Problem Solutions to CLRS

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Contents

1 Chapter 2

2.1–2

```
1: for i = 1 to A.length - 1 do
2:     key = A[i]
3:     j = i − 1
4:     while j ¿ 0 and A[j] ¡ key do
5:         A[j + 1] = A[j]
6:         j = j − 1
7:     end while
8:     A[i + 1] = key
```

2.1–3

```
1: for i = 0 to A.length - 1 do
2:     if A[i] == ν then          returni
3:     if thenreturn NIL
5:     end if
```

At the start of each iteration of the **for** loop (lines 1–3) $i - 1$ is not an index A such that $A[i - 1] = \nu$.

Let us now prove the correctness of our algorithm. Suppose $i = 0$, then $i - 1$ is clearly not an index of A and hence $A[i - 1]$ is undefined. Now suppose the loop invariant is true for some i, that is, $i - 1$ is not an index of A such that $A[i - 1] = \nu$, or equivalently, $A[i - 1] \neq \nu$. Then at line 2 the **if** loop will **return** i if $A[i] = \nu$, in which case the **for** loop terminates and there is no further iteration. Otherwise, if $A[i] \neq \nu$ then at the start of the next for loop iteration $(i + 1) - 1$ is not an index of A such that $A[(i + 1) - 1] = \nu$. Finally, for termination to occur we have either $i = n + 1$ where $n = A.length$ in which case the algorithm returns NIL indicating ν is not an element of A. Otherwise, termination occurs because of the nested **if** on line 2 which causes the algorithm to return i which indicates the index of A such that $A[i] = \nu$.