COMP26020 Part 1– Assignment 2: Matrix Multiplication in C++

The goal of this assignment is to write a C++ program performing various operations on matrices: matrix-scalar addition/multiplication as well as matrix-matrix addition/multiplication. The program takes 4 mandatory command line parameters that are `operand1`, `operation`, `operand2`, and `output`. It is launched as follows:

```
./mat-op <operand1> <operation> <operand2> <output>
```

Where:

- `operand1` is the path to a file storing a matrix being the 1st operand of the operation;
- `operation` is a character denoting the operation to be performed, either `+` for addition or `x` for multiplication (we do not use `*` as it is interpreted as a wildcard in command line shell programs);
- `operand2` is the second operand of the operation. In combination with `operation`, its value determine the operation to be performed: it is either a path to a file storing a matrix for matrix-matrix operations or a scalar value for matrix-scalar operations;
- `output` is the path to the output file that will be created by the program, storing the matrix resulting from the operation.

The files storing matrices should have a specific format: one line per row, with elements separated with a space character. **There is no space between the last number on each line and the line break**. For example for representing the 3x4 matrix present on the left below, the corresponding file content is given on the right:

$$\begin{pmatrix} 12 & 44 & 547 & 123 \\ 12 & 777 & 23 & 1 \\ 36 & 67 & 12 & 44 \end{pmatrix}$$

Matrix

```
12 44 547 123
12 777 23 1
36 67 12 44
```

File representation

Below are a couple of examples of execution for the program:

```
$ cat input1.txt
12 44 547 123
12 777 23 1
36 67 12 44
$ ./main input1.txt + 1 output1.txt            # Matrix-scalar addition
$ cat output1.txt
13 45 548 124
13 778 24 2
37 68 13 45
$ cat input2.txt
16 4 57
11 70 233
3 67 12
5 47 78
$ ./main input1.txt x input2.txt output2.txt   # Matrix-matrix multiplication
$ cat output2.txt
2932 45558 27094
8813 56026 182079
1569 7706 21239
```

For simplicity, we assume that the matrices contain only positive integers. The scalars used as operation operands will also only be positive integers. Note that only `operand2` can be a scalar, while `operand1` and `output` are always matrix files.

To represent internally a matrix, you are to implement a class named Matrix, which definition is given and detailed in the file Matrix.h available here: https://olivierpierre.github.io/comp26020/labs/lab2/Matrix.h. You are to write the class implementation in a file Matrix.cpp, and the rest of the program (in particular the main function) in a file named main.cpp.

The requirements for this assignment are as follows:

- Your sources should be composed of at least 3 files, i.e. Matrix.h, Matrix.cpp and main.cpp;
- The code should be well organized, correctly indented, and should compile without warnings;
- Using a wrong number of command line arguments, or incorrect values for these arguments should lead to a graceful exit and not a crash. Regarding the input files, no need to run check on these, you can assume that they are in the correct format;
- This assignment will be graded in part using automated methods and because of this it is crucial that the matrix file format is respected to the letter. You can find 2 example of matrix files in the correct format here:
    - https://olivierpierre.github.io/comp26020/labs/lab2/input1.txt
    - https://olivierpierre.github.io/comp26020/labs/lab2/input2.txt

The deadline for this assignment is **November 10**. To submit your assignment, push your code to the repository named "*26020-lab2-S-Matrix Multiplication in C Plus Plus*" present in the department GitLab. Make sure all files are present and pushed. Any modification to the repository passed November 10 will be considered a late submission.