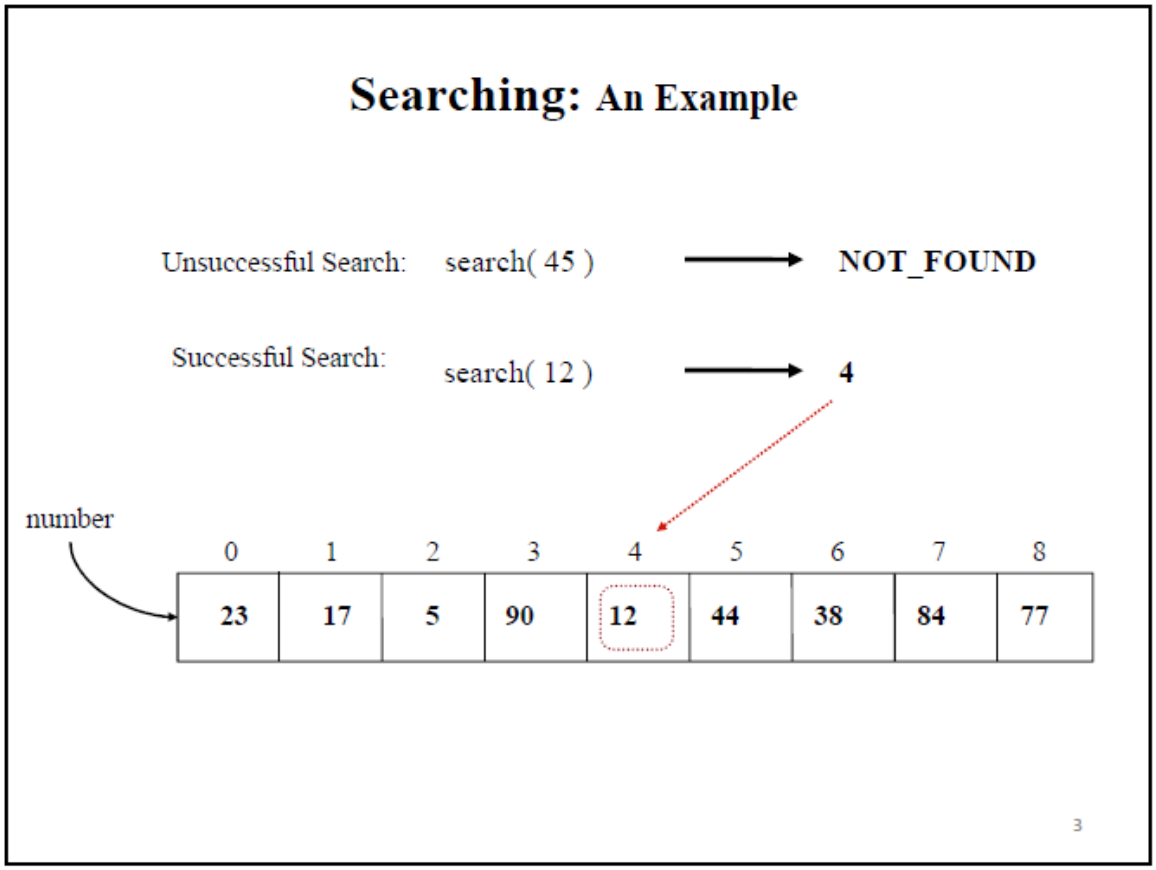
Searching البحث

• **Searching** is the process of finding a target element among a group of items (the search pool), or determining that it isn't there.



1-Linear Search:

• **Linear Search:** A linear search simply examines each item in the search pool, one at a time, until either the target is found or until the pool is exhausted.
• This approach does not assume the items in the search pool are in any particular order
• We just need to be able to examine each element in turn (in a linear fashion)
• It's fairly easy to understand, but not very efficient

Linear Search: Performance
• We analyze the successful and unsuccessful searches separately.
• We count how many times the search value is compared against the array elements.
• **Successful Search**
– **Best Case :** 1 comparison
– **Worst Case:** N comparisons (N – array size)

• **Unsuccessful Search**
– **Best Case:**
– **Worst Case:** N comparisons

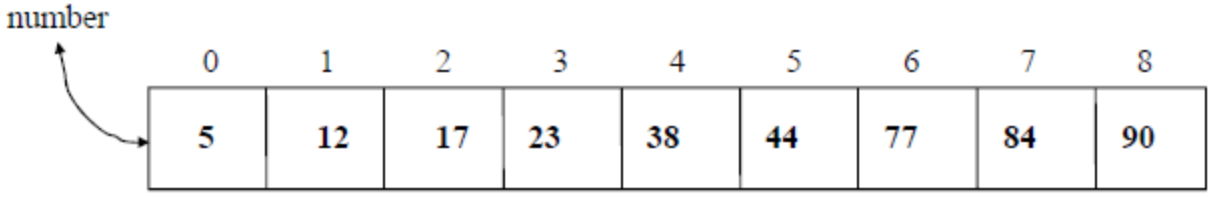
```
#include <iostream>

using namespace std;
int main()
{
    int arr[10];
    int no_of_elements, key;
    bool found = false;
    cout << "Enter the number of element: ";
    cin >> no_of_elements;
    for (int i = 0; i < no_of_elements; i++) {
        cout << "arr[" << i << "]: ";
        cin >> arr[i];
    }
    cout << "Enter the value to search: ";
    cin >> key;
    for (int i = 0; i < no_of_elements; i++) {
        if (key == arr[i]) {
            found = true;
            cout << "The value is found at index arr[" << i << "]";
        }
    }
    if (!found) {
        cout << "Key not found!";
    }
    return 0;
}
```

2-Binary Search:

في خوارزمية البحث الثنائي يجب ان تكون المصفوفة مرتبة تصاعديا قبل عملية البحث
1-نحدد العنصر الذي في وسط المصفوفة middle
2-اذا كان العنصر الذي نبحث عنه موجود في الوسط ,اذا تتوقف الخوارزمية.
3-اذا كان العنصر الذي نبحث عنه اصغر من ال middle نذهب الى الجهة اليسرى من ال middle.
4-واذا كان العنصر الذي نبحث عنه اكبر من ال middle نذهب الى الجهة اليمنى.

• If the search pool is sorted, then we can be more efficient than a linear search
• A binary search eliminates large parts of the search pool with each comparison
• Instead of starting the search at one end, we begin in the middle

Binary Search: An Example
• If the array is sorted, then we can apply the binary search technique.



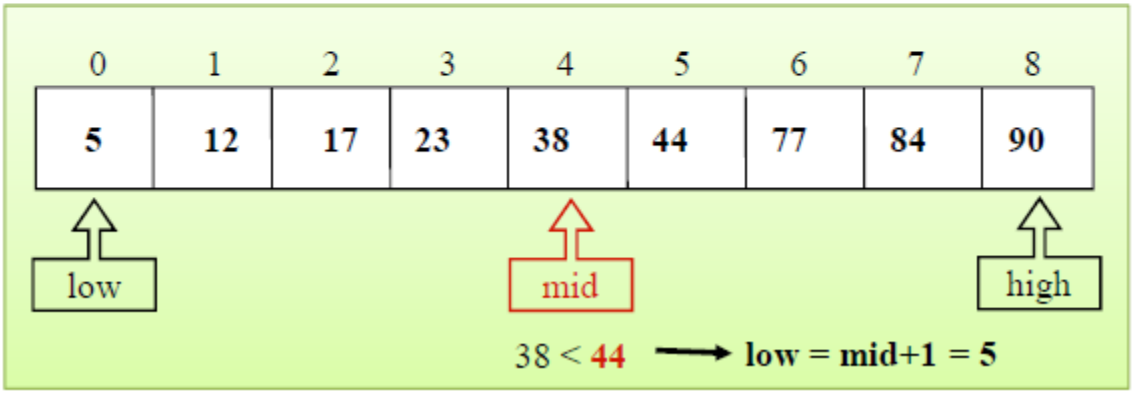
• The basic idea is straightforward. First search the value in the middle position.
If X is less than this value, then search the middle of the left half next. If X is greater than this value, then search the middle of the right half next. Continue in this manner

Binary Search: An Example

	low	high	mid
#1	0	8	4

search(44)

$$mid = \left\lfloor \frac{low + high}{2} \right\rfloor$$

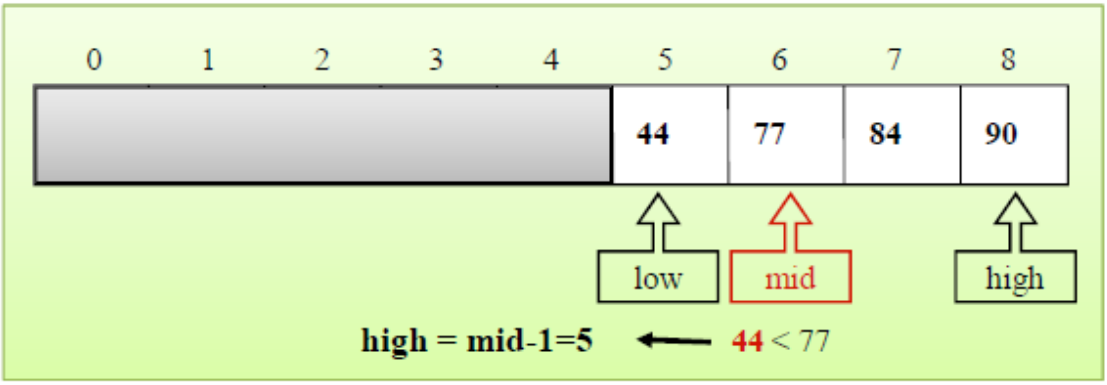


Binary Search: An Example

	low	high	mid
#1	0	8	4
#2	5	8	6

search(44)

$$mid = \left\lfloor \frac{low + high}{2} \right\rfloor$$

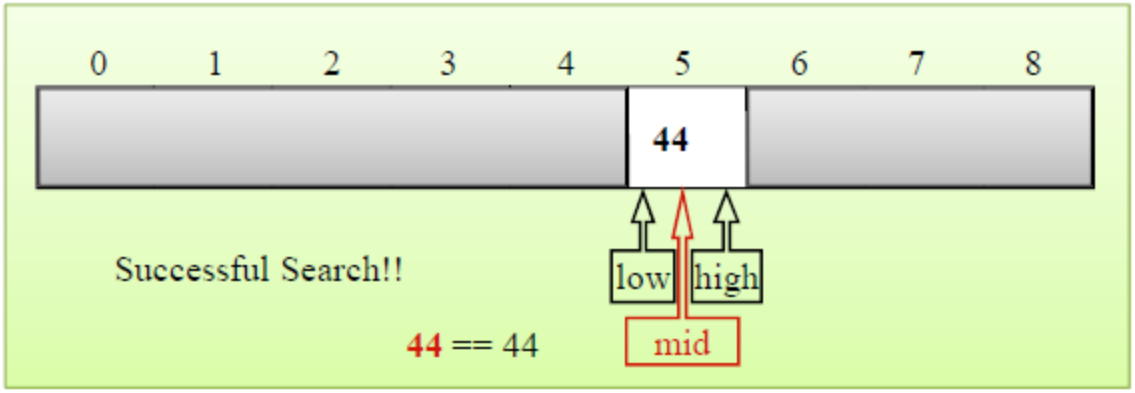


Binary Search: An Example

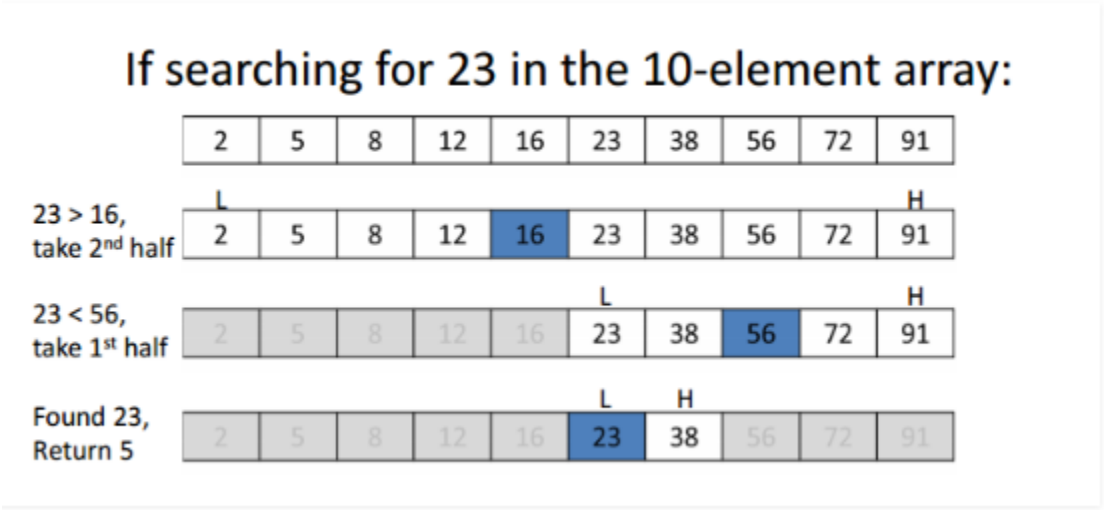
	low	high	mid
#1	0	8	4
#2	5	8	6
#3	5	5	5

search(44)

$$mid = \left\lfloor \frac{low + high}{2} \right\rfloor$$



Example:



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


int binarysearch(int [],int ,int ) ;

int main()
{

       int n, y, a[50], key;

       cout<<"Enter total number of elements :";
       cin>>n;
       cout<<"Enter "<< n <<" number :";
       for (int i=0; i<n; i++)
       {
              cin>>a[i];
       }
       cout<<"Enter a number to find :";
       cin>>key;

       y=binarysearch(a,n,key);

       if(y==-1)
        cout<<"Not found! "<< key <<" is not present in the list.";
       else
         cout<< key <<" found at location "<<y+1<<"\n";

      return 0;
}

/*---------------------*/

int binarysearch(int arr[],int n,int key)
{ int first,last,middle;

 first = 0;
 last = n-1;
 middle = (first+last)/2;
 while (first <= last)
       {
              if(arr[middle] < key)
              {
                     first = middle + 1;

              }
              else if(arr[middle] == key)
              {
                     return middle;

              }
              else
              {
                      last = middle - 1;
              }
              middle = (first + last)/2;
       }
       return -1;
```

```
}
```

H.W: suppose you have the following sorted array {3,5,6,8,11,12,14,15,17}, using the recursive binary search algorithm ,which group of numbers correctly show the sequins of comparison used to find the key 8 ?