

## Linear search algorithm

Consider the searching problem:

- Input: A sequence of  $n$  numbers  $A = \{a_1, a_2, \dots, a_n\}$  and a value  $v$ .
- Output: An index  $i$  such that  $v = A[i]$  or the special value  $N$  if  $v$  does not appear in  $A$ .

You can find the implementation [here](https://github.com/DiegoMendezMedina/C_Algorithms/blob/master/Search/linear_searching/implementations/searching_problem.c) or go to the next url: [https://github.com/DiegoMendezMedina/C\\_Algorithms/blob/master/Search/linear\\_searching/implementations/searching\\_problem.c](https://github.com/DiegoMendezMedina/C_Algorithms/blob/master/Search/linear_searching/implementations/searching_problem.c).

## Pseudocode

### **linear\_search**

1. **for**  $i = 0$  **to**  $n-1$
2.     **if**  $v == A[i]$
3.         **return**  $i$
4. **return** 'N'

## Proof

### **Loop invariant:**

At the start of each iteration of the **for** loop (lines 1-3),  $v$  was not found on the previous  $i$  values. **if**  $v == A[i]$ ,  $i$  is returned and the **for** loop breaks. Otherwise at the end of the loop 'N' is returned.

### **Initialization:**

When  $i = 0$  there are no previous  $i$  values.

**if**  $A[0] = v$ ; then  $i$  is return and the **for** loop breaks.

### **Maintenance:**

There's another iteration which means that for all the previous value of  $i$   $v$  was not found. If for the current value of  $i$  happens that  $A[i] = v$  then  $i$  is returned and the **for** loop breaks.

**Termination:**

When the loop finishes **i** had browsed all the possible positions of the array and  $v$  was not found; then '**N**' is returned.