Homework 5

1. Suppose we are given an $n \times n$ two-dimensional array A of integers. Suppose we are also told that each row and column of the array is in nondecreasing order. That means that if $i \leq i'$ and $j \leq j'$, then $A[i,j] \leq A[i',j']$. ($A[i,j]$ refers to the element in the ith row and jth column. Assume that the rows and columns are numbered from 1.)

An example of a 4×4 two-dimensional array that satisfies the above property is the following.

$$\begin{bmatrix} 2 & 3 & 3 & 8 \\ 2 & 3 & 5 & 9 \\ 3 & 3 & 6 & 9 \\ 8 & 9 & 11 & 11 \end{bmatrix}$$

Suppose that we are then given an integer x and asked to determine whether x is an element of the array. Can you design an efficient procedure to solve this problem?

As an example, if A is given by the above array and x equals 4, your procedure should return "No". As another example, if A is the above array and x equals 6, then your procedure should return "Yes".

Make your procedure as efficient as you can, in terms of its running time. What is the running time of your procedure? (e.g., is it proportional to n^2? Or to 2^n? Or to n?)

Turn in your solution (typed or neatly written) at the beginning of next class on October 29. You may describe your procedure in English with use of mathematical notation, as necessary.

2. Read the article "Brief Introduction to Digital Signatures and Public Key Encryption", following appropriate links (as they pique your interest). The article is available at

`http://www.hr.mnscu.edu/faq/pke.html`