CSC 238F 1998

Homework Assignment 0, due at the beginning of the first tutorial.

On the cover page of your assignment, you must write **and sign** *the following statement: "I have read and understood the policy on collaboration in homework stated in the Course Information handout." Without such a signed statement your homework will not be marked.*

Write a piece of pseudo-code that satisfies the following precondition/postcondition pair:

Precondition:
n is an integer, $n \geq 1$.
A is an integer array, sorted in reverse order between positions 1 and n. That is, For all i, j such that $1 \leq i \leq j \leq n$, $A(i) \geq A(j)$. (Note that A may contain repeated values.)
x is an integer.

Postcondition: n, x and A have not been changed.
If there exists an i such that $1 \leq i \leq n$ and $A(i) > x$, then the program prints the *largest* such value of i; if there does not exist such an i, then the program prints "failure".

Your program should be "essentially" a binary search, so that it runs in time $O(\log n)$.

Examples: Say that $n = 4$ and $A(1) = 5$, $A(2) = 4$, $A(3) = 4$, $A(4) = -1$.
If $x = 2$ then the program should print 3.
If $x = 5$, then the program should print "failure".

Just so that you know what one might use as "pseudo-code", here is a sample solution to a slightly different problem (that you're probably familiar with).

Precondition:
n is an integer, $n \geq 1$.
A is an integer array, sorted between positions 1 and n. That is, For all i, j such that $1 \leq i \leq j \leq n$, $A(i) \leq A(j)$. (Note that A may contain repeated values.)
x is an integer.

Postcondition: n, x and A have not been changed.
If there exists an i such that $1 \leq i \leq n$ and $A(i) = x$, then the program prints *some* such value of i; if there does not exist such an i, then the program prints "failure".

Sample Solution: In this program, all variables are assumed to hold integers. Also, if $b \neq 0$, then by "a div b" we mean the largest integer less than or equal to $\frac{a}{b}$.

```
first = 1;  last = n;
while (first ≠ last) {
    mid = (first + last) div 2;
    if (A(mid) ≥ x)
        last = mid
    else
        first = mid + 1
};
if (x == A(first))
    print (first)
else
    print ('failure')
```