Lebanese University
Faculty of Sciences 1

I2204 E – INFO216 E

Imperative Programming

Session2 2017-2018
Wed July 18th am
Duration: 2 hours

An MxN binary sparse matrix is a matrix of bits in which most elements are zero. Such a matrix can be represented by a list consisting solely of non-zero matrix elements traversed row by row. Example:

This matrix:

1	0	0	1
0	0	1	0
0	1	1	0

fig. 1

becomes:

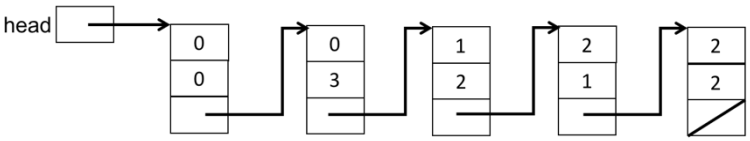

fig. 2

We give the data structure to use:

```
typedef struct node{
    int row, col;
    struct node *next;
} node;
```

Lab Exercise [25 points]

Write the function isCorrect which returns 1 if a given list representation of a sparse matrix, presents the elements in the right order. The order must respect the ascending row number, and for equal row numbers, the ascending column number. Example, the list in fig.2 is a correct representation of the sparse matrix in fig. 1.

Part I: Binary images stored in binary files [25 points]

Binary images are matrices of pixels, where each pixel is either black or white. Binary images can be considered as sparse matrices, zero representing the color black, and one representing the white. This kind of images can be stored in binary files in respect to the following pattern: two consecutive integers to indicate the dimension of the images in pixels (lines x cols), followed by the nodes.

1. Define the type binary image(***Imbi***) in which we can load such a file.
2. Write a function ***readIm*** which takes a binary file name as a parameter and returns a new binary image.

Part II: Sparse matrix transformation [28 points]

1. Write a function ***transpose*** which given a binary image(***Imbi***) transposes it. The modified image data must be ***correct*** as per lab question. No Allocation or deallocation is permitted. To reorder the elements, just use pointer manipulation. Tip: Think "insert in a sorted list".

Recall transpose operation:

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}^T = \begin{bmatrix} a & d & g \\ b & e & h \\ c & f & i \end{bmatrix}$$

Example the transpose of the list in fig.2 is fig. 3.

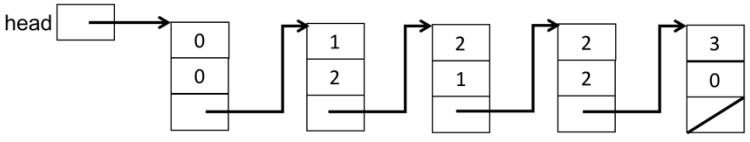

fig. 3

Good luck!