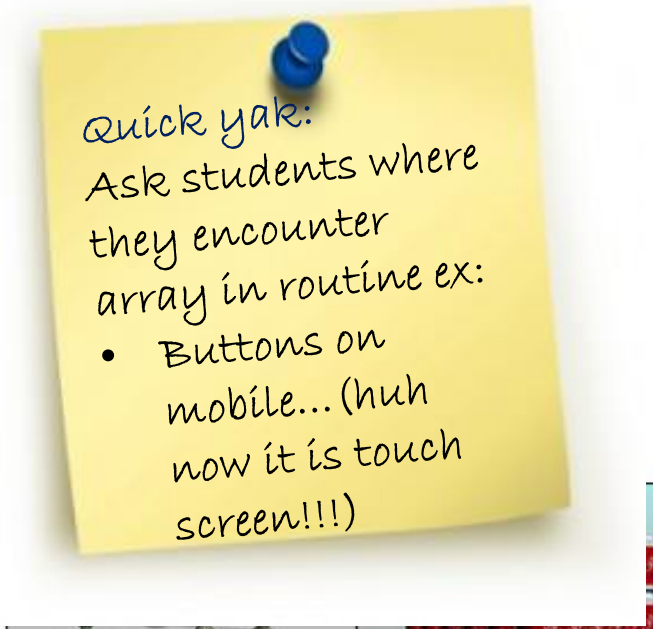
Arrays(1D and 2D)

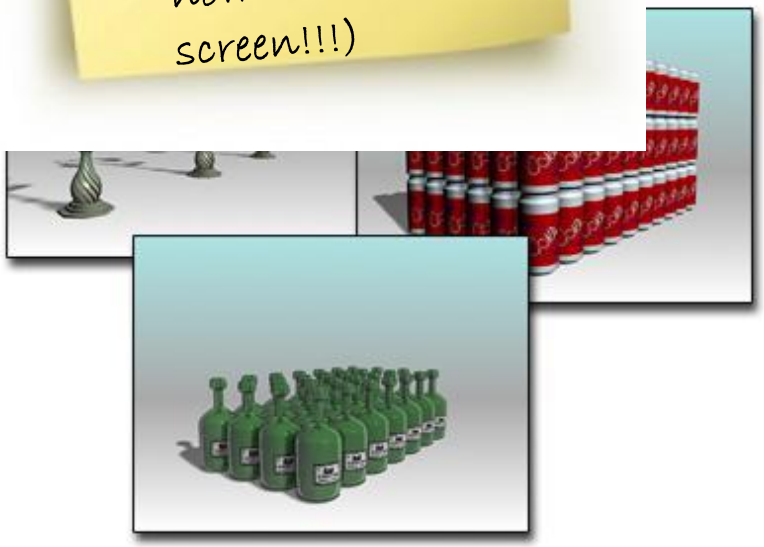
Outline

- To declare an array
- To initialize an array
- Operations on array

Introduction

- Arrays
  - Collection of **related** data it
    type.
  - Static entity – i.e. they rema
    throughout program execut





Arrays

- Array
  - Group of consecutive memory locations
  - Same name and data type
- To refer to an element, specify:
  - Array name
  - Position number in square brackets([])
- Format:

  arrayname[position_number]
  - First element is always at position 0
  - Eg. n element array named c:
    - c[0], c[1]...c[n – 1]

Name of array (Note that all elements of this array have the same name, c)

c[0]	-45
c[1]	6
c[2]	0
c[3]	72
c[4]	3
c[5]	-89
c[6]	0
c[7]	62
c[8]	-3
c[9]	1
c[10]	6453
c[11]	78

Position number of the element within array c

Arrays

- An *array* is an ordered list of values

The entire array has a single name

Each value has a numeric *index*

c

c[0]	c[1]	c[2]	c[3]	c[4]	c[5]	c[6]	c[7]	c[8]	c[9]
79	87	94	82	67	98	87	81	74	91

An array of size **N** is indexed from **zero to N-1**

This array holds 10 values that are indexed from 0 to 9

Arrays

- Array elements are like normal variables

```
c[0] =  3;/*stores 3 to c[0] element*/
```

- The position number inside square brackets is called **subscript/index**.
- Subscript must be integer or an integer expression

```
c[5 - 2] = 7;  (i.e. c[3] = 7)
```

Defining Arrays

- When defining arrays, specify:
  - Name
  - Data Type of array
  - Number of elements

```
datatype arrayName[numberOfElements];
```

  - Examples:

```
int students[10];
float myArray[3284];
```

- Defining multiple arrays of same data type
  - Format is similar to regular variables
  - Example:

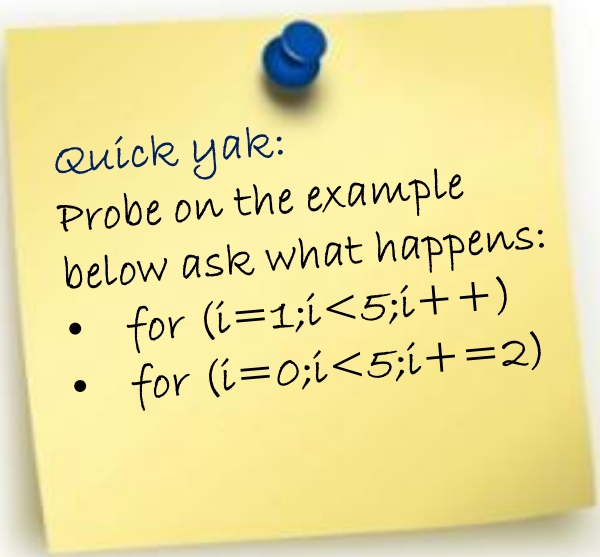
```
int b[100], x[27];
```

Initializing Arrays

- Initializers

```
int n[5] = { 1, 2, 3,
```

  - If not enough initializers elements become 0
  - `int n[5] = { 0 }; //`
  - C arrays have no bounds



- If size is omitted, initializers determine it

```
int n[] = { 1, 2, 3, 4, 5 };
```

  - 5 initializers, therefore 5 element array.

Initializing Arrays

- Array is same as the variable can prompt for value from the user at run time.
- Array is a group of elements so we use **for** loop to get the values of every element instead of getting single value at a time.
- Example: `int array[5];` // array of size 5

```
for(int i=0;i<5;i++){// loop begins from 0 to 4
        cin>>array[i];
    }
```

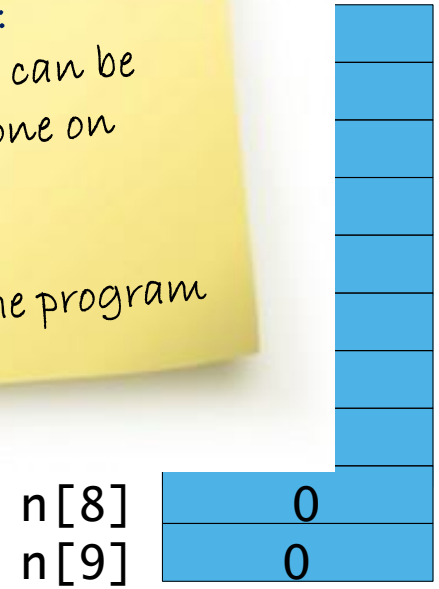
Program of Initializing an array to zero using loop.

```
#include<iostream.h>
/* function main begins program execution */
void main()
{
        int n [10]; /*n is an array of 10 integers*/

        /*initialize elements of array n to 0*/
        for (int i=0;i<10;i++) /*i is used as counter*/
        {       n[i]=0; /*set element at location I to 0*/
        }       /*end for*/

        cout<<"Element"<<"\t Value"<<endl;

        /*output contents of array n in tabular format*/

        for(int i=0;i<10;i++){
                cout<<i<<"\t"<<n[i];
        }/* end for */
}/* end main*/
```

Element	Value
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0

Quick yak:
Discussion can be quickly done on
- \t
- endl

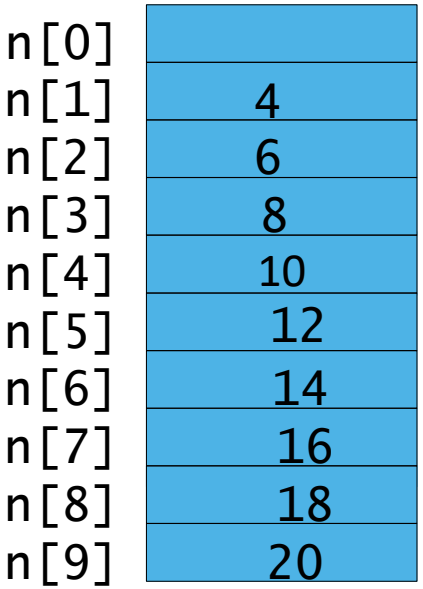
used in the program



```
#include<iostream.h>
#define SIZE 10
/* function main begins program execution */
void main()
{
        int n [SIZE]; /*n is an array of 10 integers*/

        /*initialize elements of array n to 0*/
        for (int i=0;i<SIZE;i++) /*i is used as counter */
        {       n[i]=0; /*set element at location I to 0*/
        }       /*end for*/

        cout<<"Element"<<"\t Value"<<endl;

        /*output contents of array n in tabular format*/

        for(int i=0;i<SIZE;i++){
                cout<<i<<"\t"<<n[i];
        } /* end for */
} /* end main*/
```

Program of Initializing an array element with calculations using loop.

Element	Value
0	2
1	4
2	6
3	8
4	10
5	12
6	14
7	16
8	18
9	20



Operations on arrays

- Insertion of element into an array
- Deletion of element from an array
- Search of element in an array

```
#include<iostream>
using namespace std;
int main()
{
   int a[100],i,n,k, item;
   cout<<"how many no to store in array";
   cin>>n;
   cout<<"Enter the number";
   for(i=0;i<=n-1;i++)
      cin>>a[i];
                    cout<<"Enter the no. and its position";
   cin>>tem>>k;
   k=k-1;
   for(i=n-1;i>=k;i--)
   {
       a[i+1]=a[i];
     }
   a[k]=item;
   cout<<"Contents of the array\n";
   for(i=0;i<=n;i++)
   {
        cout<<a[i];
   }
   return 0;
}
```

- Program to insert an element into an array

Output

```
How many no to store in array: 4

Enter the number: 12

14

5

11

Enter the no. and the position:  20        3

Content of the array

12

14

5

20

11
```

```
#include<iostream>
using namespace std;
int main()
{
   int a[100],i,n,k;
   cout<<"how many no to store in array"<<endl;
   cin>>n;
   cout<<"enter the number"<<endl;
   for(i=0;i<n;i++)
        cin>>a[i];
  cout<<"enter the position";
   cin>>k;
    k=k-1;
    for(i=k;i<n;i++)
    {
         a[i]=a[i+1];
     }
                    cout<<"contents of the array"<<endl;
     for(i=0;i<n-1;i++)
     {
        cout<<a[i];
     }
                     getch();
}
```

- Program to delete an element from an array

Output

```
How many no to store in array: 4

Enter the number: 12

14

5

11

Enter the position:  3

Content of the array

12

14

11
```

Searching in Arrays

- The process of finding a particular element of an array is called searching.
- Search an array for a *key* value.
- Two searching techniques:
  - Linear search
  - Binary search

Linear search

- Linear search
  - Simple
  - Compare each element of array with key value
  - Useful for small and unsorted arrays
- It simply examines each element sequentially, starting with the first element, until it finds the key element or it reaches the end of the array.

  Example: If you were looking for someone on a moving passenger train, you would use a sequential search.

```
#include<iostream>
using namespace std;
int main()
{
  int a[20],key,i,n, c=-1;
  cout<<“Enter the number of elements:\t";
  cin>>n;
  cout<<"Enter the elements:\t";
  for(i=0;i<n;i++)
    cin>>a[i];
 cout<<"Enter the element to be found \t";
 cin>>key;
  for(i=0;i<n;i++)
    if(a[i]==key)          //comparison
    {
    cout<<“Key found at location \t"<<i;
    c++;
    break;
    }
  if (c==-1)
    cout<<"element not found in the list";
  return 0;
}
```

- Program of linear search in an array.

Output

```
Enter the number of elements: 4

Enter the element: 12

14

5

11

Enter a number to be found: 14

Key found at location 2
```

Binary search

- Binary search
  - Applicable for **sorted** arrays
- The algorithm locates the **middle** element of the array and compares it to the key value.
  - Compares `middle` element with the `key`
    - If equal, match found
    - If `key < middle`, looks in left half of `middle`
    - If `key > middle`, looks in right half of `middle`
    - Repeat (the algorithm is repeated on **one-quarter** of the original array.)

Binary search

- It repeatedly divides the sequence in two, each time restricting the search to the half that would contain the element.
- This is a tremendous increase in performance over the linear search that required comparing the search key to an average of half of the array elements.
- You might use the binary search to look up a word in a dictionary

```
#include<iostream>
using namespace std;
int main()
{
        int ar[100],beg,mid,end,i,n,search;
        cout<<"How many numbers in the array: ";
        cin>>n;
        cout<<"Enter "<<n<<" numbers in ascending order --> ";
        for(i=0;i<n;i++)
                cin>>ar[i];
        beg=0;end=n-1;
        cout<<"Enter a number to search: ";
        cin>>search;
        while(beg<=end)
        {
                mid=(beg+end)/2;
                if(ar[mid]==search)
                        cout<<"\nItem found at position"<<(mid+1);
                if(search>ar[mid])
                        beg=mid+1;
                else
                        end=mid-1;

        }
                cout<<"\nSorry! "<<search<<" doesnot found.";
        return 0;
}
```

- Program of binary search in an array.

Output

```
How many numbers in the array: 4
Enter 4 numbers in ascending order→12
14
26
47
Enter a number to search:26
Item found at position 3
```