

## Insertion Sort

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Form groups of 2-3 students and work together on the following tasks.

Insertion sort is a simple sorting algorithm that builds a sorted list of  $n$  elements given in a random order. The algorithm somehow works similarly to the way people manually sort items. Basically, in each iteration, an item is inserted in the proper place into an (initially empty) list by comparing it with each item in the list until it finds the new element's successor or the end of the list. Here is the pseudo code of the insertion sort.

```
function INSERTION-SORT( $A$ )  
  for  $j \leftarrow 2$  to  $length[A]$  do  
     $key \leftarrow A[j]$   
    Insert  $A[j]$  into the sorted sequence  $A[1, j - 1]$ .  
     $i \leftarrow j - 1$   
    while  $i > 0$  and  $A[i] > key$  do  
       $A[i + 1] \leftarrow A[i]$   
       $i \leftarrow i - 1$   
    end while  
     $A[i + 1] \leftarrow key$   
  end for  
end function
```

### In 15 minutes ...

Considering the given pseudo code of the algorithm, discuss and try to find:

1. the best, worst, and average cases of the algorithm.
2. the average runtime of the algorithm (Big-O notation).