CSC1003 Assignment 4

Important Notes:

1. The assignment is an individual project, to be finished on one's own effort.
2. The work must be submitted before <u>6pm Dec. 14, 2022</u> (Saturday), Beijing Time. This is a firm deadline. No late submissions are accepted.
3. Plagiarism is strictly forbidden, regardless of the role in the process. Notably, ten consecutive lines of identical codes are treated as plagiarism. Depending on the seriousness of the plagiarism, 30%-100% marks will be deducted.

Marking Criterion:

1. The maximum score of the assignment is 100 marks.
2. Each program will be evaluated with several unseen test cases. A program obtains the full score if and only if it passes all test cases.
3. According to the school policy, using AI will be regarded as academic dishonesty. If TA suspects that your code was generated by AI, you will be invited to an offline meeting and express your understanding of the assignment. Otherwise, you may receive a minimum grade.

Running Environment:

1. The submissions will be evaluated in the course's OJ system running Java SE version 17 and Linux platform.
2. The submission is only allowed to import four packages of (java.lang.*; java.util.*; java.math.*; java.io.*) included in Java SDK. No other packages are allowed.
3. All students will have an opportunity to test their programs on the OJ platform prior to the official submission.

Submission Guidelines:

1. You will receive your grade only if you submit your code both on OJ and on bb on time. Late submission on bb leads to 10%-mark deduction, and late submission on OJ leads to minimum grade.
2. For bb submission, you need to directly upload your java file on bb. That is, your submission should be **"AddSparseMatrix.java", and "MultiplySparseMatrix.java"**. Wrong submission format will receive 10%-mark deduction.
3. Inconsistency with or violation from the guideline leads to marks deduction.
4. It is the students' responsibility to read this assignment document and submission guidelines carefully and in detail. No argument will be accepted on issues that have been specified clearly in these documents.

Input:

Write **two programs** to read two sparse matrices from the input, add/multiply them, and print out the result matrix to the console. For example, **both the input and output** have the following format.

```
3 2
1 1:7 2:9
2
3 2:-5
2 3
1 2:3 3:5
2 1:-1 2:3 3:-5
```

Here,

- The first line of the file ("3 2") represents the size of the matrix is 3 rows and 2 columns. The two numbers are separated by a space.
- The second line starts with "1", which means the 1st row of the matrix. "1:7" means the 1st column of the row is 7; "2:9" means the 2nd column of the row is 9. Similarly, "1:7" and "2:9" are separated by a space.
- The third line starts with "2", which means the 2nd row of the matrix. There are no other elements, which means all the columns of the row are "0".
- The fourth line starts with "3", which means the 3rd row of the matrix. "2:-5" means the 2nd column of the row is -5.
- All matrix elements that are not listed explicitly are treated as 0.
- All (input and output) matrix elements will be integer values.
- For each row, the non-zero elements (if there are) are sorted in column ascending order.

Therefore, the input represents the following matrix:

$$\begin{bmatrix} 7 & 9 \\ 0 & 0 \\ 0 & -5 \end{bmatrix}$$

Similarly, the next three lines represent the following matrix:

$$\begin{bmatrix} 0 & 3 & 5 \\ -1 & 3 & -5 \end{bmatrix}$$

Programs:

1. Write a program called **AddSparseMatrix.java** that reads two matrices (of the same size) from the input, add the two input matrices, and output the result matrix.
2. Write a program called **MultiplySparseMatrix.java** that reads two matrices from the input, multiply the two input matrices, and output the result matrix. (Surely, the column number of the first matrix equals the row number of rows of the second matrix).

Note that, in the test:

1. Most matrix elements (more than 99%) are zero. All non-zero elements are **integers**.
2. The size of input matrices will be no larger than 500×500.
3. The definitions of matrix addition and multiplication can be found from:
   https://en.wikipedia.org/wiki/Matrix_addition
   https://en.wikipedia.org/wiki/Matrix_multiplication