

Sorting & Searching Techniques

Unit#5



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Data Structure
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Highlights

- Searching Concepts and Methods
 - Linear and
 - Binary Search

Searching Concepts and Methods

- Searching means to find whether a particular value is present in the data structure or not.
- Two popular methods:
 - Linear Search
 - Binary Search
- Which one should I use? – Depends on the values.
- If values are sorted list, then binary search is efficient.



Linear Search

- This is known as sequential search.
- Works on both sorted and unsorted array
- Compares every element one by one.

```
int A[] = {10, 8, 9 ,5, 1, 2};
```

- If we are searching for '9' then answer is '3'(POS)
- Linear search algorithm efficiency is $O(n)$, where n is the number of elements.
- **Best Case $O(1)$: first element is the VAL**



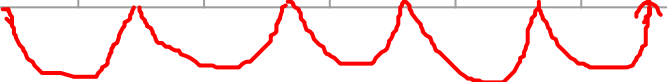
Linear Search

0	1	2	3	4	5	6
1	4	7	9	12	16	18

Example:

If search value: 16 then sequential search will be done from index 0 to index 5.
In index 5, the value found so search stops.

0	1	2	3	4	5	6
1	4	7	9	12	16	18



Linear Search

LINEAR_SEARCH(A, N, VAL)

STEP₁: [INITIALIZE] SET POS = -1

STEP₂: [INITIALIZE] SET I = 0

STEP₃: Repeat Step 4 while I = 0 to N

STEP₄: IF A[I] = VAL, then

SET POS = I

Go to Step 6

STEP₅: PRINT "Value not present in array"

STEP₆: RETURN POS



Binary Search

- Records are partitioned in two parts and it is compared with middle key element
- **Works efficiently with sorted list.**
- Works on sorted array (ascending or descending)
- Algorithm finds the position of a particular element in the array.
- Take an example: Dictionary
- Random search so fast access than linear.



Binary Search

0	1	2	3	4	5	6
1	4	7	9	12	16	18

Example:

If search value: 16

$$\begin{aligned}\text{Mid} &= (\text{lb} + \text{up}) / 2 \\ &= (0 + 6) / 2 \\ &= 3\end{aligned}$$

In index 3, value 9 is present which is less than search value so discard all elements to its left. 1, 4, 7, 9 will be skipped.

Remaining index is 4, 5, 6. so, $(\text{lb} + \text{up}) / 2$ is $(4 + 6) / 2 = 5$

In 5th index the search value present.

0	1	2	3	4	5	6
1	4	7	9	12	16	18



Binary Search

BINARY SEARCH(A, lower_bound, upper_bound, VAL)

```
STEP1: [INITIALIZE] SET BEG= lower_bound,
        END = upper_bound, POS = -1
```

STEP2: Repeat Step 3 and Step 4 while BEG<=END

STEP₃: SET MID = (BEG+END)/2

STEP₄: IF A[MID] = VAL THEN

POS = MID

GO TO Step 6

IF A[MID] > VAL THEN

SET END = MID - 1

ELSE

SET BEG = MID + 1

STEP₅: PRINT "Value not present in array"

STEP6: RETURN POS



Thank You.

