Indian Institute of Technology (ISM), Dhanbad

Data Structure Lab (NCSC104)

Assignment-2

1. **Theoretical Description**

   A matrix is considered sparse if it is populated by only a few non-zero values. This is in contrast with a dense matrix, which is filled with multiple non-zero values. Matrices like these are commonplace in many situations.
   For instance, in a social media platform, there are multiple users registered, but each of them is connected only with a few people. Therefore, the interaction matrix can be of million-by-million in size, but it would have at most one hundred non-zero entries in each row, and can be rightfully dubbed sparse.

2. **The Problem**

   - Create two sparse rating matrices ***A, B*** of size *m*n;* where m = number of user, and n = number of item. These rating matrices will contain ratings given by different users to different items at 2 different timestamp. Generate the value of ratings ***r*** so that they lie between 1 to 5, and the value of ***p*** which lies between 0 and *n/20.* Select ***p*** random column indices of matrix using any in-built function and fill them with the rating values.
   - Write a function to represent A, B as sparse matrix representation. Print A and B in sparse matrix representation.
   - Write a function to represent a sparse matrix **C** which is an average of **A** and **B; C = (A + B)/2.** Print **C**.
   - Compare the time taken to calculate the average of matrices in normal 2D representation and sparse matrix representation. Also, compare the time complexity when the matrix size is increased. (Note: Increase the value of *n* for the comparison, i.e., n = 50, 10,000, and 10^6.)