Lecture (07)
Arrays

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introduction

- An array is used to store a collection of data, but it is often more useful to think of an array as a collection of variables of the same type.
- Instead of declaring individual variables, such as number0, number1, ..., and number99, you declare one array variable such as numbers and use numbers[0], numbers[1], and ..., numbers[99] to represent individual variables.
- A specific element in an array is accessed by an index
- All arrays consist of contiguous memory locations. The lowest address corresponds to the first element and the highest address to the last element.

Declaring Arrays

```
type arrayName [ arraySize ];
```

This is called a single-dimension array. The **arraySize** must be an integer constant greater than zero and **type**

```
double balance[10];
```


Initializing Arrays

```
double balance[5] = {1000.0, 2.0, 3.4, 17.0, 50.0};
```

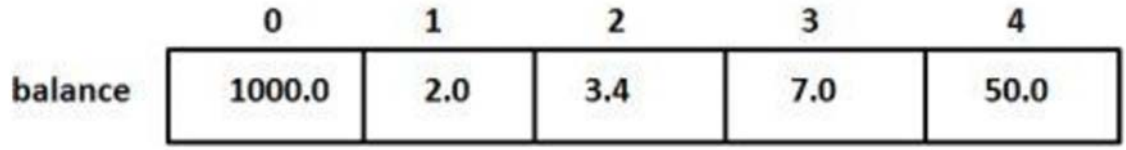
The number of values between braces { } can not be larger than the number of elements that we declare

```
double balance[] = {1000.0, 2.0, 3.4, 17.0, 50.0};
```

You will create exactly the same array as you did

```
balance[4] = 50.0;
```

statement assigns element number 5th in the array a value of 50.0



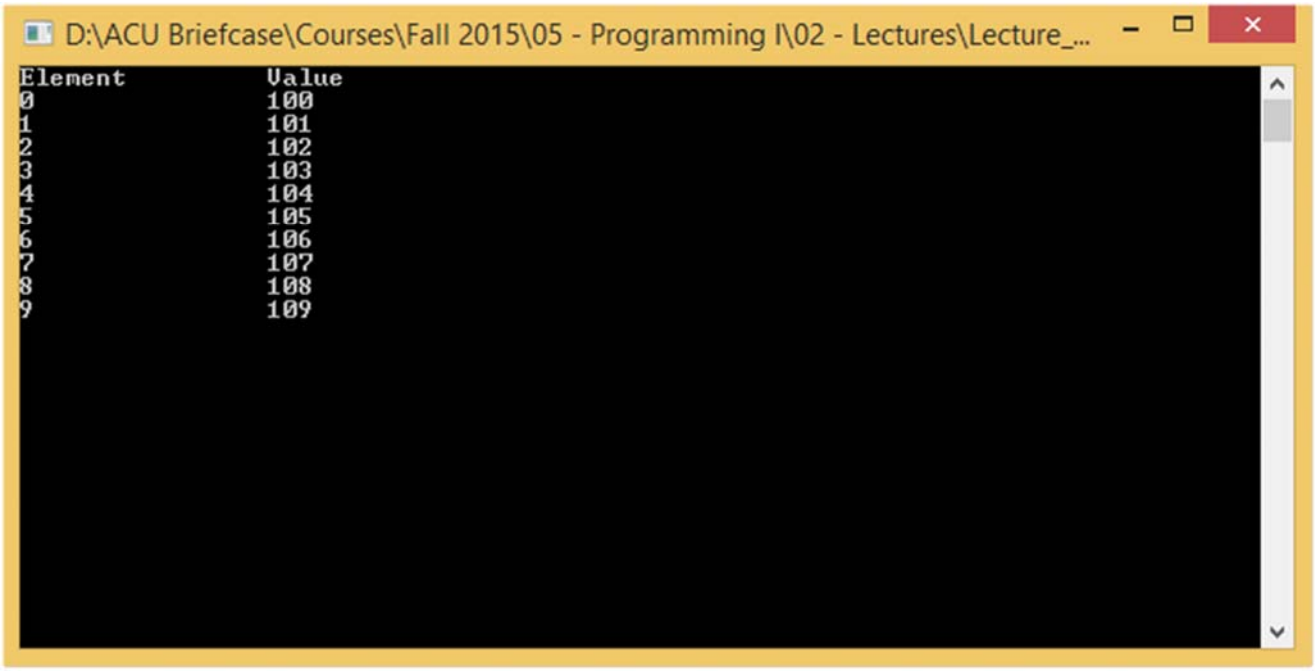
Accessing Array Elements

```
double salary = balance[9];
```

```
Cout<< “balance[10];
```


Example 01

```
#include "stdafx.h"
#include <iostream>
using namespace std;

int _tmain(int argc, _TCHAR* argv[])
{
	int n[ 10 ];
	for ( int i = 0; i < 10; i++ )
	{
		n[ i ] = i + 100;
	}
	cout << "Element" << "\t\t" << "Value" << endl;
	for ( int j = 0; j < 10; j++ )
	{
		cout << j << "\t\t"<< n[ j ] << endl;
	}
	cin.get();
	return 0;
}
```



Multi-dimensional arrays

the general form

```
type name[size1][size2]...[sizeN];
```

three dimensional

```
int threedim[5][10][4];
```

Two-Dimensional Arrays

The simplest form of the multidimensional array

```
type arrayName [ x ][ y ];
```

A two-dimensional array can be think as a table

	Column 0	Column 1	Column 2	Column 3
Row 0	a[0][0]	a[0][1]	a[0][2]	a[0][3]
Row 1	a[1][0]	a[1][1]	a[1][2]	a[1][3]
Row 2	a[2][0]	a[2][1]	a[2][2]	a[2][3]

Initializing Two-Dimensional Arrays

initialized by specifying bracketed values for each row

```
int a[3][4] = {
{0, 1, 2, 3} , /* initializers for row indexed by 0 */
{4, 5, 6, 7} , /* initializers for row indexed by 1 */
{8, 9, 10, 11} /* initializers for row indexed by 2 */
 ;{
```

infested braces, which indicate the intended row, are optional.

The following initialization is equivalent to previous example

```
int a[3][4] = {0,1,2,3,4,5,6,7,8,9,10,11};
```

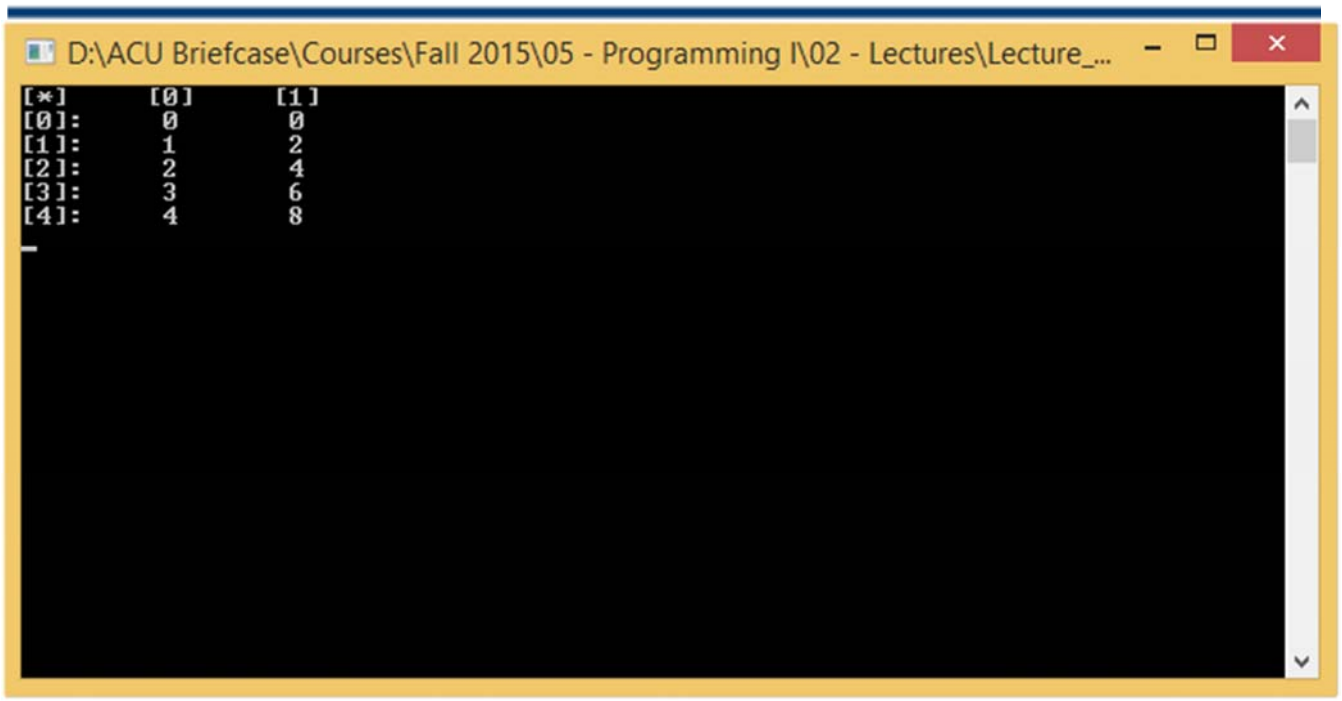
Accessing Two-Dimensional Array Elements

Using row index and column index of the array

```
int val = a[2][3];
```


Example 02

```
#include "stdafx.h"
#include <iostream>
using namespace std;
int _tmain(int argc, _TCHAR* argv[])
{
	int a[5][2] = { {0,0}, {1,2}, {2,4}, {3,6},{4,8}};
	cout << "[*]\t[0]\t[1]"<<endl;
	for ( int i = 0; i < 5; i++ )
	{
		cout<<"["<<i<<"]:\t";
		for ( int j = 0; j < 2; j++ )
		{
			cout << " "<<a[i
			][j]<<"\t";
		}
		cout<<endl;
	}
	cin.get();
	return 0;
}
```



Pointer to an array

- An array name is a constant pointer to the first element of the array.

```
double balance[50];
```

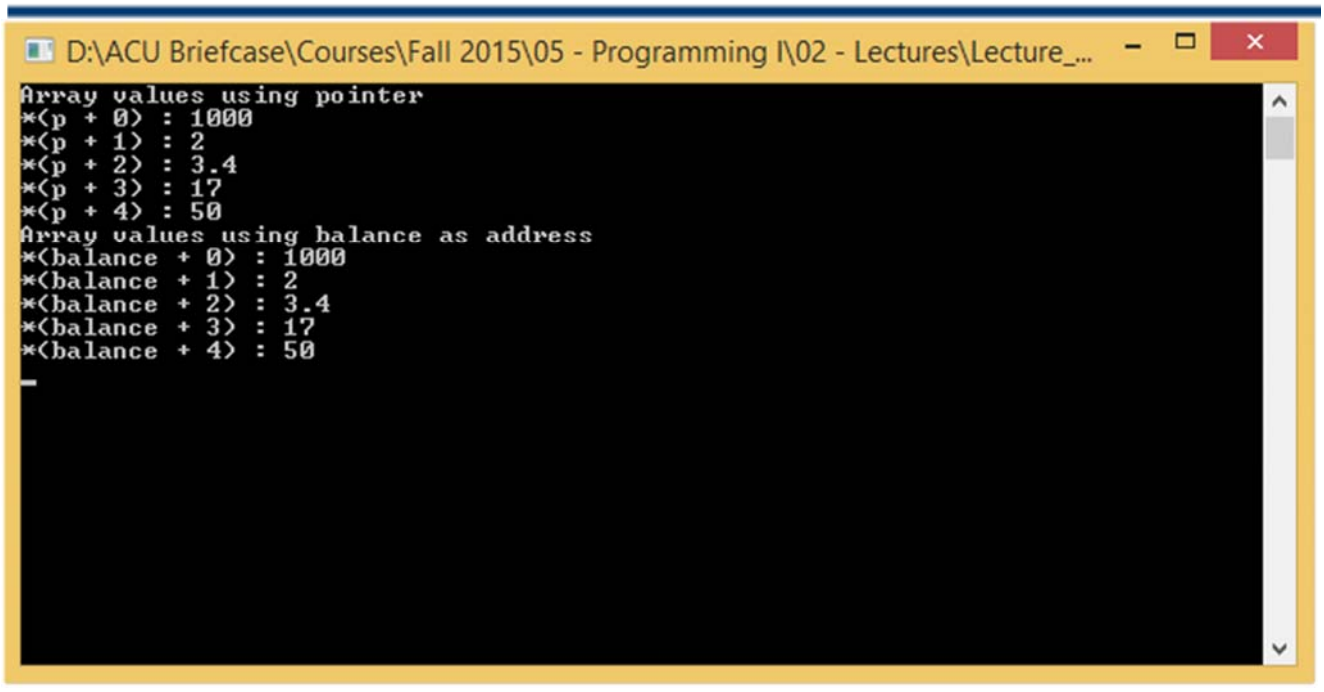
- **balance** is a pointer to &balance[0], which is the address of the first element of the array balance

```
double *p;
double balance[10];
p = balance;
```

- Therefore, *(balance + 4) is a legitimate way of accessing the data at balance[4].

Example 03

```
#include "stdafx.h"
#include <iostream>
using namespace std;

int _tmain(int argc, _TCHAR* argv[])
{
	double balance[5] = {1000.0, 2.0, 3.4, 17.0, 50.0};
	double *p;
	p = balance;
	cout << "Array values using pointer " << endl;
	for ( int i = 0; i < 5; i++ )
	{
		cout << "*(p + " << i << ") : ";
		cout << *(p + i) << endl;
	}
	cout << "Array values using balance as address " << endl;
	for ( int i = 0; i < 5; i++ )
	{
		cout << "*(balance + " << i << ") : ";
		cout << *(balance + i) << endl;
	}
	cin.get();
	return 0;
}
```



Passing arrays to functions

- C++ does not allow to pass an entire array as an argument to a function. However, You can pass a pointer to an array by specifying the array's name without an index.

Way-1

```
void myFunction(int *param)
 }
        .
        .
        .
 {
```


Way-2

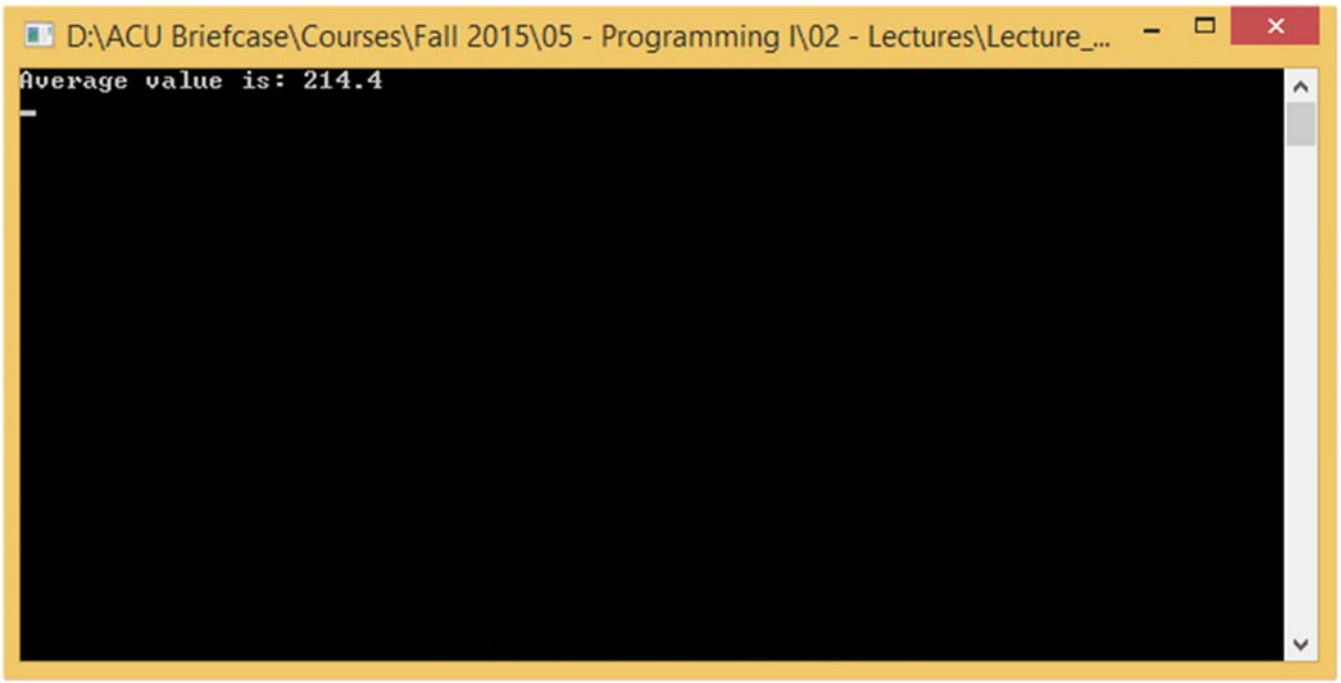
```
void myFunction(int param[10])
 }
        .
        .
        .
 {
```

Way-3

```
void myFunction(int param[])
 }
        .
        .
        .
 {
```

Example 04

```
#include "stdafx.h"
#include <iostream>
using namespace std;
double getAverage(int arr[], int size);
int _tmain(int argc, _TCHAR* argv[])
{
	int balance[5] = {1000, 2, 3, 17, 50};
	double avg;
	avg = getAverage( balance, 5 ) ;
	cout << "Average value is: " << avg << endl;
	cin.get();
	return 0;
}
double getAverage(int arr[], int size)
{
	int i, sum = 0;
	double avg;
	for (i = 0; i < size; ++i)
	{
		sum += arr[i];
	}
	avg = double(sum) / size;
	return avg;
}
```

Return array from functions

- If you want to return a single-dimension array from a function, you would have to declare a function returning a pointer

```
int * myFunction()
 }
 .
 .
 .
}
```

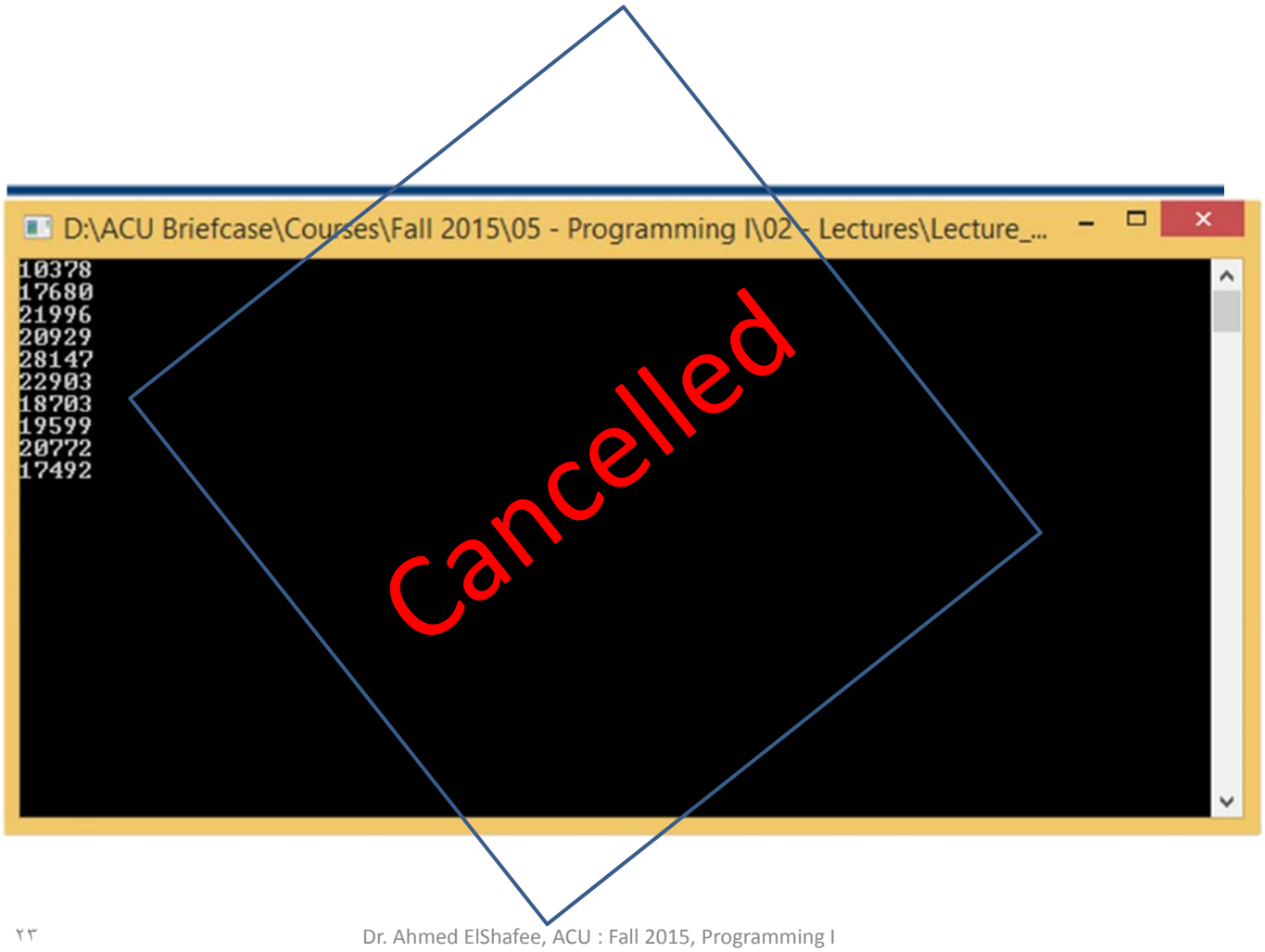
- C++ does not advocate to return the address of a local variable to outside of the function so you would have to define the local variable as **static** variable

Cancelled

Example 05

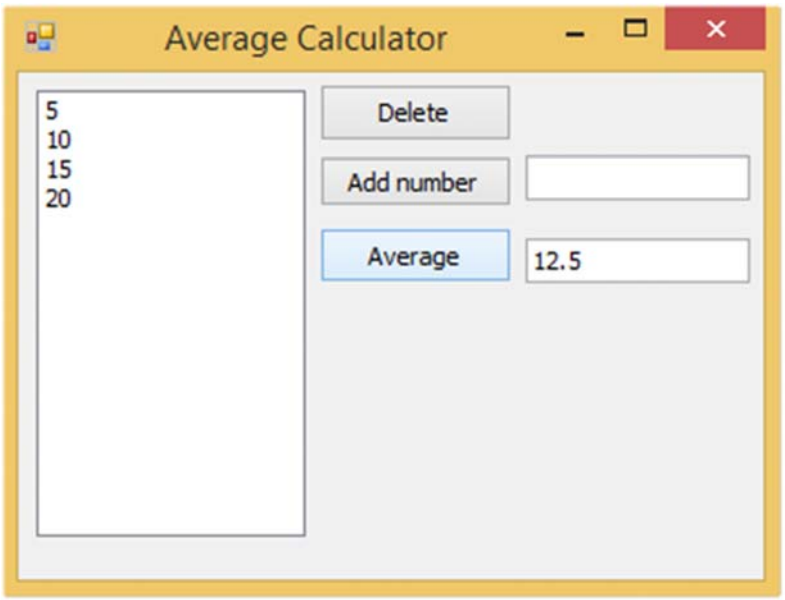
```
#include "stdafx.h"
#include <iostream>
#include <ctime>
using namespace std;
int * getRandom( )
{
	static int r[10];
	 /* initialize random seed: */
	srand(time( NULL ) );
	for (int i = 0; i < 10; ++i)
	{
		r[i] = rand();
		cout << r[i] << endl;
	}
	cin.get();
	return r;
}

int _tmain(int argc, _TCHAR* argv[])
{
	int *p;
	p = getRandom();
	for ( int i = 0; i < 10; i++ )
	{
		cout << "*(p + " << i << ") : ";
		cout << *(p + i) << endl;
	}
	return 0;
}
```

Cancelled



Example 06

Build a GUI application that calculates average a number entered by the user as follow



```
double getAverage(double arr[], int size)
{
    double avg,sum=0;
    for (int i = 0; i < size; ++i)
    {
        sum += arr[i];
    }
    avg = double(sum) / size;
    return avg;
}
```

```
private: System::Void button3_Click(System::Object^  sender, System::EventArgs^  e) {
            int index=listBox1->SelectedIndex ;
            listBox1->Items->RemoveAt( index );
        }
```



```
private: System::Void button1_Click(System::Object^  sender, System::EventArgs^  e) {
            listBox1->Items->Add(textBox1->Text);
            textBox1->Text="";

        }
private: System::Void button2_Click(System::Object^  sender, System::EventArgs^  e) {
            double nums[100];
            double result;
            int length=listBox1->Items->Count;
            for(int n=0;n<length;n++)
            {
                nums[n]=double::Parse(listBox1->Items[n]->ToString());
                result=getAverage(nums,length);
            }
           textBox2->Text=result.ToString();
        }
```


Thanks,..
Wish you all the best ☺