AMS 562 Homework 5

Due: Monday, 11/26, 11:59 pm

Your task is:

Matrices (dense), or in general *tensors*, are one of main data types in *machine learning*. Their arithmetic operations lie in the core for building a variety range of ML algorithms. In this homework assignment, we will use `std::vector` as the underlying data structure to represent matrices; specifically speaking, we will empoly `std::vector<std::vector<double>>`, so that it can natively map to the concept of matrices.

Your main task is to handle operator overloading, including both as member and free functions.

For the output operator, given matrix:

$$\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix}$$

the corresponding output format **must** be: `1 2 3\n4 5 6\n7 8 9\n` (simply check this with `std::cout` on your terminal screen).

For the input operator, you need to use the following pseudocode:

Input & Output: Matrix $\boldsymbol{A} \in \mathbb{R}^{m \times n}$
Input: C++ input streamer, in_s

for $i = 1 : m$
    for $j = 1 : n$
        in_s >> A_{ij} // write to A(i,j)
    end for
end for

With input and output operators properly overloaded, you can, then, utilize functions `readFromFile` and `writeToFile`, which are already implemented, to do I/O with matrices.

Write a test program.

Hints:

1. There are couple of test matrices files that you can start with.
2. There is a random number generator, `RandGen`, with a simple usage demo included in the directory; it can be helpful for you to generate some random test cases.
3. Be aware that the `matrix` is defined within `namespace ams562`.