

Linear Search

Linear search is the simplest search algorithm and often called sequential search. In this type of searching, we simply traverse the list completely and match each element of the list with the item whose location is to be found. If the match found then location of the item is returned otherwise the algorithm return NULL.

Linear search is mostly used to search an unordered list in which the items are not sorted. The algorithm of linear search is given as follows.

Algorithm

- `LINEAR_SEARCH(A, N, VAL)`
- **Step 1:** [INITIALIZE] SET POS = -1
- **Step 2:** [INITIALIZE] SET I = 1
- **Step 3:** Repeat Step 4 while $I \leq N$
- **Step 4:** IF $A[I] = VAL$
SET POS = I
PRINT POS
Go to Step 6
[END OF IF]
- SET $I = I + 1$
[END OF LOOP]
- **Step 5:** IF POS = -1
PRINT " VALUE IS NOT PRESENTIN THE ARRAY "
[END OF IF]
- **Step 6:** EXIT

Binary Search

Binary search is the search technique which works efficiently on the sorted lists. Hence, in order to search an element into some list by using binary search technique, we must ensure that the list is sorted.

Binary search follows divide and conquer approach in which, the list is divided into two halves and the item is compared with the middle element of the list. If the match is found then, the

location of middle element is returned otherwise, we search into either of the halves depending upon the result produced through the match.

Binary search algorithm is given below.

BINARY_SEARCH(A, lower_bound, upper_bound, VAL)

- **Step 1:** [INITIALIZE] SET BEG = lower_bound
END = upper_bound, POS = - 1
- **Step 2:** Repeat Steps 3 and 4 while BEG <=END
- **Step 3:** SET MID = (BEG + END)/2
- **Step 4:** IF A[MID] = VAL
SET POS = MID
PRINT POS
Go to Step 6
ELSE IF A[MID] > VAL
SET END = MID - 1
ELSE
SET BEG = MID + 1
[END OF IF]
[END OF LOOP]
- **Step 5:** IF POS = -1
PRINT "VALUE IS NOT PRESENT IN THE ARRAY"
[END OF IF]
- **Step 6:** EXIT

Example

Let us consider an array arr = { 1, 5, 7, 8, 13, 19, 20, 23, 29 }. Find the location of the item 23 in the array.

In 1st step :

1. BEG = 0
2. END = 8
3. MID = 4
4. a[mid] = a[4] = 13 < 23, therefore

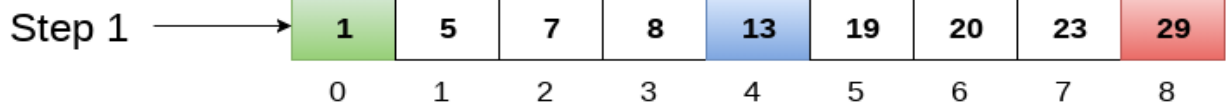
in Second step:

1. Beg = mid +1 = 5
2. End = 8
3. mid = $(5 + 8) / 2 = 6$
4. a[mid] = a[6] = 20 < 23, therefore;

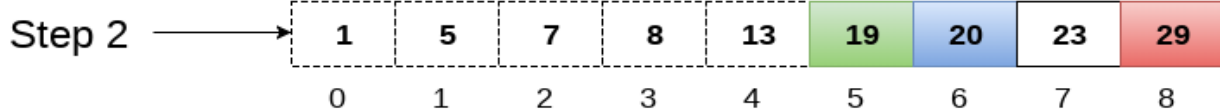
in third step:

1. $beg = mid + 1 = 7$
2. $End = 8$
3. $mid = 15/2 = 7$
4. $a[mid] = a[7]$
5. $a[7] = 23 = item;$
6. therefore, set location = mid;
7. The location of the item will be 7.

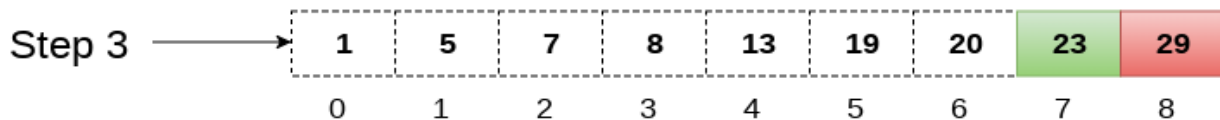
Item to be searched = 23



$a[mid] = 13$
 $13 < 23$
 $beg = mid + 1 = 5$
 $end = 8$
 $mid = (beg + end)/2 = 13 / 2 = 6$



$a[mid] = 20$
 $20 < 23$
 $beg = mid + 1 = 7$
 $end = 8$
 $mid = (beg + end)/2 = 15 / 2 = 7$



$a[mid] = 23$
 $23 = 23$
 $loc = mid$

Return location 7