CAAM 519, Homework #4

ask15

November 30, 2022

1 main.cpp file and its output

1.1 Main.cpp file

```
#include <iostream>
#include ‘‘vector.h’’
#include ‘‘matrix.h’’
using namespace std;

int main(void){
  Matrix<double> A(6,4);
  Matrix<double> B(4,5);
  Matrix<double> C(6,5);
  Vector<double> z(5);

  for (int i = 0; i < A.num_rows(); ++i){
    for (int j = 0; j < A.num_columns(); ++j){
      A[i][j] = (double) (i+j);
    }
  }
  for (int i = 0; i < B.num_rows(); ++i){
    for (int j = 0; j < B.num_columns(); ++j){
      B[i][j] = (double) 1 / (i + j + 1);
    }
  }
  for (int i = 0; i < C.num_rows(); ++i){
    for (int j = 0; j < C.num_columns(); ++j){
      C[i][j] = (double) i * j;
    }
  }
  Vector<double> x(5);
  for (int i = 0; i < x.length(); ++i){
    x[i] = i;
  }
  Vector<double> y(6);
  for (int i = 0; i < y.length(); ++i){
    y[i] = 1 - i;
  }

  double a = 1.5;
  std::cout << ``Matrix A is:'' << std::endl;
  A.print();
  std::cout << ``Matrix B is:'' << std::endl;
  B.print();
  std::cout << ``Matrix C is:'' << std::endl;
  C.print();
  std::cout << ``Vector x is:'' << std::endl;
  x.print();
  std::cout << ``Vector y is:'' << std::endl;
  y.print();
  std::cout << ``Scalar a is: `` << a << std::endl;
  z=((A*B + C) * x + a * y);
  std::cout << ``First computation of vector z is:'' << std::endl;
  z.print();
  z = 3.0*z - (y - 1.0) / 2.0 + 0.5;
  std::cout << ``Second computation of vector z is:'' << std::endl;
  z.print();
}
```

1.2 Commands to get the output

```
g++ --std=c++11 -o main -I./include main.cpp
./main
```

1.3 Output of main.cpp file

```
Matrix A is:
Matrix = [
  0 1 2 3
  1 2 3 4
  2 3 4 5
  3 4 5 6
  4 5 6 7
  5 6 7 8
]
Matrix B is:
Matrix = [
  1 0.5 0.333333 0.25 0.2
  0.5 0.333333 0.25 0.2 0.166667
  0.333333 0.25 0.2 0.166667 0.142857
  0.25 0.2 0.166667 0.142857 0.125
]
Matrix C is:
Matrix = [
  0 0 0 0 0
  0 1 2 3 4
  0 2 4 6 8
  0 3 6 9 12
  0 4 8 12 16
  0 5 10 15 20
]
Vector x is:
Vector = [
  0
  1
  2
  3
  4
]
Vector y is:
Vector = [
  1
  0
  -1
  -2
  -3
  -4
]
Scalar a is: 1.5
First computation of vector z is:
Vector = [
  11.4286
  47.9286
  84.4286
  120.929
  157.429
  193.929
]
Second computation of vector z is:
Vector = [
  34.7857
  144.786
  254.786
  364.786
  474.786
  584.786
```

]

2 How to overload += operators

It is very similar to the combination of overloading operators + and then = all in one method.First, we create a vector of certain matching length and then add the corresponding elements. After that, we do the same as we did for overloading the = operator.
This method is more efficient as it would cost less than storing a new vector and then returning this vector before resizing it and setting it equal to another vector.