Tutorial 1

There are several areas in Physics and Engineering where computer programs have to be developed that make use of *sparse matrices*. A sparse matrix is an extremely large two-dimensional array of integer numbers that has very few elements of interest and all the other elements are set to zero.

These matrices are sometimes too big to store in computer memory and are then represented by linked lists instead. Each node in the list contains the following information:

row;
column;
matrix value at position [row, column];
pointer to next node in the list;

Any element of the matrix where the value is zero does *not* have a node in the linked list.

We will assume that sparse matrices are always *square*, i.e. max rows = max columns.

1. What is the largest 2-dimensional array of integer numbers that you can create using your usual compiler? (to be answered when you get access to a computer)

2. Discuss the conditions in which sparse matrices are better represented by linked-lists. (tip: how many bytes do you need to represent an element using arrays, and using linked-lists?)

3. Find out how to represent a matrix and how to add two matrices.

4. Check how to set up a linked list, insert elements and delete elements. Consider the following questions:

    • In what order should matrix values be stored in the linked list?

    • Should you insert values at a particular place in the linked list?

    • Or only append values to the *front* of the list?

    • Or only append values to the *rear* of the list?

    • Which insertion method is the easiest? Why?