

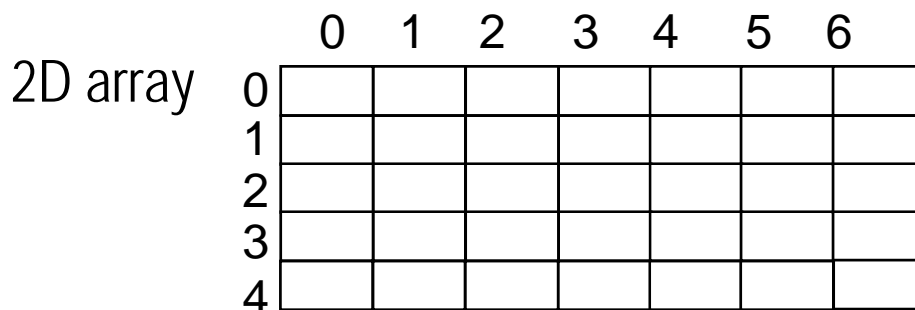
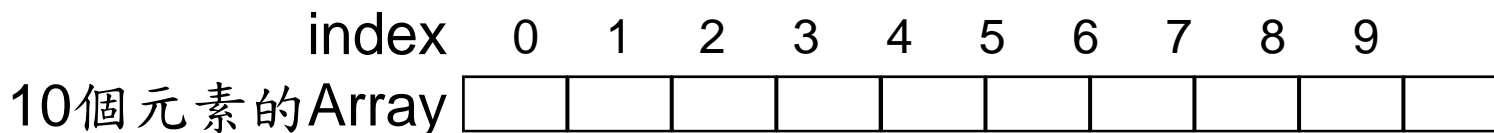
單元3： 陣列(Array)

主題：

- a. 介紹Array
- b. 使用自動索引(Auto Indexing)，以迴圈建立Array
- c. 藉紹常用的Array函數
- d. 多型(Polymorphism)

Arrays

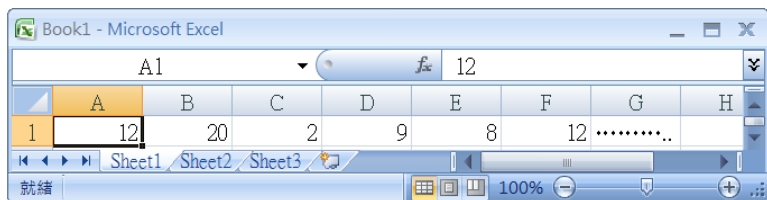
- 陣列將同一種類型的資料元件組成群
- 可以有一個或多個維度，每一個維度可達 2^{31} 個元件
- 可以使用索引(index)來取得陣列內的元素，索引從零開始計算，第一個元素的index是0



5列(row)7欄(column)的陣列，共有35個元素

Arrays

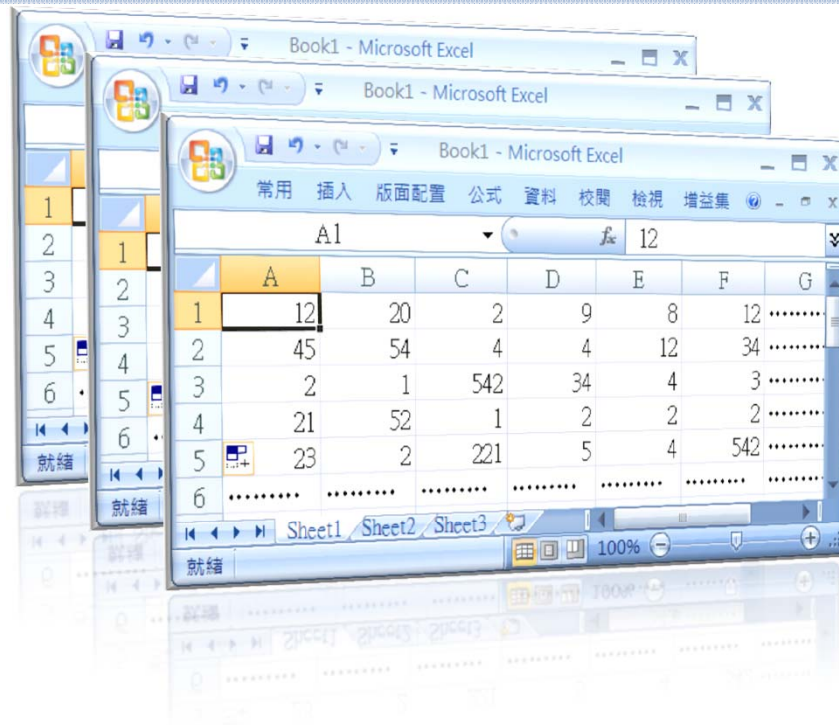
1D array就像是Excel當中只有一排資料，index使用A、B、C...表示



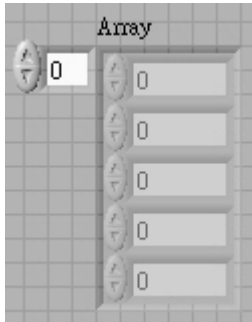
2D array就像是Excel當中有一頁資料，index使用A1、B3、C 4....表示



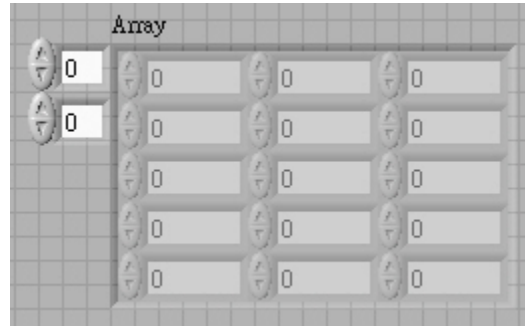
3D array就像是Excel當中有多頁資料，其index使用3A1、1B3、3C 4....表示



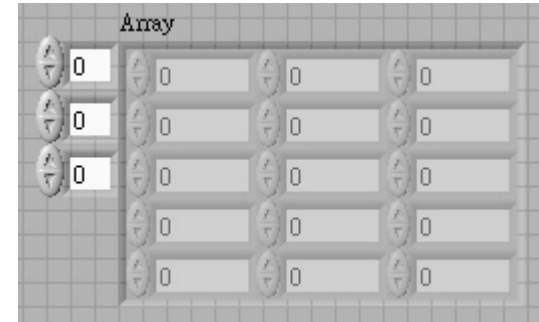
Array 在LabVIEW裡面的表示方法



1D array

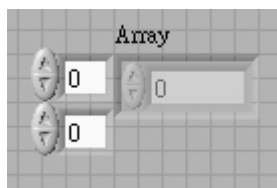
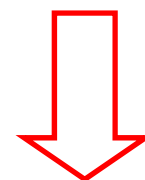
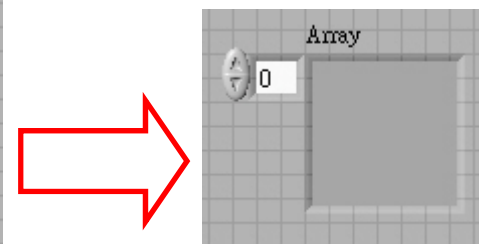
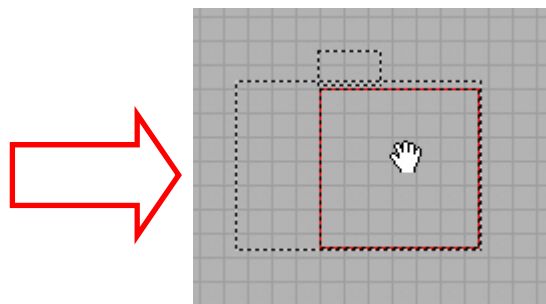
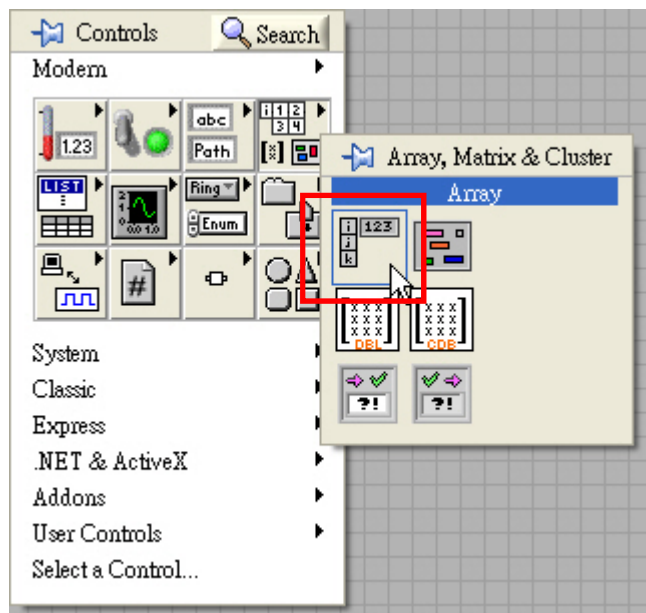


2D array



3D array

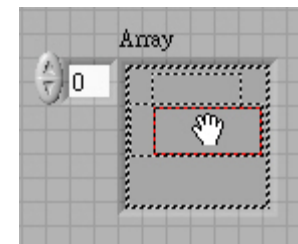
建立陣列的控制器與指示器



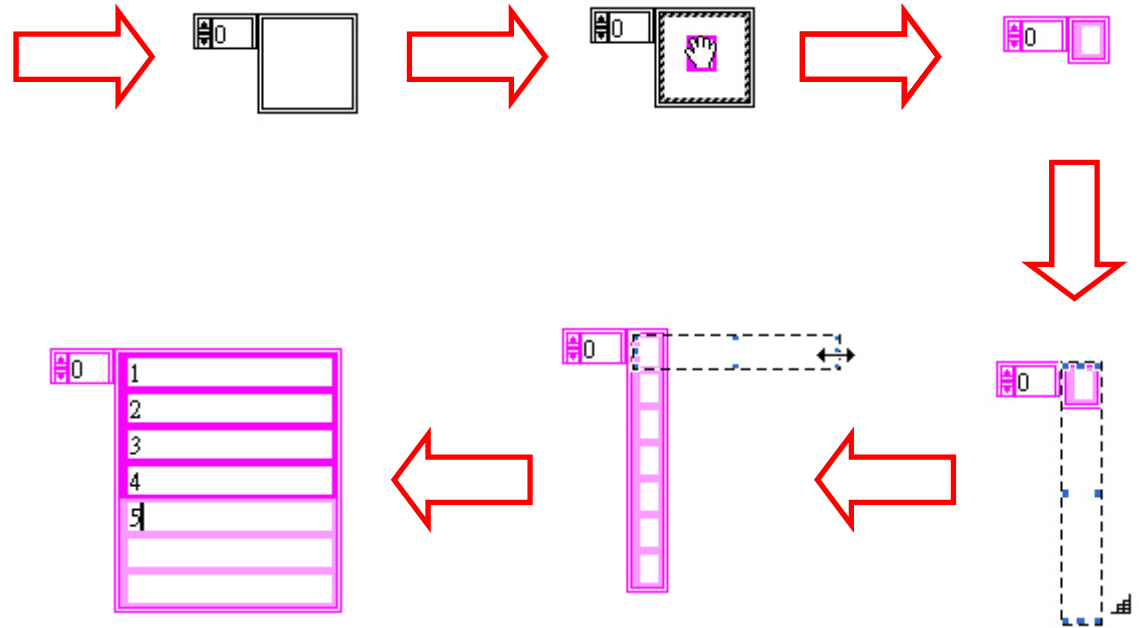
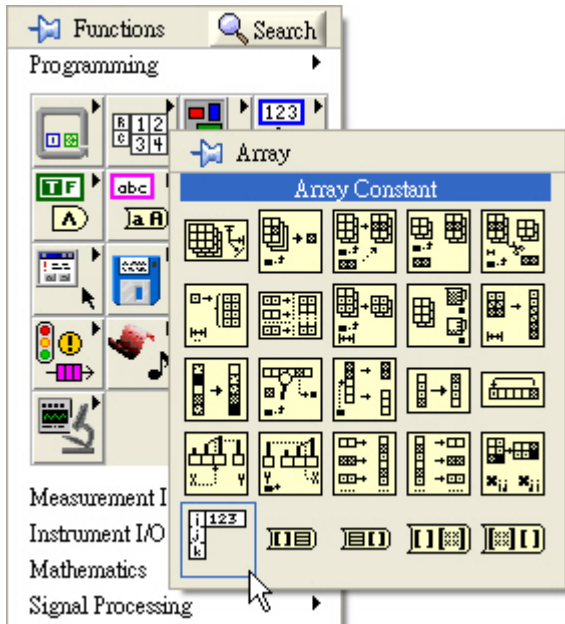
2D Array



1D Array

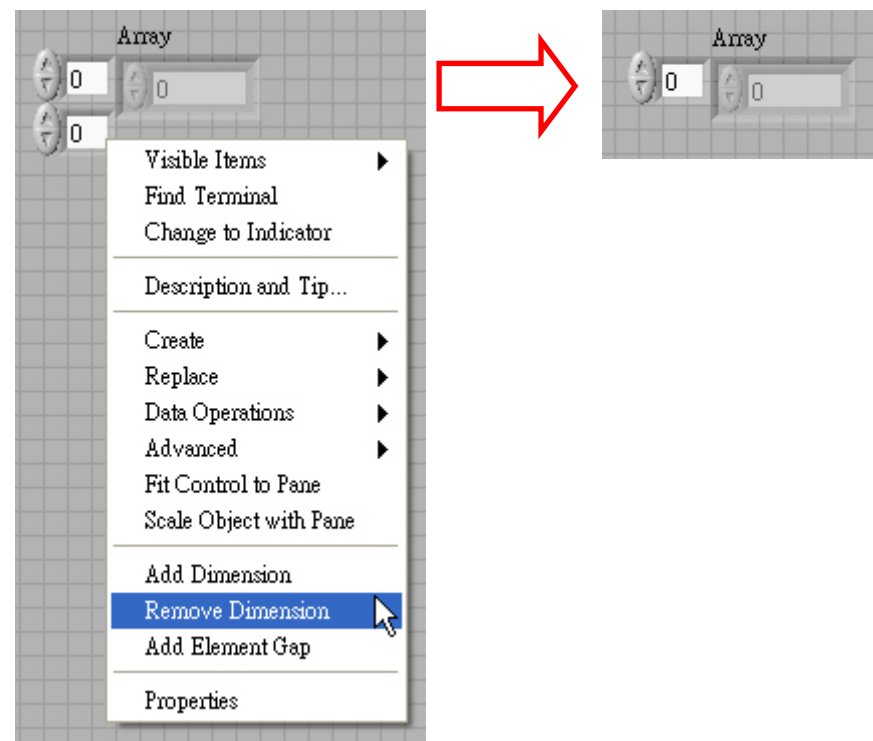
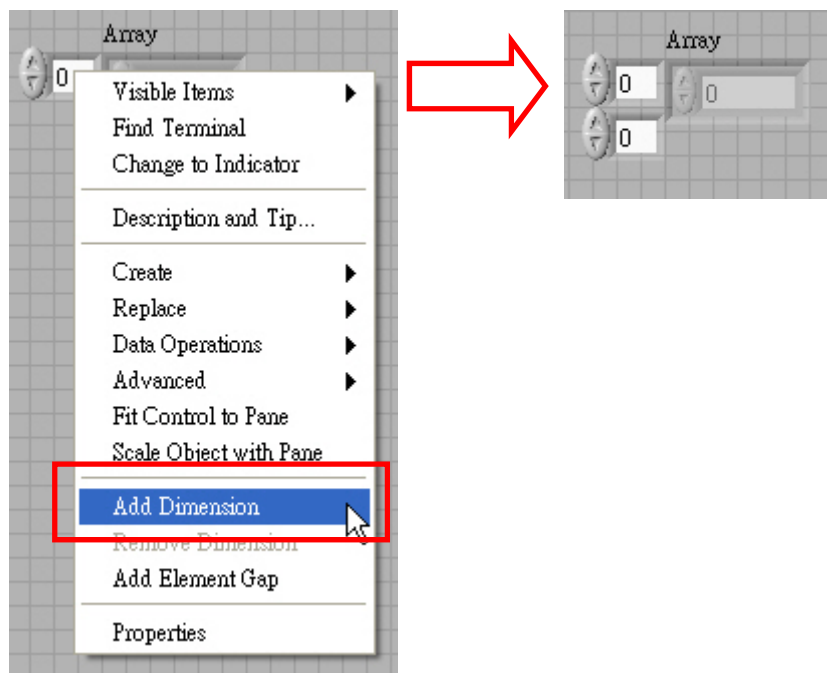


建立一個內含常數的Array



! 注意：不能建立一個含有Array的Array

增加維度、減少維度

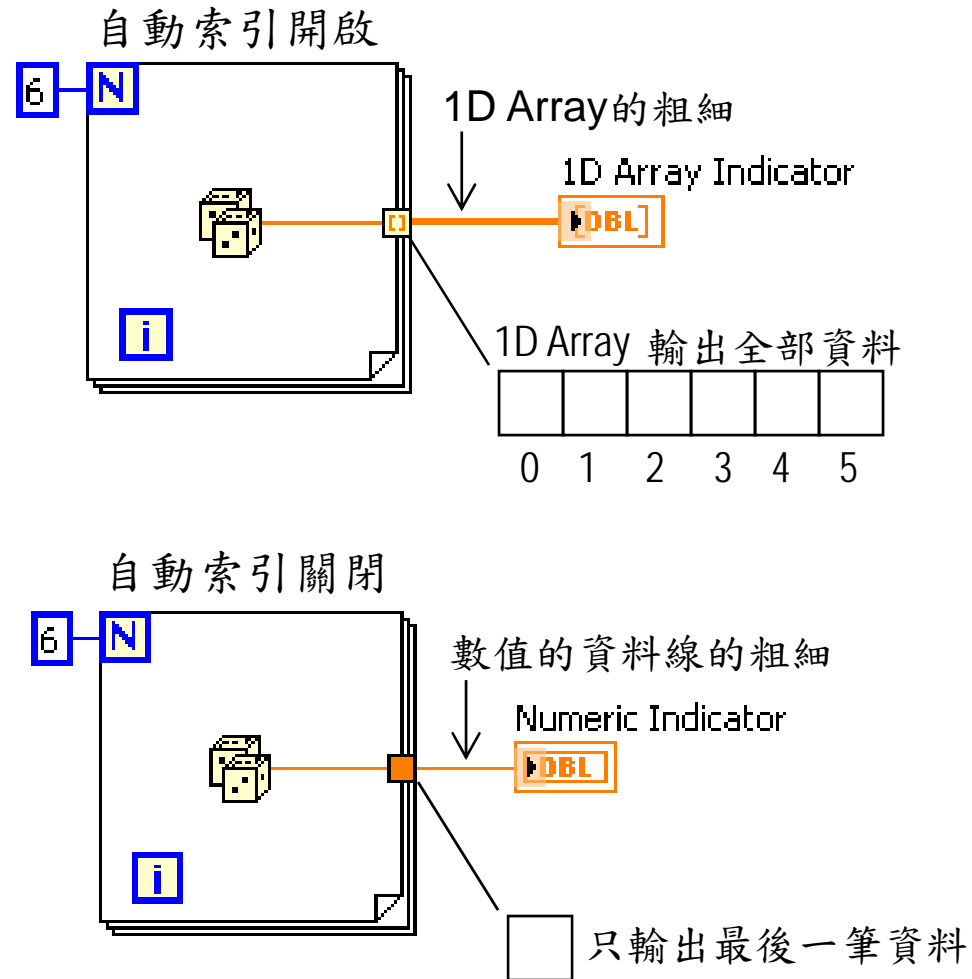


增加維度

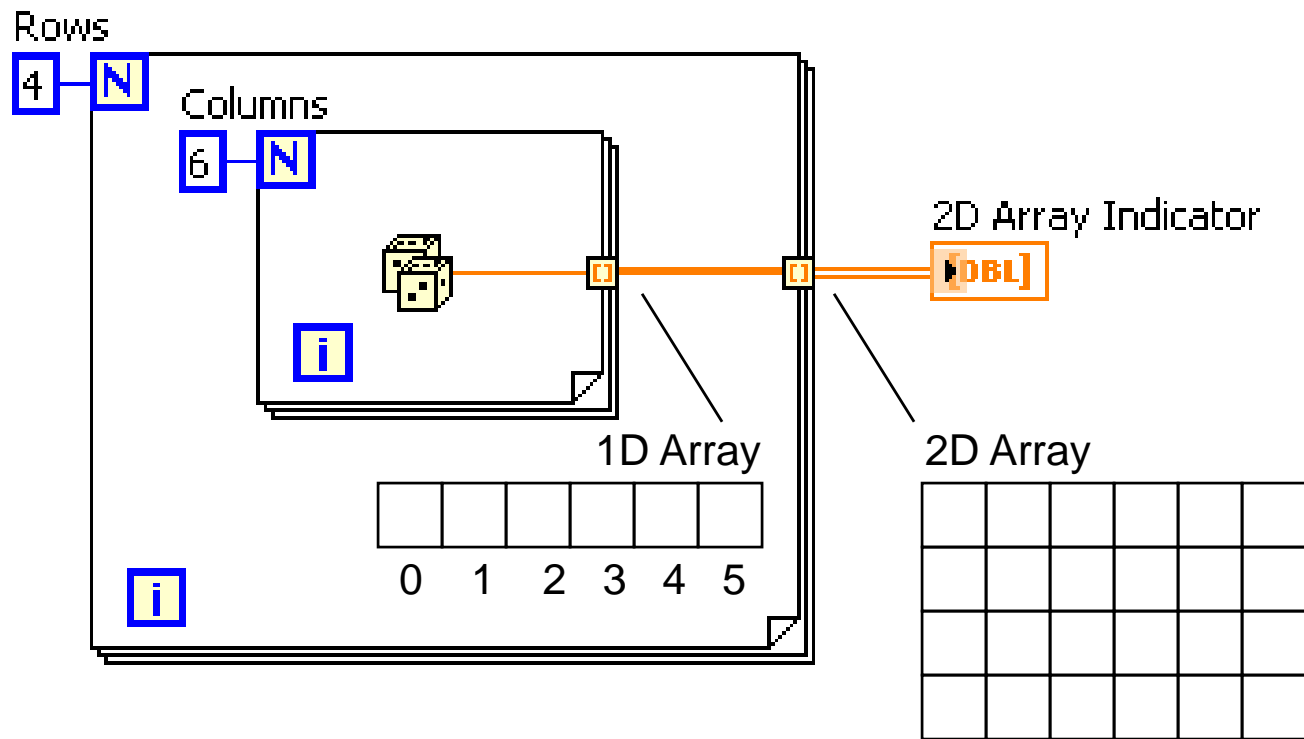
減少維度

自動索引 (Auto-Indexing)

- 資料流出或流入loop的地方稱為「通道」
- 在loop內的資料要流出時經過通道，可以自動將所有資料變成Array
- For Loop的自動索引預設為開啟；While Loop的自動索引預設為關閉。但是這些都是可以事後設定的。
- 在通道按滑鼠右鍵，就可以選擇是否要開啟自動索引的功能。



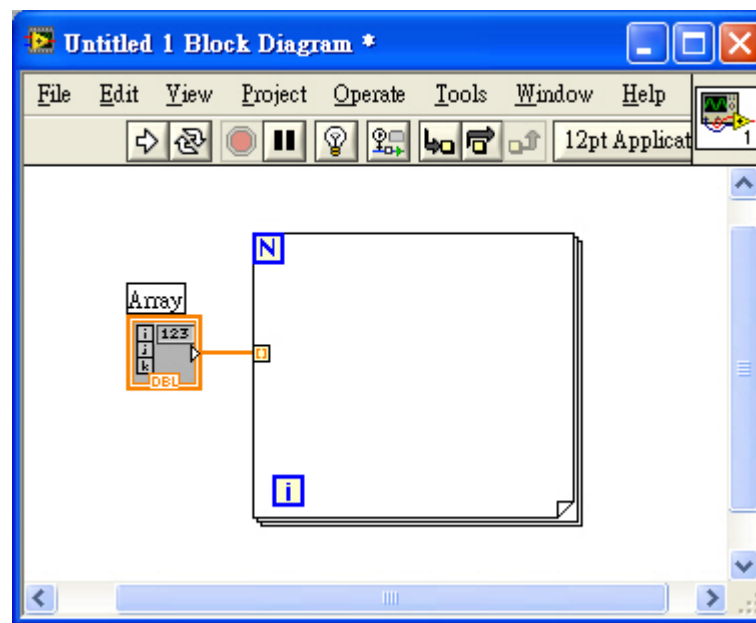
建立一個2D Array



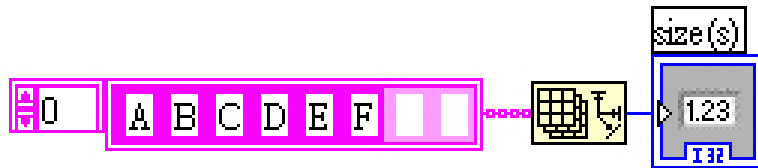
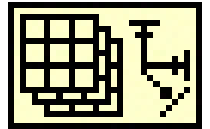
- 內部迴圈形成Row
- 外部迴圈把那些Row行成Column

使用自動索引來設定For Loop執行的次數

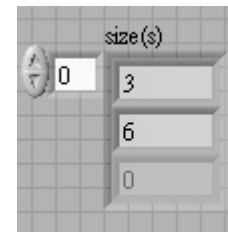
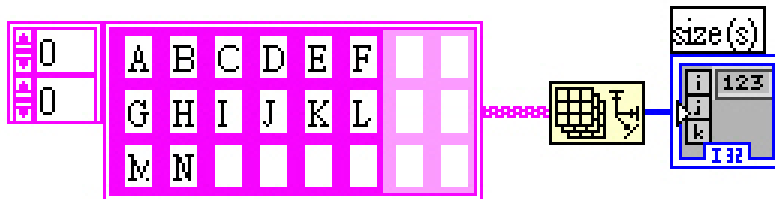
- 如果你啟動連接至For Loop輸入接頭的陣列的自動索引，LabVIEW會將計數接頭 (count terminal) 設定為陣列的大小，這樣你就不需要連接計數接頭。
- 如果你啟動一個以上通道的自動索引，或是你連接了計數接頭，則計數會改變為二者之中較小者




常用的Array函數 – Array Size



Array Size

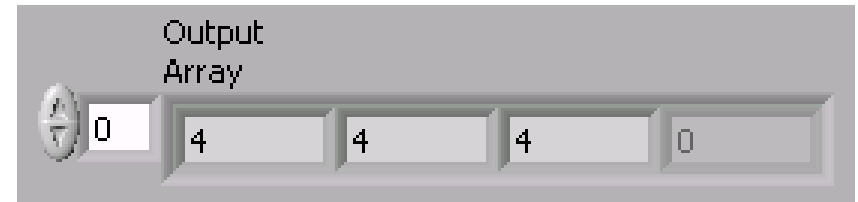
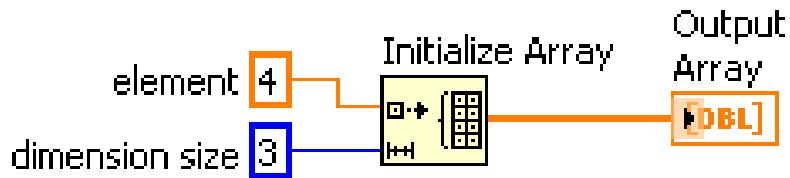
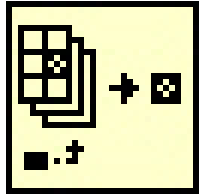


Array Size

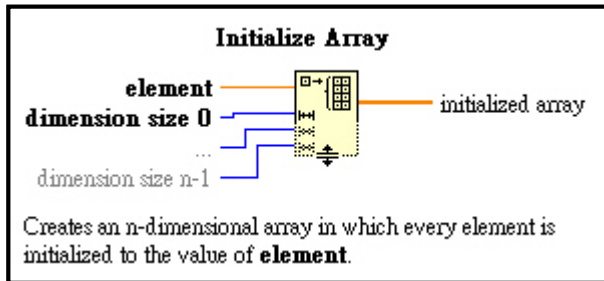
array →  → size(s)

Returns the number of elements in each dimension of **array**.

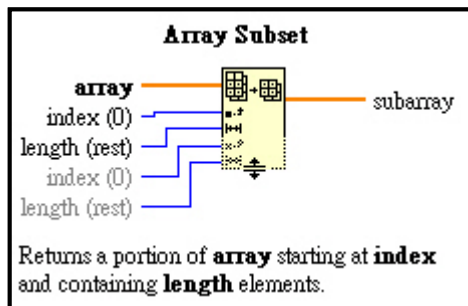
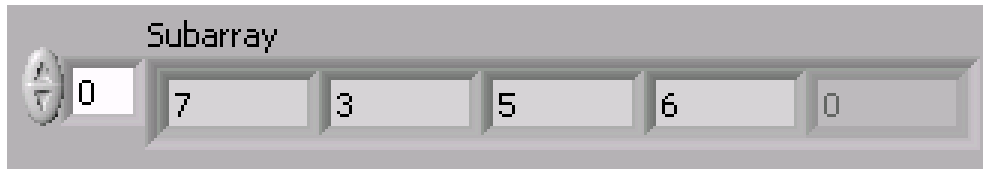
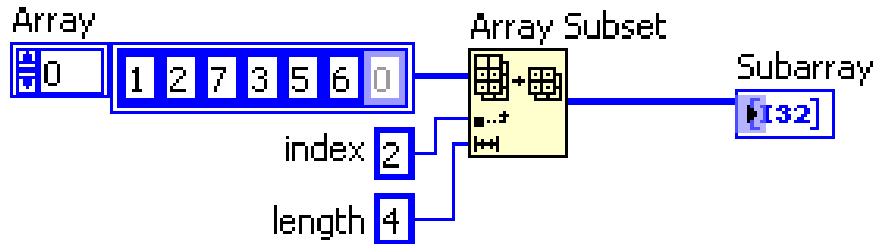
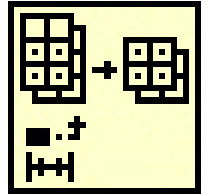
常用的Array函數 – Initialize Array



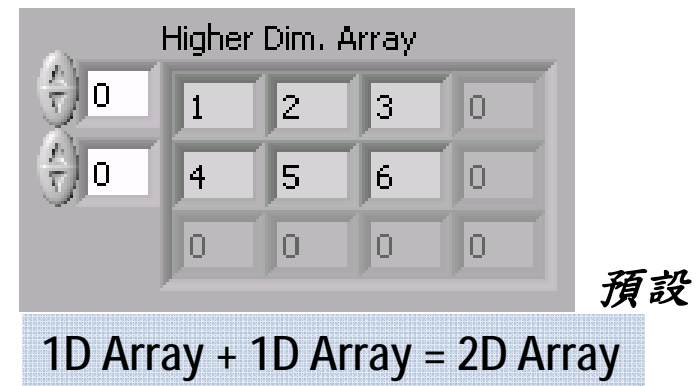
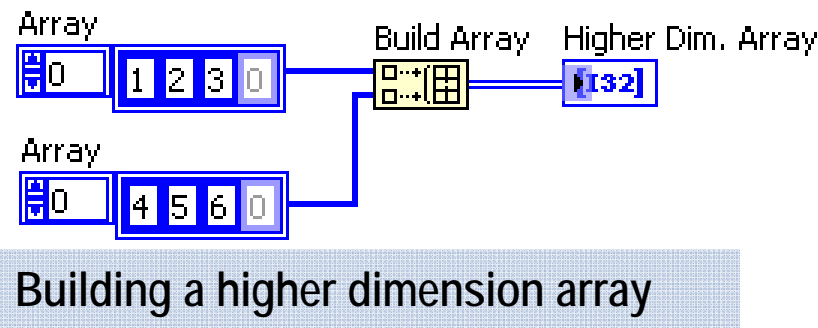
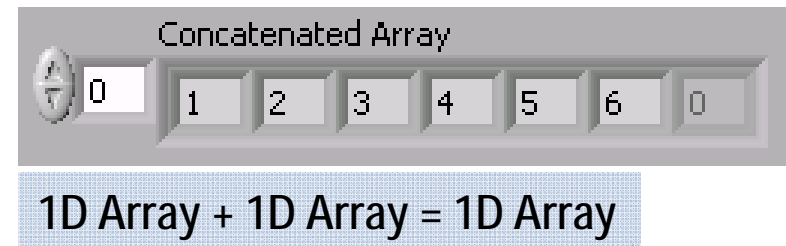
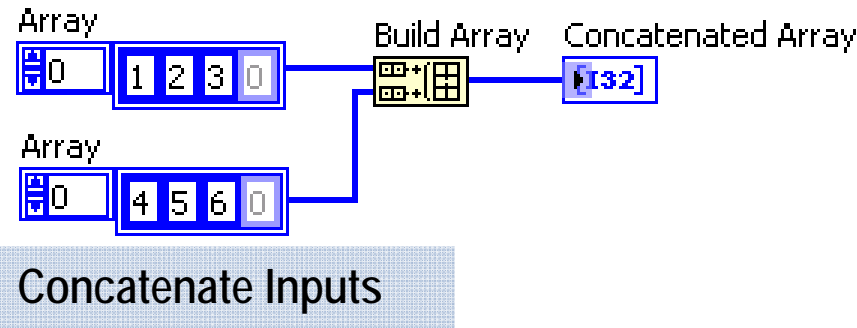
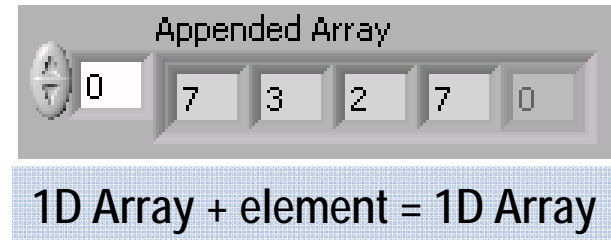
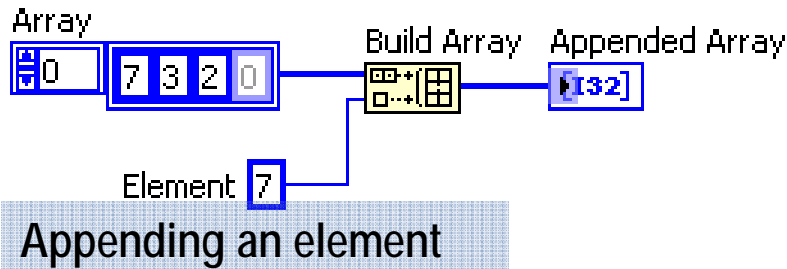
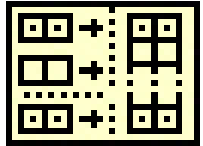
Initialize Array



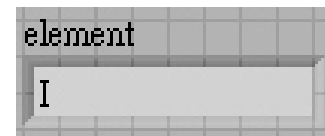
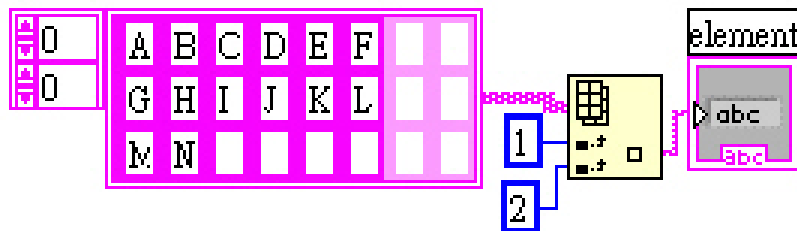
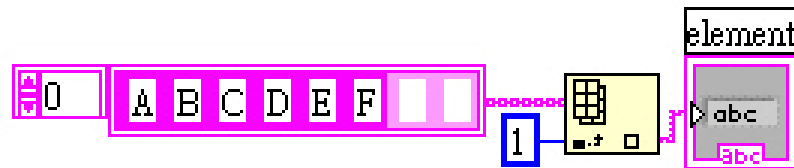
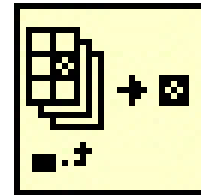
常用的Array函數 – Array Subset




常用的Array函數 – Build Array





常用的Array函數 – Index Array



Index Array

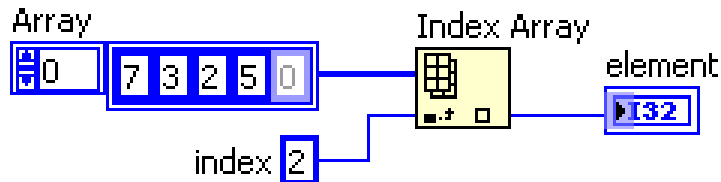
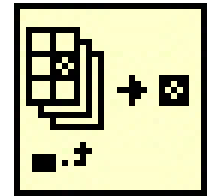
n-dimension array →  → element or subarray

index 0 →  → element or subarray

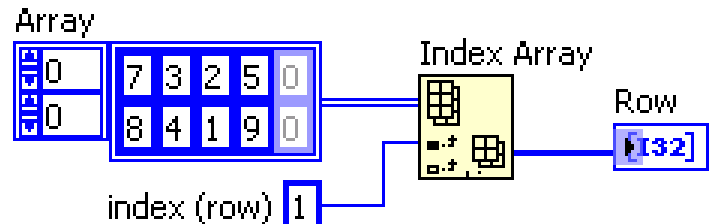
index n-1 →  → element or subarray

Returns the **element or subarray** of n-dimension array at **index**.

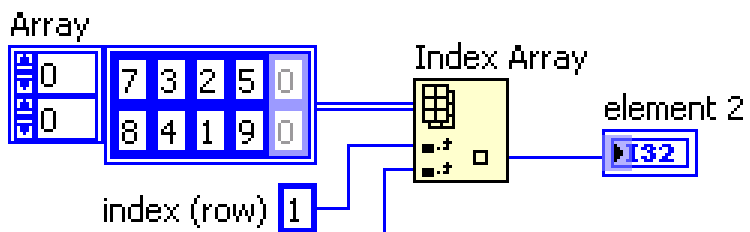
常用的Array函數 – Index Array



Extracting an Element



Extracting a Row



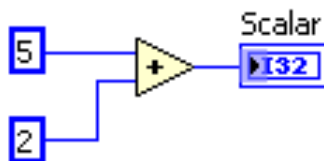
Extracting an Element of a Row

多型 (Polymorphism)

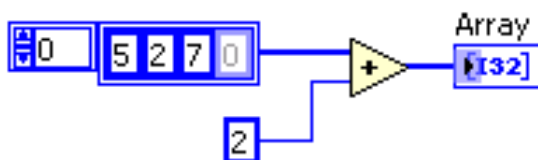
- 多型的函數，表示其輸入值可以是不同的資料結構，如純量或陣列

組合

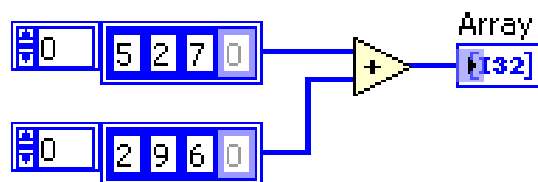
純量 + 純量



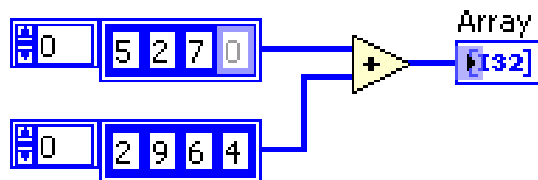
Array + 純量



Array + Array

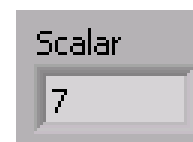


Array + Array



結果

純量



Array



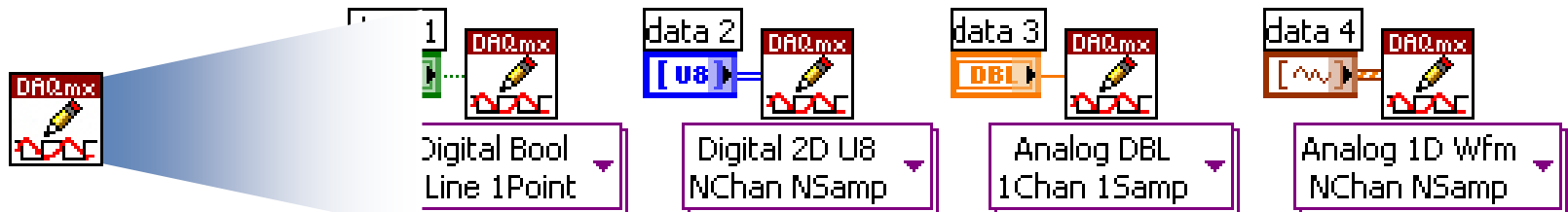
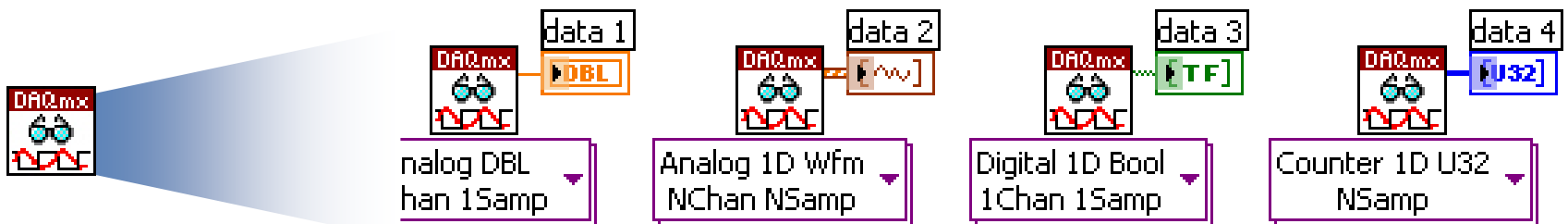
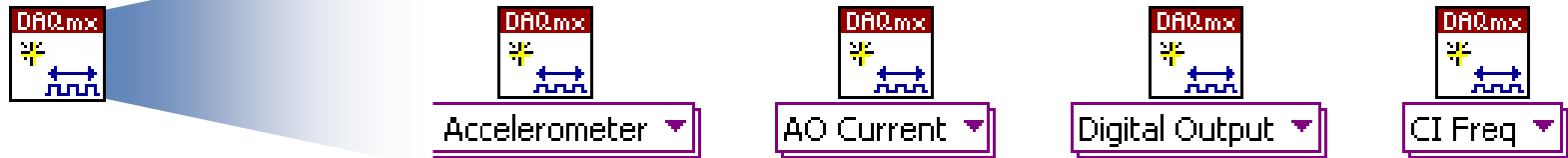
Array



Array



另一個多型的例子 - DAQmx



練習3.1 – 熟悉Array的使用

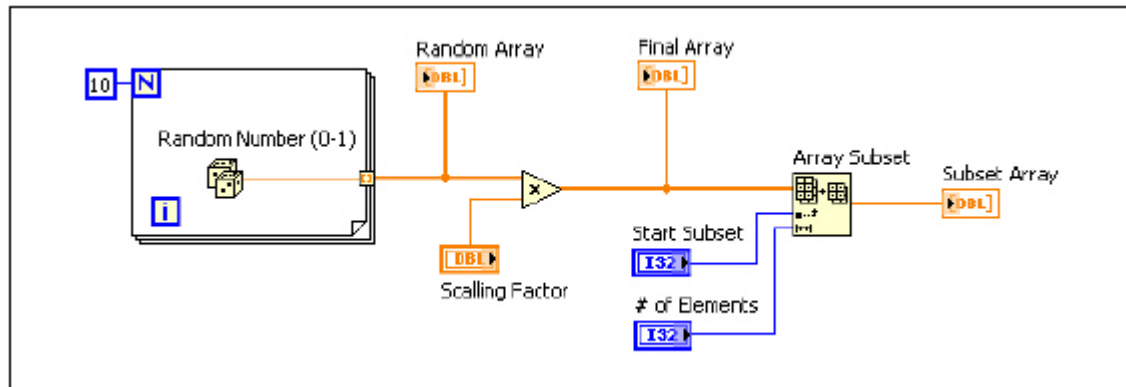
■ 建立以下的人機介面

The image shows a software interface for array manipulation. It consists of the following sections:

- Random Array:** A spin control on the left is set to 0. To its right are ten input fields, each containing the value 0.00.
- Scaling Factor:** A spin control on the left is set to 0.00.
- Final Array:** A spin control on the left is set to 0. To its right are ten input fields, each containing the value 0.00.
- Start Subset:** A spin control on the left is set to 0.
- # of Elements:** A spin control on the left is set to 0.
- Subset Array:** A spin control on the left is set to 0. To its right are ten input fields, each containing the value 0.00.

練習3.2 – 熟悉Array的使用

■ 建立以下的程式區



練習3.3 – 以自動索引建立陣列

1. 拉出亂數產生器
2. 在亂數產生器外面加上for loop
3. 拉出亂數的資料線，行成1D Array。
4. 再加上一個for loop，拉出亂數的資料線，行成2D Array

本章重點回顧

- 陣列將同種類型的資料元件組合起來。你可以建立數值、布林、路徑、字串、波形，以及叢集資料類型的陣列。
- 索引從零開始，也就是說它位於0 至 $n-1$ 的範圍內， n 是陣列中元件的數目。
- 如果將陣列連接至For Loop 或While Loop 輸入通道，你可以啟動自動索引(auto-indexing)，以讀取並處理陣列中的每一個元件。
- 在預設情況下，LabVIEW 啟動For Loop 的自動索引功能，關閉While Loop 的自動索引功能。
- 多型是指函數依照不同資料結構的輸入資料而做調整

挑戰題

- 建立一個VI，其功能為翻轉內含100個隨機數字之陣列的元件順序。舉例來說，array[0]變成array[99]，array[1]變成array[98]，餘此類推。
- 建立一個VI，其功能為產生三列十行的二維隨機數字陣列。在產生陣列之後，為每一列製作索引，並使用每一列的內容繪製獨立的圖表。人機介面上應該有三個圖表。
- 建立一個VI，其功能為模擬擲骰結果（值介於1和6之間），並記錄擲出每個值的次數。輸入埠為擲骰的次數，輸出則包括擲出每個數字的次數。只能使用一個移位暫存器。
- 建立一個VI，其功能為產生一維陣列，然後將元件兩兩相乘（從元件0和1開始），並傳回結果陣列。舉例來說，輸入陣列的值為1,23,10,5,7,11，輸出陣列則為23,50,77。