E0 251: Programming Assignment 1
Due before 11.59 PM on 20-08-2019

Please mail the source code with a README file and 5 test cases for each problem (code and test data in separate files) ullas@iisc.ac.in and protikpaul@iisc.ac.in . Please make a ZIP file of all the files and then mail the ZIP file. Any extra instructions regarding submission (if necessary) will be sent by Ullas and Protik.

1. Write and test C functions for the following. Maximum size of the matrix is 150 x 100.

   a) Write a random integer sparse matrix generator that takes the size of the matrix (m and n), density of non-zero entries (as a % of the total number of elements in the matrix), and percentage of negative numbers in the matrix. The generator must distribute the non-zero elements randomly among the rows and columns of the matrix. You must write the sparse matrix in the COO format and keep it in memory for further processing.

   b) Transform the COO format matrix to CSR and CSC formats and keep both of them in memory for further operations.

   c) Write a function to multiply two matrices A and B, one in CSR format and another in CSC format. The result should be in COO format.

   d) Perform row transformations on the CSC format matrix. Consider the parameters to the function: $r_1, k_1, r_2, k_2,$ where r_i are the row numbers and k_i are the multiplication factors. The result matrix should also be in CSC format. The computation to be carried out in abstract format is:

   $$A[r_2] = k_1*A[r_1] + k_2*A[r_2]$$

   i.e., the row r_2 of A is to be replaced by the sum as indicated above. You should be able to handle all sparse matrices of size smaller than 150 x 100. You should not construct the whole matrix in memory from the CSR representation before doing the row transformations.

   e) Write a function to print COO/CSR/CSC format matrices, when sizes are smaller than 20x20.

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