

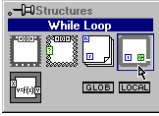

Lecture 3 (week Feb 8-12) Expanding the Features of a VI

You Will Learn:

- A. Structures--While Loop, for loop (How to use shift registers), case structure, sequence, formula node
- B. Arrays and Clusters
- C. Charts and Graphs
- D. Strings

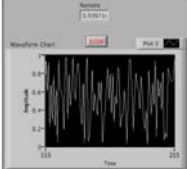
A. Structures--While Loop

1. Select While Loop
2. Enclose code to be repeated
3. Drop or drag additional nodes and then wire

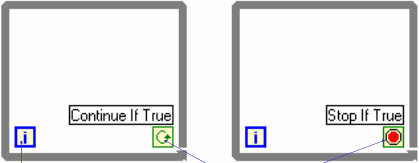
Do
(Execute diagram inside Loop)
stop if Condition is TRUE

Save as while loop.vi 2



Select the Loop Condition

- Right-click on Conditional Terminal to define when the loop stops

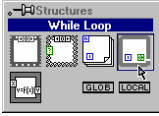



Iteration Terminal Conditional Terminal

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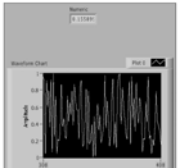
A. Structures--While Loop

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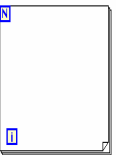
Do
(Execute diagram inside Loop)
continue if Condition is TRUE

Save as while loop1.vi 4



A. Structures--For Loop

- In Structures subpalette of Functions palette
- Enclose code to be repeated and/or resize and add nodes inside boundary
- Executes diagram inside of loop a predetermined number of times
- Shift registers can be created at the border

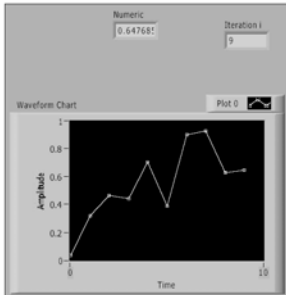
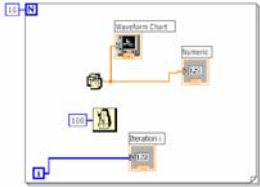


Count terminal
(Numerical input)

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A. Structures--For Loop

Replace while loop with for loop

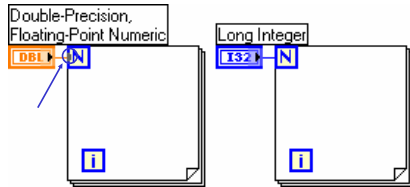



Save as for loop.vi

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A. Structures--For Loop Numeric Conversion

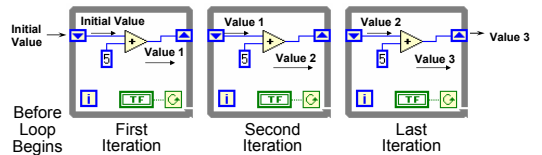
- Numeric defaults to double precision (8 bytes) or long integer (4 bytes)
- LabVIEW automatically converts to different representations
- Gray coercion dot on terminal indicates conversion



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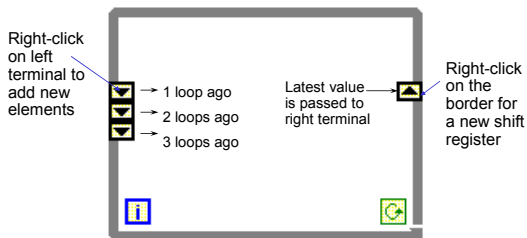
A. Structures--For Loop Shift Registers

- Available at left or right border of loop structures
- Right-click on border and select Add Shift Register
- Right terminal stores data on completion of iteration
- Left terminal provides stored data at beginning of next iteration



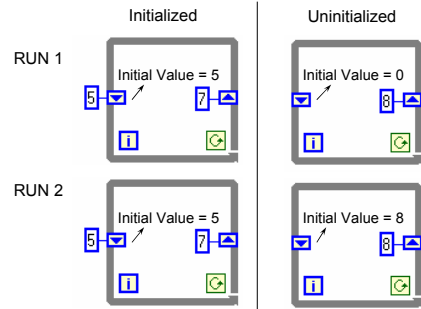
8

Additional Shift Register Elements



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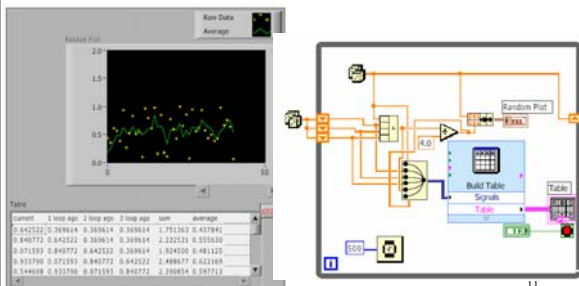
Initializing Shift Registers



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1. Find the VI from Help>Find Examples...>Search
2. Type in shift registers and search
3. Choose Calculate Running Average.vi
4. Modify the VI as shown following
5. Save to your floppy disk

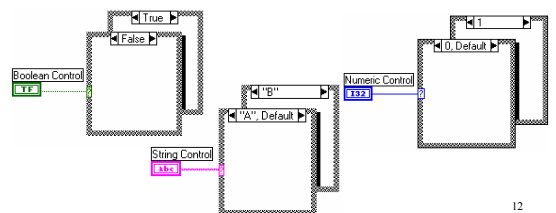
6. Change to for loop



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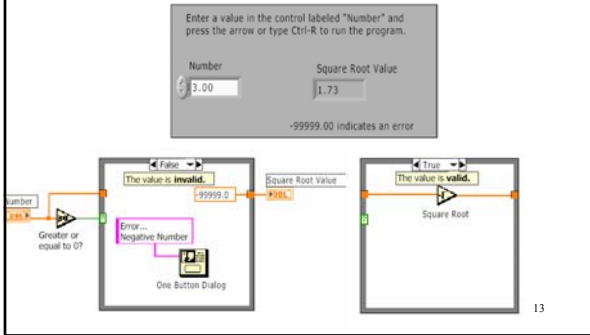
A. Structures--case structures If...Then...Else

- In the Structures subpalette of Functions palette
- Enclose nodes or drag them inside the structure
- Stacked like a deck of cards, only one case visible



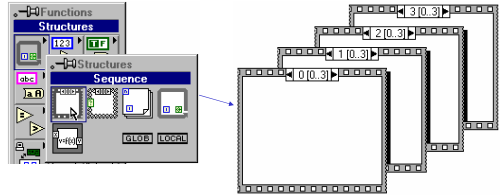
12

1. Find the VI from Help»Find Examples...»Search
2. Type in “simple case” and search
3. Choose Simple Case Structure.vi

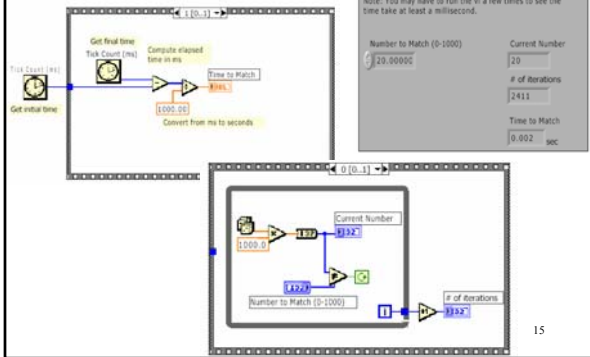


A. Structures--Sequence Structures

- In the Structures subpalette of Functions palette
- Executes diagrams sequentially, Frame 0 (0..x), where x is the total number of frames
- Stacked like a deck of cards, only one frame visible

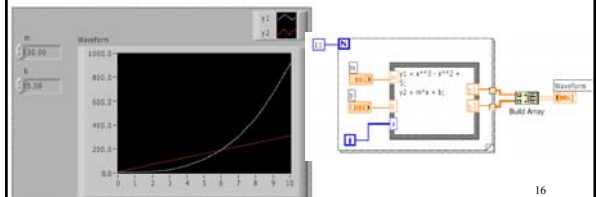


1. Find the VI from Help»Find Examples...»Search
2. Type in “sequence” and search
3. Choose Time to Match.vi



A. Structures--Formula Node

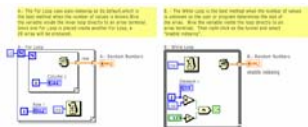
- In the Structures subpalette
- Implement complicated equations
- Variables created at border
- Variable names are case sensitive
- Each statement must terminate with a semicolon (;)
- Context Help Window shows available functions



B. Array Controls and Indicators

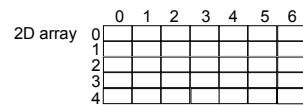
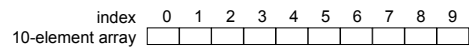
- A. About arrays
- B. About generating arrays with loops
- C. Some basic array functions
- D. What polymorphism is
- E. Using graphs to display data
- F. About clusters
- G. Some cluster functions

1. Find the VI from Help»Find Examples...»Search
2. Type in “array” and search
3. Choose Time to Match.vi



Arrays

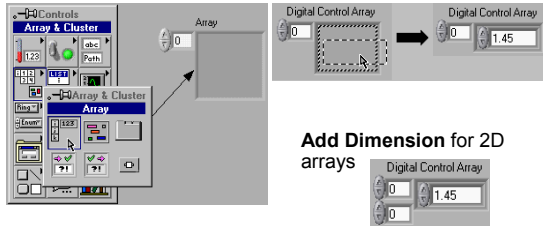
- Collection of data elements that are of same type
- One or more dimensions, up to 2³¹ elements per dimension
- Elements accessed by their index
- First element is index 0



Five-row by seven column array of 35 elements

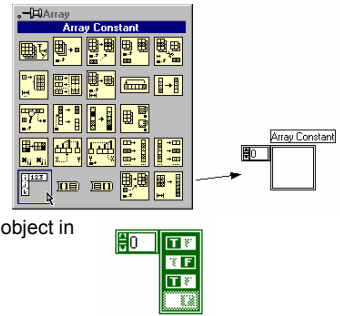
Array Controls and Indicators

1. Select the **Array Shell** from the Controls palette
2. Place **data object** inside shell



Creating Array Constants

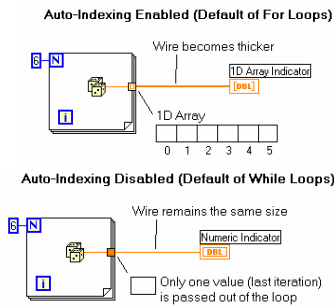
1. Select **Array Constant** shell from the **Array** subpalette



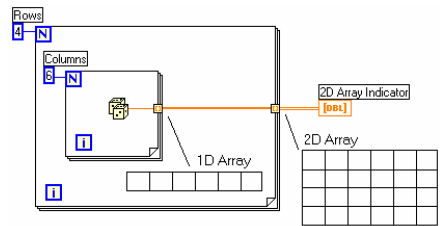
2. Place the data object in the array shell

Creating and Using Arrays

- **Auto-Indexing** – loops accumulate arrays at their boundaries
- For Loops auto index by default; While Loops do not

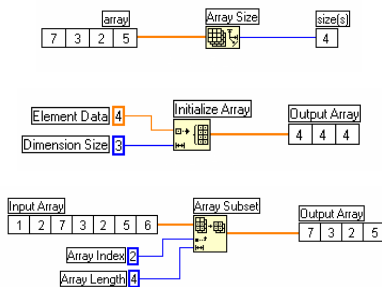


Creating 2D Arrays

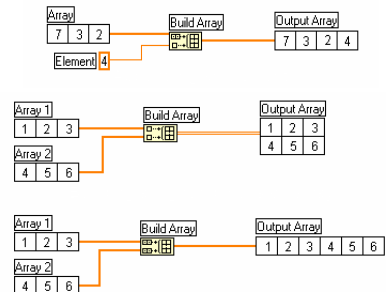


- Inner loop creates column elements
- Outer loop stacks them into rows

Common Array Functions



The Build Array Function



B. Arrays and Clusters---- Clusters

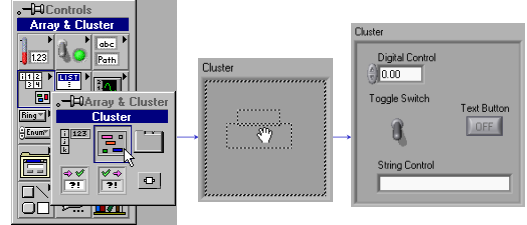
- Data structure that groups data together
- Data may be of different types
- Analogous to *record* in Pascal or *struct* in C
- Elements must be either all controls or all indicators
- Thought of as wires bundled into a cable



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Cluster Controls and Indicators

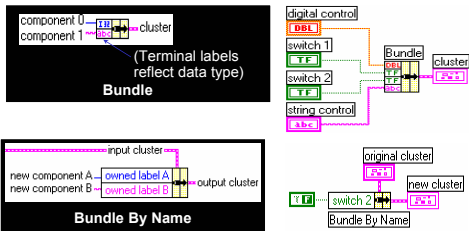
1. Select a **Cluster** shell from the **Array & Cluster** subpalette
2. Place objects inside the shell



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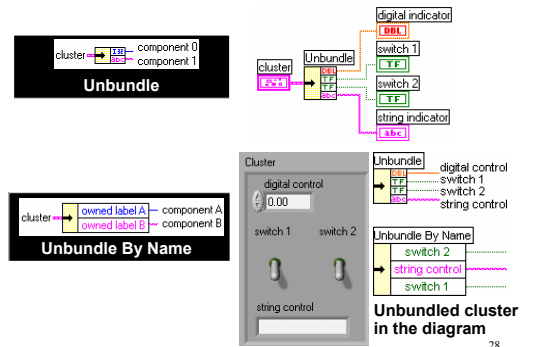
Cluster Functions

- In the **Cluster** subpalette of the **Functions** palette
- Can also be accessed by right-clicking on the cluster terminal



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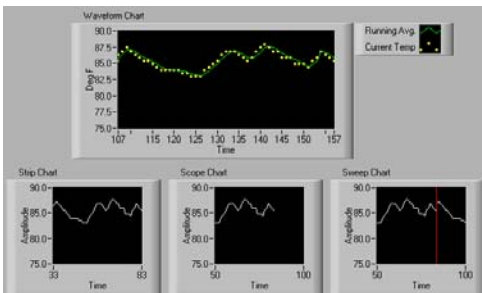
Cluster Functions



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C. Charts and graphs---- charts

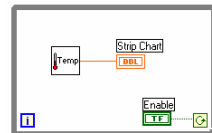
- Selected from the **Controls»Graph** subpalette



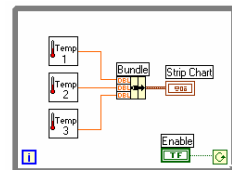
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Wiring to Charts

- **Single-Plot Chart**



- **Multiple-Plot Chart**



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1. Find the VI from Help»Find Examples...»Search
2. Type in "chart" and search
3. Choose charts.vi

Run the VI and investigate the differences between the Charts. Press Stop when done.

Shift register is used here to remember point for data generation.

Customizing Charts and Graphs

- Plot Legend (color, point style, line style, etc.)
- Digital Display
- Scrollbar
- Customize the X and Y Axes
- Graph Palette
- Scale Legend

C.Charts and graphs---- graphs

- Selected from the Graph subpalette
- Waveform Graph – Plot an array of numbers against their indices
- XY Graph – Plot one array against another

Plot Legend (point and line styles)

Scale Legend

Graph Palette

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Single-Plot Waveform Graphs

Uniform X axis - initial X = 0.0, delta X = 1.0

Uniform X axis - you specify point spacing

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Multiple-Plot Waveform Graphs

Each row is a separate plot (initial X = 0, delta X = 1)

Each row is a separate plot (Bundle specifies point spacing of the X axis)

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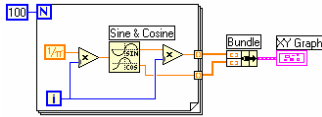
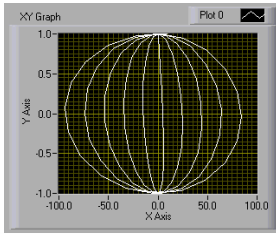
1. Find the VI from Help»Find Examples...»Search
2. Type in "graph" and search
3. Choose Waveform Graph.vi

Instructions: Run the VI and investigate the different types of graphs.

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XY Graphs

- Non-uniform X axis
- Separate X and Y arrays define data points



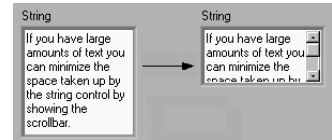
1. Find the VI from Help»Find Examples...»Search
2. Type in "xy graph" and search
3. Choose XY Graph.vi

Chart and Graph Use Summary

- Use the Context Help window with charts and graphs

D. Strings

- A string is a sequence of displayable or nondisplayable characters (ASCII)
- Many uses – displaying messages, instrument control, file I/O
- String control/indicator is in the Controls»String subpalette

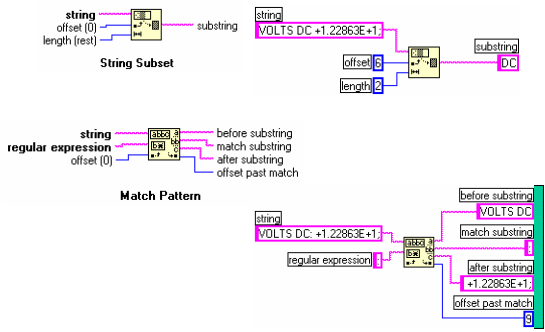


String Display Modes

<ul style="list-style-type: none"> • Normal display 	<ul style="list-style-type: none"> • \ code display
<ul style="list-style-type: none"> • Password display 	<ul style="list-style-type: none"> • Hex display

String Functions

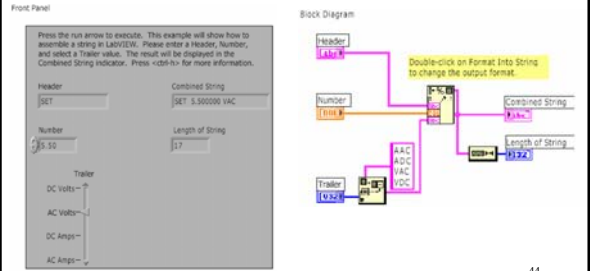
String Functions



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D. Strings

1. Find the VI from Help » Find Examples... » Search
2. Type in "string" and search
3. Choose Build String.vi



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Summary

- **Two structures to repeat execution**
 - While Loop-----continue, stop if it is true
 - For Loop
- Loop timing controlled using Wait Until Next ms Multiple function
- Shift registers transfer data values from one iteration to the next
 - Adapt to any data type
 - Additional left terminals may be added to access previous iteration
- **Two structures to control flow of data**
 - Case structure and Sequence structure
- **Case structure**
 - Boolean or numeric cases – selector determines type
 - Subdiagrams placed inside case structure
 - Output from a Case structure must be defined for all cases

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Summary--Cnd

- **Sequence structure** executes subdiagrams sequentially
- **Sequence locals** pass data between frames
 - Created at the border of Sequence structure
 - Data available in subsequent frames
- **Formula Nodes** allow direct entry of equations in the block diagram
- An array is a collection of elements of same data type – numeric, Boolean, string, etc.
- Creating array or cluster controls/indicators is a two-step process
 1. Get array or cluster shell
 2. Place desired control/indicator inside the shell
- Loops can accumulate arrays at boundaries – auto-indexing
- Array functions are in Array subpalette of Functions palette
- Clusters group data that can be different types
- The Bundle and Unbundle functions are used to create and disassemble clusters

Summary--Cnd

- Three modes of waveform charts**
- Strip chart
 - Scope chart
 - Sweep chart
- Charts can be customized – right-click on chart for menus
- Plot data on graphs
 - Many features to manipulate plotted graph
 - Multiple plots can be plotted on one graph
 - String is a collection of ASCII characters – many uses
 - Display messages
 - Instrument control
 - File I/O
 - Many functions to manipulate strings – Strings palette of Functions menu

Homework for Today

1. Make a VI to scan the potential $E=E_0+vt$
2. Make VIs for C to F and F to C using Formula Node

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