Case Analysis

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1 Linear Search Algorithm

Suppose we have an array:

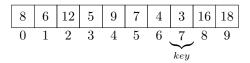


Figure 1: Searching for key = 3 after 7 steps

Algorithm 1 Linear Search Algorithm

```
1: procedure LinearSearch(A, n, x)

2: for i \leftarrow 0 to n-1 do

3: if A[i] = x then

4: Return i

5: end if

6: end for

7: Return -1

8: end procedure
```

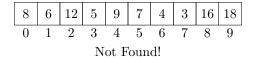


Figure 2: Searching for key = 0 after 10 steps

Best Case $B(n) \Longrightarrow$ Searching key element is present at index 0. Then it will take O(1). Worst Case $W(n) \Longrightarrow$ Either the element is absent or its at last index. Then it will take O(n). Average Case $\Longrightarrow \Longrightarrow \frac{\text{all possible cases time}}{\text{no. of cases}}$

Most of the cases, finding the average case time is not possible. But most of the cases it would be equal to Worst case time.

To calculate:

$$\begin{aligned} &AvgTime = \frac{\sum_{i=0}^{n} \text{time taken to find } i^{th} \text{ index element}}{n} \\ &AvgTime = \frac{1+2+3+\cdots+n}{n} \\ &AvgTime = \frac{\frac{n(n+1)}{2}}{n} \\ &AvgTime = \frac{(n+1)}{2} \simeq O(n) \cong W(n) \end{aligned}$$