[20] **Homework 3**: *Sparse Matrices*

Due: February 9, by the end of class.

[10] Let A and B be two lower triangular matrices, each with n rows. The total number of elements in the lower triangles is $n(n+1)$. Devise a scheme to represent both the triangles in any array $C[1..n, 1..n+1]$. *Hint: represent the triangle of A as the lower triangle of C and the transpose of B as the upper triangle of C.* Write algorithms to determine the values of $A[i,j]$, and $B[i,j]$, for $1 \leq i$ and $1 \leq n$, from array C.

[10] Another kind of sparse matrix that arises often in numerical analysis is the *tridiagonal matrix*. In this square matrix, all elements other than those on the major diagonal and on the diagonals immediately above and below this one are zero:

$$A = \begin{pmatrix} x & x & 0 & & & & \cdots \\ x & x & x & 0 & & & \cdots \\ 0 & x & x & x & 0 & & \cdots \\ 0 & 0 & x & x & x & 0 & \cdots \\ & & & & & & \cdots \\ & & & \cdots & & x & x \\ & & & \cdots & & x & x \end{pmatrix}$$

If the elements in the band formed by these three diagonals are represented rowwise in an array, B, with $A[1,1]$ being stored in $B[1]$, obtain an algorithm to determine the value of $A[i,j]$, for $1 \leq i, j \leq n$ from the array B.