

# CAAM 419/519, Homework #4

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December 8, 2022

## 1 main.cpp script

### 1.1 Code part

```
1 #include <iostream>
2 #include "vector.h"
3 #include "matrix.h"
4
5 int main(void){
6     Matrix A(6,4);
7     Matrix B(4,5);
8     Matrix C(6,5);
9
10    for (int i = 0; i < A.num_rows(); ++i){
11        for (int j = 0; j < A.num_columns(); ++j){
12            A[i][j] = (double) (i+j);
13        }
14    }
15    for (int i = 0; i < B.num_rows(); ++i){
16        for (int j = 0; j < B.num_columns(); ++j){
17            B[i][j] = (double) 1 / (i + j + 1);
18        }
19    }
20    for (int i = 0; i < C.num_rows(); ++i){
21        for (int j = 0; j < C.num_columns(); ++j){
22            C[i][j] = (double) i * j;
23        }
24    }
25
26    Vector x(5);
27    for (int i = 0; i < x.length(); ++i){
28        x[i] = i;
29    }
30    Vector y(6);
31    for (int i = 0; i < y.length(); ++i){
32        y[i] = 1 - i;
33    }
34
35    double a = 1.5;
36
37    std::cout<<"Matrix A:"<<std::endl;
38    A.print();
39
40    std::cout<<"Matrix B:"<<std::endl;
41    B.print();
42
43    std::cout<<"Matrix C:"<<std::endl;
44    C.print();
45
46    std::cout<<"Vector x:"<<std::endl;
47    x.print();
48
49    std::cout<<"Vector y:"<<std::endl;
50    y.print();
51
52    std::cout<<"Scalar a:"<<a<<std::endl;
53
54    Vector z = (A*B + C)*x + a*y;
55    z.print();
56    z = 3*z - (y-1)/2 + 0.5;
57    z.print();
58 }
```

## 1.2 Output

```
henry@henry-VirtualBox:~/homework-4$ ./main
Matrix A:
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:
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:
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:
Vector = [
0
1
2
3
4
]
Vector y:
Vector = [
1
0
-1
-2
-3
-4
]
Scalar a:1.5
```

Figure 1: Print of matrices, vectors, and scalar

```
Vector = [
11.4286
47.9286
84.4286
120.929
157.429
193.929
]
Vector = [
34.7857
144.786
254.786
364.786
474.786
584.786
]
```

Figure 2: Value of z computed

## 2 Discussion

When using  $x = x+y$  or  $x = x*y$ , we do an additional new vector or matrix to copy vector or matrix  $x$ . Therefore, we need to assign more memory. If we use  $*=$  or  $+=$  operators, we can modify (\*this) vector or matrix, which does not need additional memory and is more efficient.