
Algorithm 3.1.37 Bubble Sort that halts when the elements are ordered.

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1: procedure OPTIMIZED BUBBLE SORT( $a_1, a_2, \dots, a_n$ : sequence of integers)
2:   for  $i = 1$  to  $(n - 1)$  do
3:      $swap\ counter \leftarrow 0$ 
4:     for  $j = 1$  to  $n - i$  do
5:       if  $a_j > a_{j+1}$  then
6:          $temp \leftarrow a_j$ 
7:          $a_j \leftarrow a_{j+1}$ 
8:          $a_{j+1} \leftarrow temp$ 
9:          $swap\ counter += 1$ 
10:      end if
11:    end for
12:    if  $\neg swap\ counter$  then
13:       $break$ 
14:    end if
15:  end for
16:  return  $a_1, a_2, \dots, a_n$ 
17: end procedure
```
