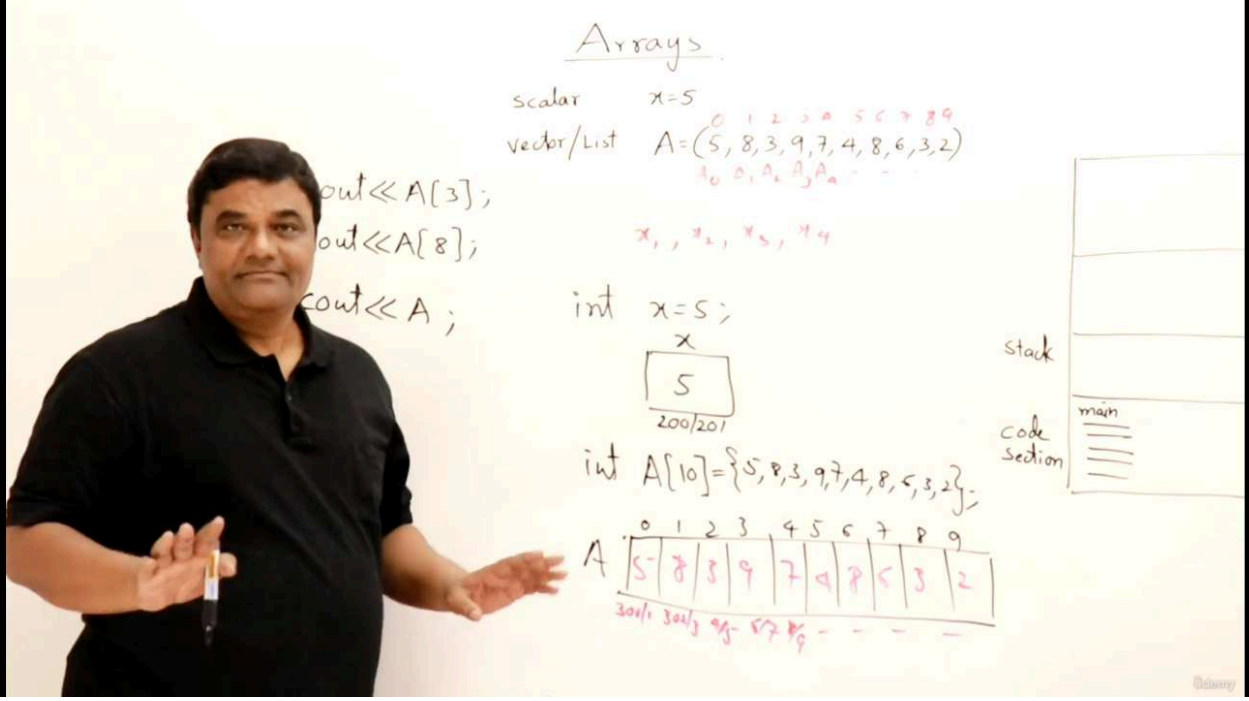
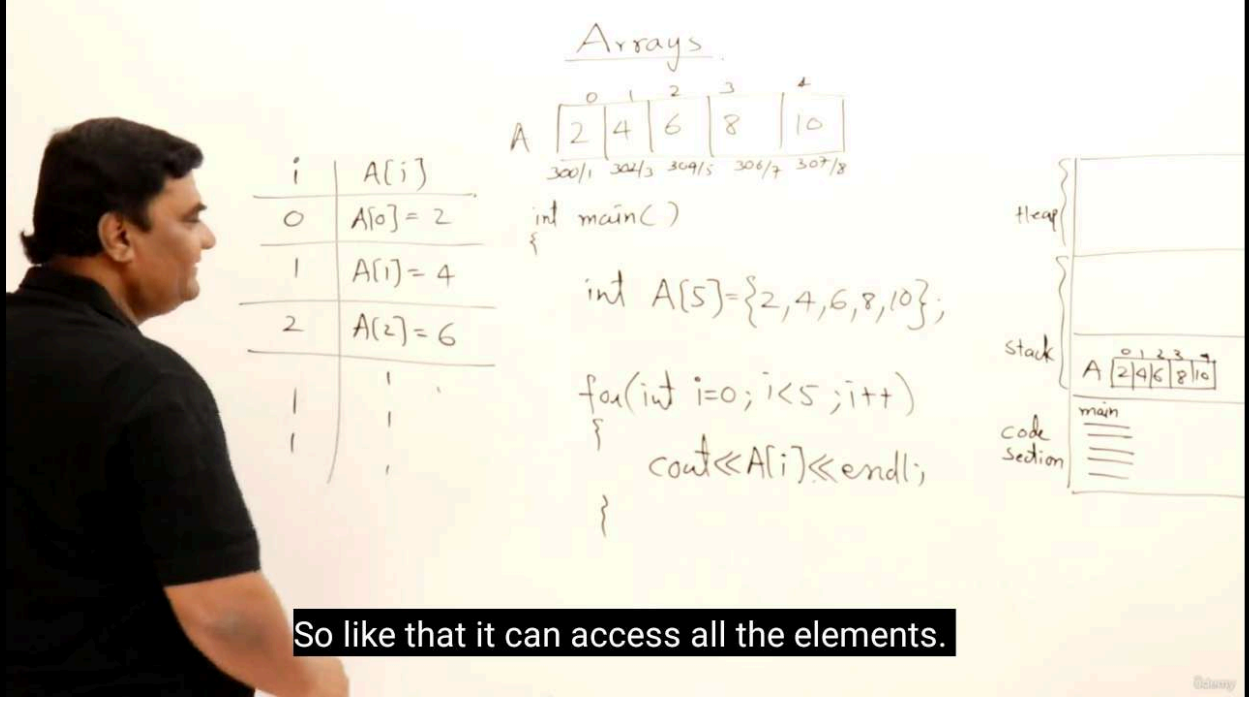
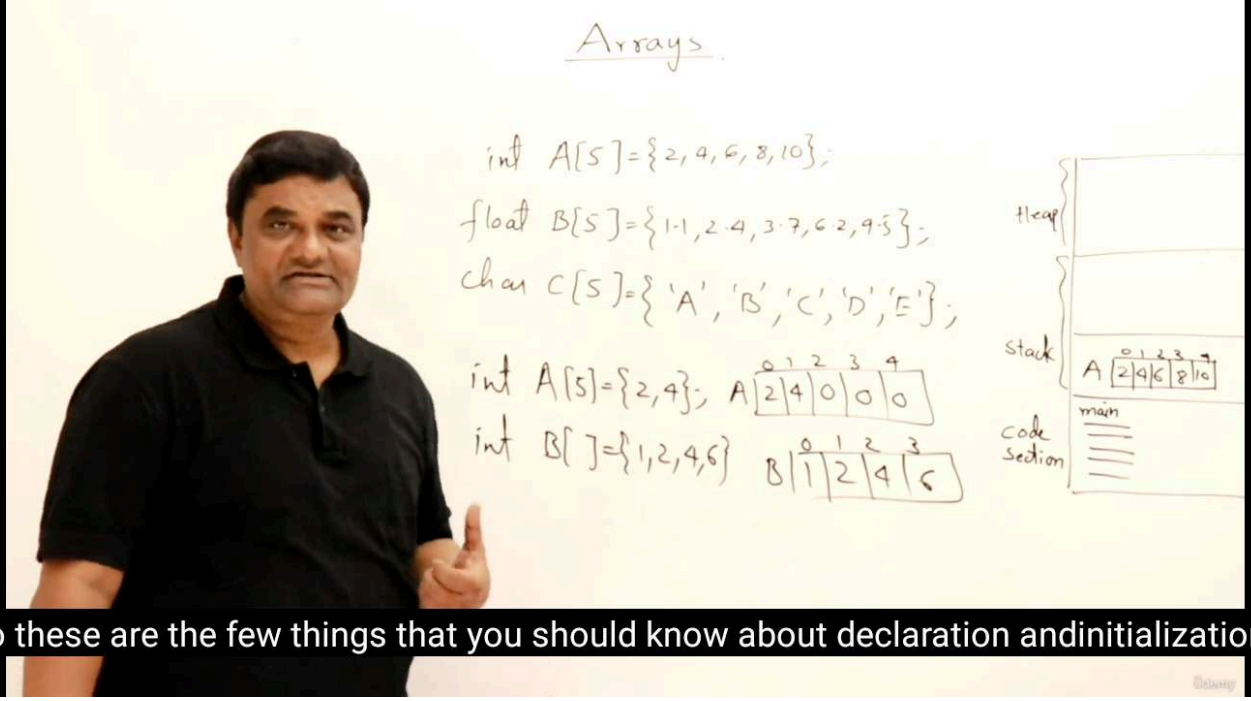
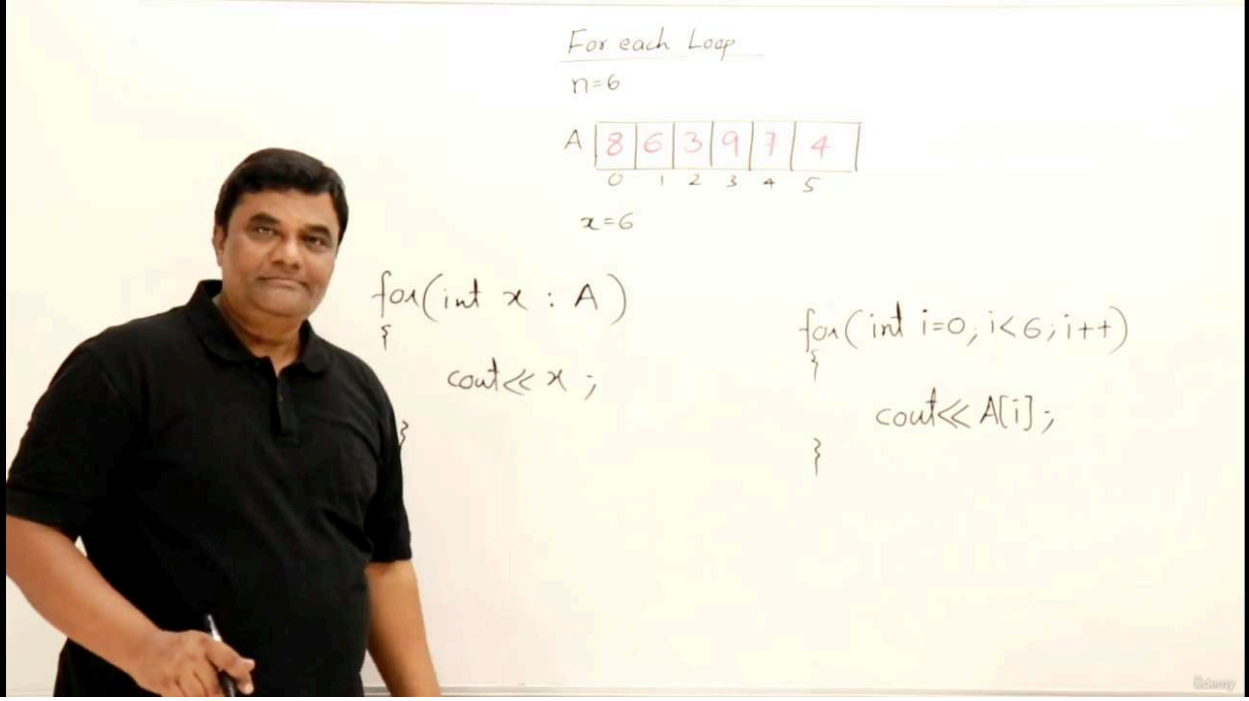

Arrays
scalar x=5
Vector/List A=(5,8,3,9,7,4,8,6,3,2)
0 1 2 3 4 5 6 7 8 9
cout<<A[3];
cout<<A[8];
cout<<A;
int x=5;
x
5
200/201
stack
main
code section
int A[10]={5,8,3,9,7,4,8,5,3,2};
A
0 1 2 3 4 5 6 7 8 9
5 8 3 9 7 4 8 5 3 2

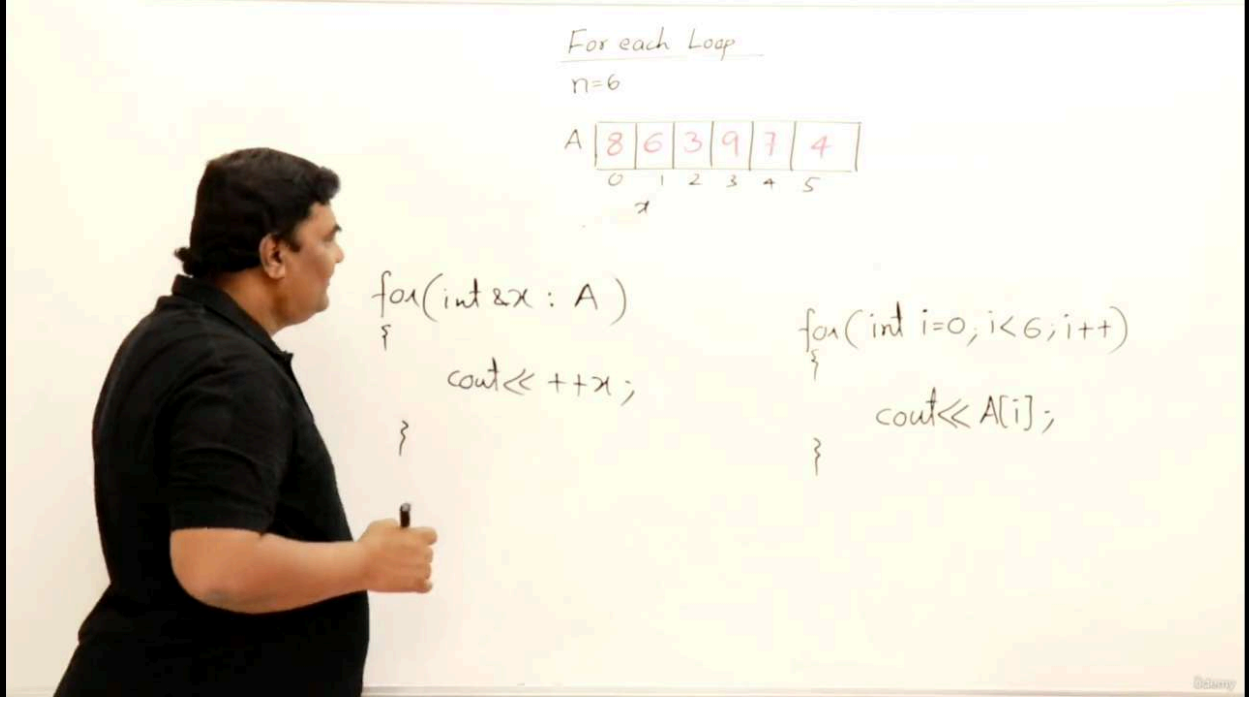


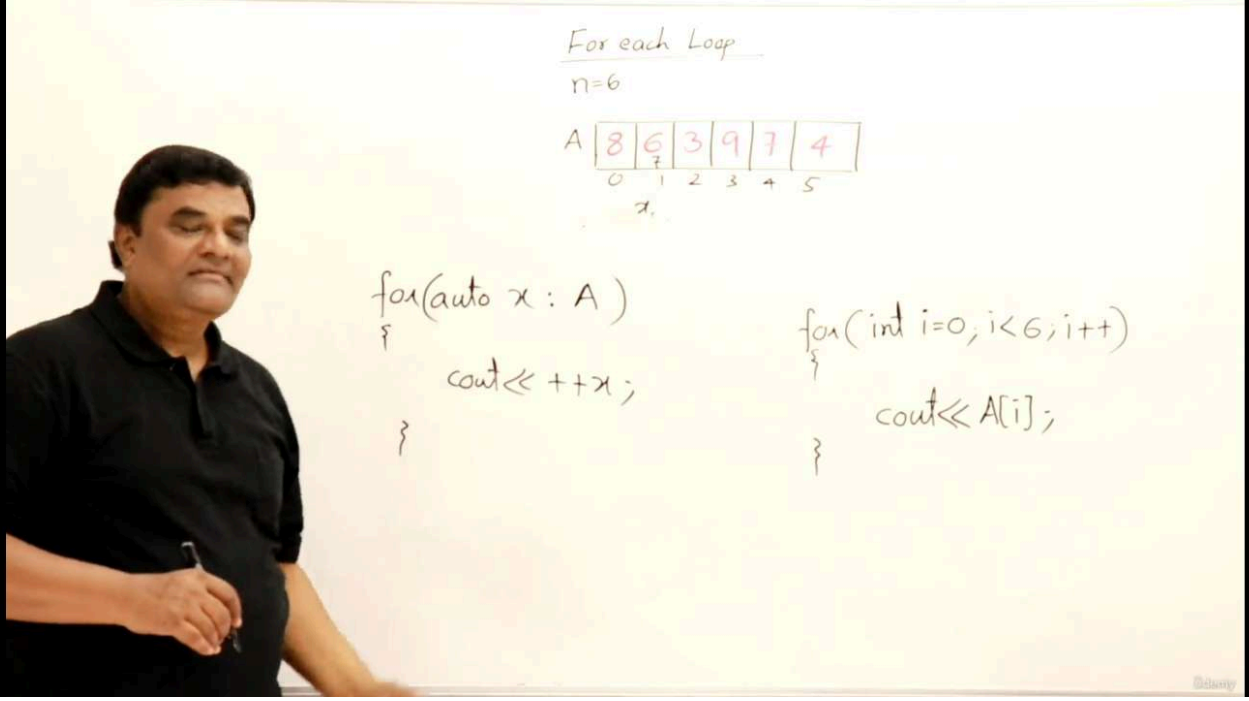
So like that it can access all the elements.



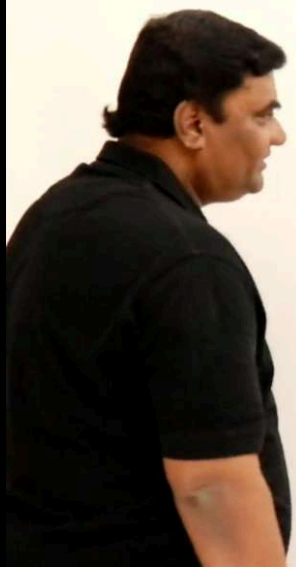
So these are the few things that you should know about declaration andinitialization.


For each Loop
n=6
A
8 6 3 9 7 4
0 1 2 3 4 5
x=6
for(int x : A)
{
cout<< x ;
}
for(int i=0; i<6; i++)
{
cout<< A[i];
}


For each Loop
n=6
A
8 6 3 9 7 4
0 1 2 3 4 5
x
for(int &x : A)
{
cout<< ++x;
}
for(int i=0; i<6; i++)
{
cout<< A[i];
}


For each Loop
n=6
A
8 6 3 9 7 4
0 1 2 3 4 5
x
for(auto x : A)
{
cout<< ++x;
}
for(int i=0; i<6; i++)
{
cout<< A[i];
}

Sum of Array Elements



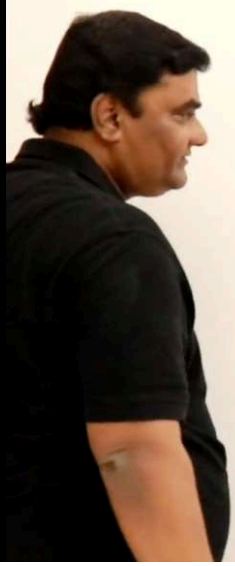
```
int main( )
{
   int A[7]={4,8,6,9,5,2,7}
   int n=7, sum=0;

   for(int i=0; i<7; i++ )
   {
      sum=sum+A[i];

   }
   cout<<"Sum is "<<sum;

   ret---
}
```

A	4	8	6	9	5	2	7
	0	1	2	3	4	5	6

n=7 sum=0;

i	A[i]	sum=sum+A[i]
0	4	0+4=4
1	8	4+8=12
2	6	12+6=18
3	9	18+9=27
4	5	27+5=32
5	2	32+2=34
6	7	34+7=41

Sum of Array Elements



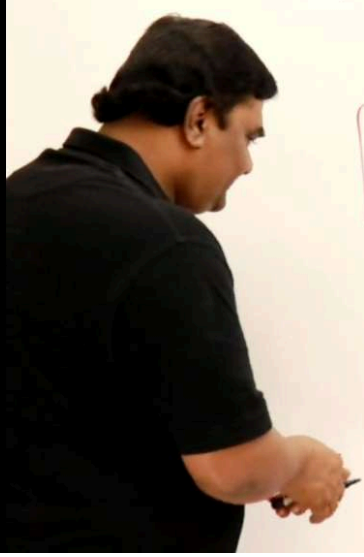
```
int main( )
{
   int A[7]={4,8,6,9,5,2,7}
   int n=7, max;
   max=A[0];
   for(i=1; i<7 ;i++)
   {
      if (A[i]>max)
      {
         max=A[i];
      }
   }
   cout<<"Maximum no is"<<max;
}
```

A	4	8	6	9	5	2	7
	0	1	2	3	4	5	6

n=7 max=4

i	A[i]	if(A[i]>max) max=A[i]
0	4	4
1	8	8
2	6	8
3	9	9
4	5	9
5	2	9
6	7	9

Linear Search



```
int main()
{
    int A[10], n=10, i;

    cout<<"Enter numbers";
    for(i=0;i<n;i++)
    {
        cin>>A[i];
    }
    cout<<"Enter key";
    cin>>key;
    for(i=0;i<n;i++)
    {
        if(key==A[i])
        {
            cout<<" found at "<<i;
            return 0;
        }
    }
    cout<<"Not Found";
}
```

n=10

A	6	11	25	8	15	7	12	20	9	14
	0	1	2	3	4	5	6	7	8	9

Key=12 successful
6

Key=35 unsuccessful

Linear Search

```
int main()
{
    int A[10], n=10, i;

    cout<<"Enter numbers";
    for(i=0;i<n;i++)
    {
        cin>>A[i];
    }
    cout<<"Enter key";
    cin>>key;
    for(i=0;i<n;i++)
    {
        if(key==A[i])
        {
            cout<<" found at "<<i;
            return 0;
        }
    }
    cout<<"Not Found";
}
```

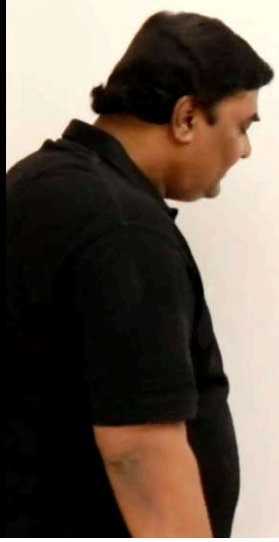
n=10

A	6	11	25	8	15	7	12	20	9	14
	0	1	2	3	4	5	6	7	8	9

Key=12 successful
6

Key=35 unsuccessful

Binary Search



```
int main()
{
    int A[10]={6,8,13,17,20,22,25,28,30,35};
    int l=0,h=9, key, mid;
    cout<<"Enter key";
    cin>>key;
    while( l<=h )
    {
        mid=(l+h)/2;
        if(key==A[mid])
        {
            cout<<"Found at"<<mid;
            return 0;
        }
        else if(key<A[mid]) h=mid-1;
        else l=mid+1;
    }
    cout<<"Not Found";
}
```

n=10 l=0 h=9

	0	1	2	3	4	5	6	7	8	9
A	6	8	13	17	20	22	25	28	30	35
							h	l		

Key = 25
27

l	h	mid = ⌊(l+h)/2⌋
0	9	(0+9)/2 = 4
5	9	(5+9)/2 = 7
5	6	(5+6)/2 = 5
6	6	(6+6)/2 = 6

Arrays

- Array is a collection of similar data elements under one name, each element is accessible using its index
- Memory for array is allocated contagiously
- For-each loop is used for accessing array
- N-dimension arrays are supported by C++
- Two-Dimensional Arrays are sued for Matrices
- Array can be created in Stack or Heap Section of memory

Program to find Sum of all elements in an Array

```
#include <iostream>
using namespace std;

int main()
{
    int A[10]={2,4,6,8,12,3,5,7,9,11};
    int sum=0;

    for(int i=0;i<=10;i++)
        sum=sum+A[i];

    cout<<"The sum is "<<sum<<endl;
}
```

Program to find maximum element from an Array

```
#include <iostream>
using namespace std;

int main()
{
    int A[10]={2,4,6,8,12,3,5,7,9,11};
    int max=INT_MIN;

    for(int i=0;i<=10;i++)
    {
        if(A[i]>max)
            max=A[i];
    }

    cout<<max<<endl;
}
```

Program for Linear Search

```
#include <iostream>
using namespace std;

int main()
{
    int A[10]={2,4,6,8,12,3,5,7,9};
    int key;

    cout<<"Enter a Key element ";
    cin>>key;

    for(int i=0;i<10;i++)
    {
        if(key==A[i])
        {
            cout<<"The Key element is found at "<<i<<endl;
            exit(0);
        }
    }
    cout<<"Key element not found"<<endl;

    return 0;
}
```

Variable Length Array

What is variable sized Array??
How to declared, initialise variable sized array?

a variable-length array (VLA), also called variable-sized, runtime-sized, whose length is determined at run time. It is created in stack.

cin>>n;

int A[n];

This array is a dynamic sized array. Its size can be mentioned on once. It cannot be resized agin.

Dynamic Array vs Variable Length Array

Dynamic Array: created in Heap using pointer

int *p=new int[n];

Variable Sized Array: created in stack

int A[n];

Dynamic Array: size is dynamic, decided at run-time

Variable Sized Array: size is dynamic, decided at run-time

Dynamic Array: size can be change by creating new array

int *p=new int[n];

delete []p;

p=new int[2*n];

Variable Sized Array: once created, size cannot be changed.

Dynamic Array: it can be used anywhere in the program, it address is available

Variable Sized Array: useful for temporary purpose within a function.

What is a garbage value?

If you declare any variable then definitely it will have some value. that value is a garbage value.

imagine that variable is like a chair in public place.

If you get a chair you will not sit directly, first you clean it.

may be someone left something in chair, which doesn't belong to you so it's garbage for you.

Duplicates in Search

searching is done in unique list of elements.
If there are duplicates we can't perform search.

If they are duplicates then you should look for all occurrences of a element.

Example:

List : 8,5,7,8,10,8,2,7,8

Here 8 is appearing 4 time. If you search for 8, then which 8 you want?

break vs return vs exit(0)

break will stop loop or switch case.

return will stop function

exit(0) will stop program

Middle element in Binary Search

If there a even number of elements then what is mid?

Example:

List: 2 4 6 10 12 15 18 10

List is having 8 elements then middle element will be 10

l=0 and h=7

mid=(l+h)/2 = (0+7)/2 = 3.5 = 3

l and h are integers. We get floor value. 3

What is INT_MAX?

It is a maximum integer value. It is a predefined constant available in some compilers.

For finding minimum number we initialise

min=INT_MAX.

If it is not available in your compiler then initialise min with first elements.

min=A[0];

Mistakes on whiteboard

Lecture 91: I have taken n=7 but not used it in for loop. For loop should be

for(int i=0;i<n;i++)

Lecture 97 : I did not write count++. count should be incremented.

```
for(int i=0;i<4;i++)
{
```

```
        for(int j=0;j<4;j++)
        {
                cout<<count<<" ";
                count++; // this line is missing.
        }
        cout<<endl;
}
```

2D array for each loop

2D array can be considered as array of rows.

If there is a 2D array

int A[4][5];

Method for accessing it using for each loop, is.

for(auto &x:A) // here x represents a row of a 2D array. We cant declare it so take auto reference.

```
{
        for(int y:x)
        {
                cout<<y<<" ";
        }
}
```