

# Sorting Algorithms

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## **Contents**

# 1 Bubble Sort

Given a list of numbers  $a$ .

We check each pair of adjacent numbers in the list  $(a_i, a_{i+1})$ .

If  $a_i > a_{i+1}$ , we swap  $a_i$  and  $a_{i+1}$ .

We repeat this process until we check every tuple without performing the swap operation.

	Best-case	Average-case	Worst-case
<b>comparison</b>	$O(n)$	$O(n^2)$	$O(n^2)$
<b>swap</b>	$O(1)$	$O(n^2)$	$O(n^2)$

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**Algorithm 1** Bubble Sort

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```
swapped  $\leftarrow$  false
do
  swapped  $\leftarrow$  false
  for  $i \leftarrow 0$  to  $\text{length}(a) - 1$  do
    if  $a_i > a_{i+1}$  then
      swapped  $\leftarrow$  true
      swap  $a_i$  and  $a_{i+1}$ 
while swapped
```

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## 2 Selection Sort

Given a list of numbers  $a$ .

We find the minimum value in the list starting from an offset of 1.

We swap the minimum value and the value before the offset.

We increment the offset by 1 and repeat this process while the offset is less than the length of the list.

	Best-case	Average-case	Worst-case
<b>comparison</b>	$O(n^2)$	$O(n^2)$	$O(n^2)$
<b>swap</b>	$O(1)$	$O(n)$	$O(n)$

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**Algorithm 2** Selection Sort

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```
for  $i \leftarrow 0$  to  $\text{length}(a) - 1$  do
   $\text{min} \leftarrow i$ 
  for  $j \leftarrow i + 1$  to  $\text{length}(a)$  do
    if  $a_j < a_{\text{min}}$  then
       $\text{min} \leftarrow j$ 
  swap  $a_i$  and  $a_{\text{min}}$ 
```

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