# CSCI 430: Homework 2

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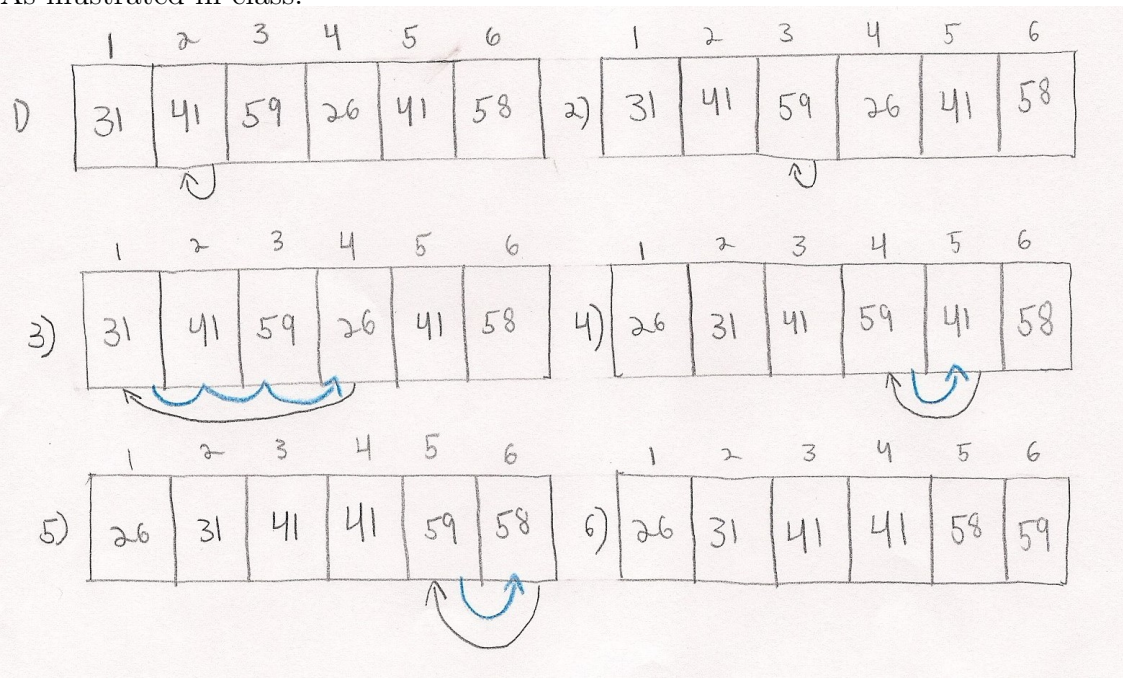
## 1 2.1-1

As illustrated in class:




## 2 2.1-2

for $j = 2$ to A.length
    $key = A[j]$
    Insert $A[j]$ in to the sorted sequence $A[1...j-1]$
    $i = j - 1$
    while $i > 0$ and $A[i] < key$
        $A[i+1] = A[i]$
        $i = i - 1$
    $A[i+1] = key$

# 3 2.1-3

Search$(A, v)$
    for $i = 1$ to $A.length$
        if $A[i] == v$
            return i
    return NIL

Loop invariant: At the start of each iteration of the for loop, the sub-array $A[1...i-1]$ consists of elements that are different than v.

Proof:
Initialization: [We must show that the loop invariant holds before the first iteration]. The sub-array is initially the empty array.

Maintenance: [We must show that each iteration maintains the loop invariant]. We know that v is not in $A[1...i-1]$ so we compare it with $A[i]$ and if they are the same we will return i, otherwise we continue to the next step.

Termination: [We examine what happens when the loop terminates]. We terminate when $i > A.length$ and since i is increased by 1, we know that all elements in A have been accounted for and that v is not among them, thus return NIL.

# 4 2.1-4

Input: Let $A =< a_1, a_2, ..., a_n >$ and $B =< b_1, b_2, ..., b_n >$ be sequences of binary numbers that represent the binary integers A and B with $a_1$ and $b_1$ being the least significant bits.

Output: Let $C =< c_1, c_2, ..., c(n+1) >$ be a sequence of binary numbers that represent the sum of A and B with $c_1$ being the least significant bit.

$SUM(A, B, C)$
    $carry = 0$
    for $i = 1$ to A.length
        if $(A[i] + B[i] + carry) == 3$
            $carry = 1$
            $C[i] = 1$
        elseif $(A[i] + B[i] + carry) == 2$
            $carry = 1$
            $C[i] = 0$
        elseif $(A[i] + B[i] + carry) == 1$
            $carry = 0$

$C[i] = 1$

else

$carry = 0$

$C[i] = 0$

$C[i] = carry$