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LINEAR-SEARCH($A$, $x$, $n$)
1. $index = \text{NIL}$
2. for $i = 1$ to $n$
3.     if $A[i] = x$
4.         $index = i$
5. return $index$
```

Loop Invariant: After the i^{th} iteration of the for loop in lines 2-4, if the sub-array $A[1 : i]$ contains x, then $A[index] = x$, otherwise $index = \text{NIL}$.

Initialisation: Before the 1^{st} iteration, x obviously cannot be in the sub-array $A[1 : 0]$, since it has no elements. Accordingly, $x = \text{NIL}$.

Maintenance: Before the i^{th} iteration, let us say $index = k \ni A[k] = x$ if x is present in the sub-array $A[1 : i - 1]$ and NIL if not. If $A[i] = x$, then after the i^{th} iteration, $index$ holds i. This satisfies our loop invariant, since it means $A[1 : i]$ contains x with $A[index] = A[i] = x$.

Now let us take the alternate case, if $A[x] \neq i$, then $index$ equals to k or NIL depending on if $A[1 : i - 1]$ contains x. This also satisfies our loop invariant, since if both $A[1 : i - 1]$ and $A[i]$ don't contain x, then $A[1 : i]$ doesn't contain x, and accordingly $index = NIL$. Otherwise, if $A[1 : i - 1]$ does contain x, then so does $A[1 : i]$, with $A[index] = A[k] = x$.

Termination: The for loop has i go from 1 to n, which means there are n iterations of the loop. Thus after the n^{th} iteration, if $A[1 : n]$ doesn't contain x $index = \text{NIL}$, otherwise $A[index] = x$.