Add
   d) Unknown



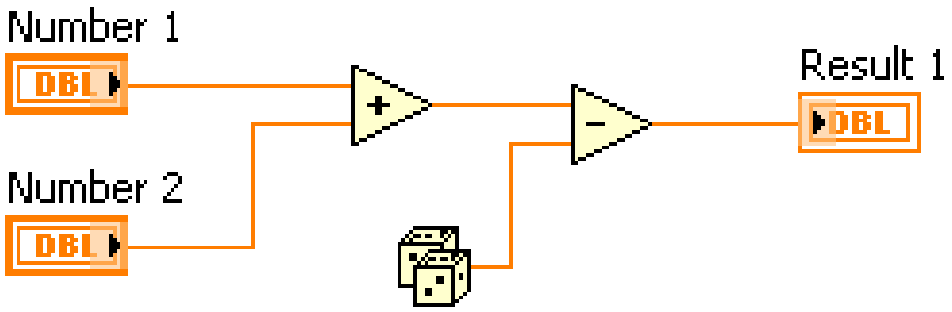
Summary—Quiz Answer

3. Which of the following functions executes first: Random Number, Add or Divide?
   a) Random Number
   b) Divide
   c) Add
   d) Unknown



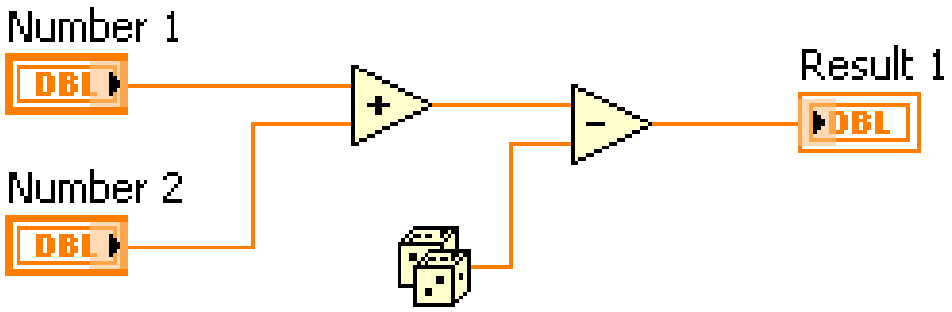
Summary—Quiz

4. Which of the following functions execute last: Random Number, Subtract or Add?
   a) Random Number
   b) Subtract
   c) Add
   d) Unknown



Summary—Quiz Answer

4. Which of the following functions execute last: Random Number, Subtract or Add?
   a) Random Number
   b) Subtract
   c) Add
   d) Unknown



Summary—Quiz

5. What are the three parts of a VI?
    a) Front Panel
    b) Block Diagram
    c) Project
    d) Icon/Connector Pane

Summary—Quiz Answer

5. What are the three parts of a VI?
   - **a) Front Panel**
   - **b) Block Diagram**
   - c) Project
   - **d) Icon/Connector Pane**