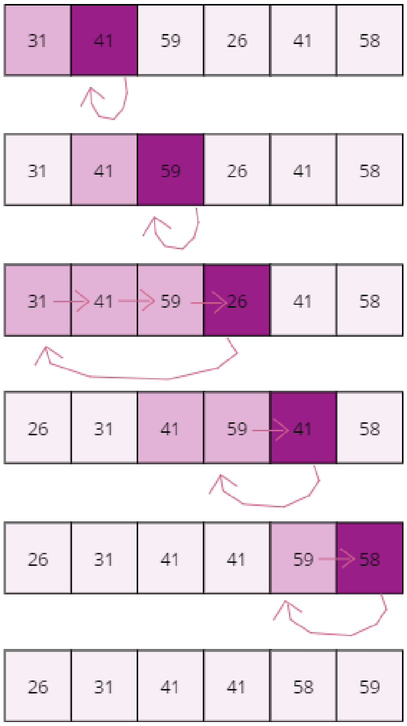
1 Using Figure 2.2 as a model? illustrate the operation of Insertion-Sort on the array A = (31,41,59,26,41,58).



31 41 59 26 41 58

31 41 59 26 41 58

31 41 59 26 41 58

26 31 41 59 41 58

26 31 41 41 59 58

26 31 41 41 58 59

2 Rewrite the Insertion-Sort procedure to sort into nonincreasing instead of non-decreasing order.

```
def sort(array):
    for i in range(1, len(array), 1):
        tempValue = array[i];
        j = i-1;
        while j >= 0 and array[j] <  tempValue:
            array[j+1] = array[j];
            j = j - 1;
        array[j+1] = tempValue;

array = [1,2,3,4,5,6];
sort(array)
print(array);


array = [6,5,4,3,2,1];
sort(array)
print(array);

array = [1];
sort(array)
print(array);
```

3 Consider the searching problem

Input: A sequence of n numbers = A = (a1,a2,..,an) and a value v.

Output: An index i such that v = A[i] or the special value NIL if v does not appear in A.

Write pseudocode for linear search? which scans through the sequence? looking for v/ Using a loop inveriant, prove that your algorithm is correct. Make sure that your loop invariant fullfills the three necessary properties.

```
def search(array, v):
    for i in range(0, len(array), 1):
        if array[i] == v:
            return i;
    return None;

print(search([1,2,3,4,5,6], 6));
print(search([1,2,3,4,5,6], 1));
print(search([1,2,3,4,5,6], 7));
```

Loop Invartiant:

For an array length of n, if value v exists in array it located at A[i..n-1].

Initialization: for i = 0, value v can be located in whole array A[0..n-1]

Maintenance: for i = k, value v can be located at the part of array A[k..n-1], so if value v exists at A[k] we find it, if not, at the next iteration i = k+1, value v can be located at the part of array A[k+1..n-1]. Invariant holds.

Termination: If loop terminates at i¡=n-1, we find the value at A[i,n-1]. If loop terminates at i = n, we didn't find value, return none.

4 Consider the problem of adding two n-bit binary integers? stored in two n-element arrays A and B. The sum of the two integers should be stored in binary form in an (n+1)-element array C. State the problem formally and write pseudocode for adding the two integers.

Input: 2 arrays A and B of length n. Each element of array contains only numbers 0 or 1. Output: array C of length n+1, culculated as C[i+1]=A[i]+B[i]. If C[i+1]¿2 then C[i] = A[i-1]+B[i-1] + 1 and C[i+1]=C[i+1] mod 2.

```python
def add(array1, array2, length):
    resultArray = [0] * (length + 1);
    for i in range(length-1, -1, -1):
        resultArray[i+1] = resultArray[i+1] + array1[i] + array2[i];
        if resultArray[i+1] > 1:
            resultArray[i] = 1;
            resultArray[i + 1] = resultArray[i+1] % 2;
    return resultArray;

print(add([1],[1], 1)); #10
print(add([1,0,1,0],[0,1,0,1], 4)); #01111
print(add([1,1,1,1],[1,1,1,1], 4)); #11110
```