Pre-Condition: A is an array of elements with a total order.
Invariant: Before running the for loop with value $j \geq 2$ the input elements $A[1, \ldots, j-1]$ at positions $1, \ldots, j-1$ are sorted in increasing order. Running the for loop with value j, takes element $A[j]$, shifts all elements whose value is larger then $A[J]$ one position to the "right" and places $A[j]$ at the first position i where $A[i-1]$ is not greater than $A[j]$ (you can formalize this with another invariant). Hence after having finished the for loop for value j the input elements $A[1, \ldots, j]$ at positions $1, \ldots, j$ are sorting in increasing order. Hence before running the for-loop for j+1,the input elements $A[1, \ldots, j]$ at positions $1, \ldots, j$ are sorting in increasing order.
Post-condition: For loop has been executed with $j = N$ at termination. Hence, before running the for-loop with j=N+1, the given input elements are sorted in increasing order.