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BP3 Project 1

Project Concept:

In this project, we are required to develop a library for performing matrix operations, and utilize Makefile to make the file executable from the command line.

Project Specifications:

1. A main.c file, which only includes the main( ) function, and calls functions form the matrix library.
2. A matrixLib.c file, which includes all the matrix operation functions' bodies.
3. A matrixLib.h file, which only includes the headers of those functions.
4. A MakeFile file
5. An executable file.

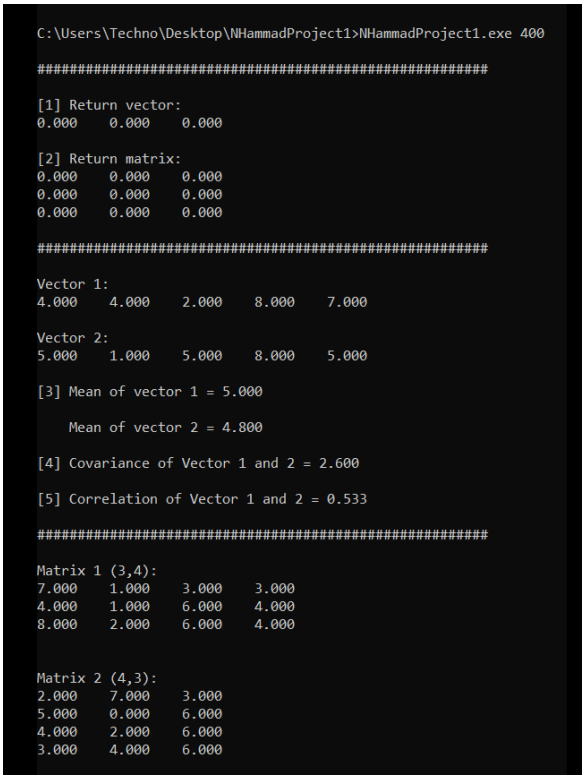
Notes:

I did not face many difficulties while working on this project, but I had to rewrite a few functions from scratch in order to match the exact method that the teacher specified. There was almost no freedom given in terms of how we can develop the required algorithms, which was a bit of a shame. But other than that, it was overall a fruitful project.

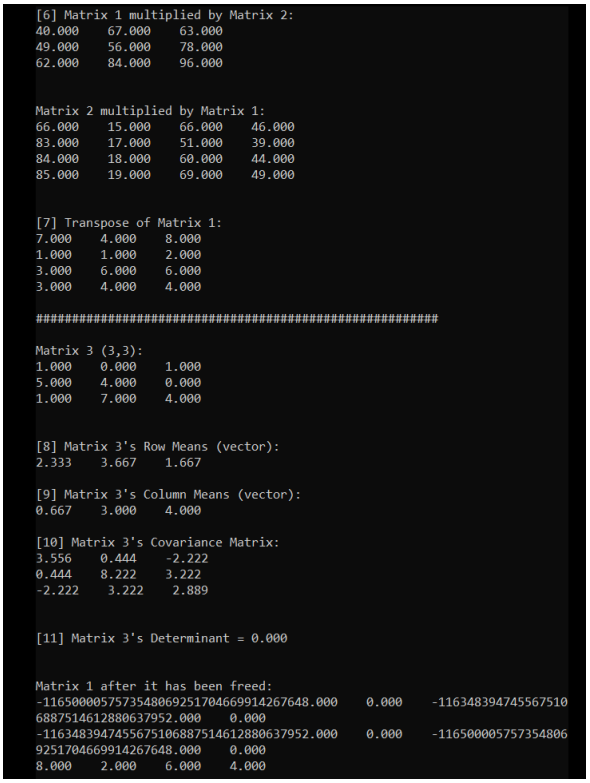
Matrix Functions (Listed in order, as shown in the screenshots):

1. Return Vector:
2. Return Matrix
3. Mean
4. Covariance
5. Correlation
6. Matrix Multiplication
7. Matrix Transpose
8. Row Means
9. Column Means
10. Covariance Matrix
11. Determinant
12. Print Vector
13. Print Matrix
14. Free Matrix

Running the program with “NHammadProject1.exe 400”:

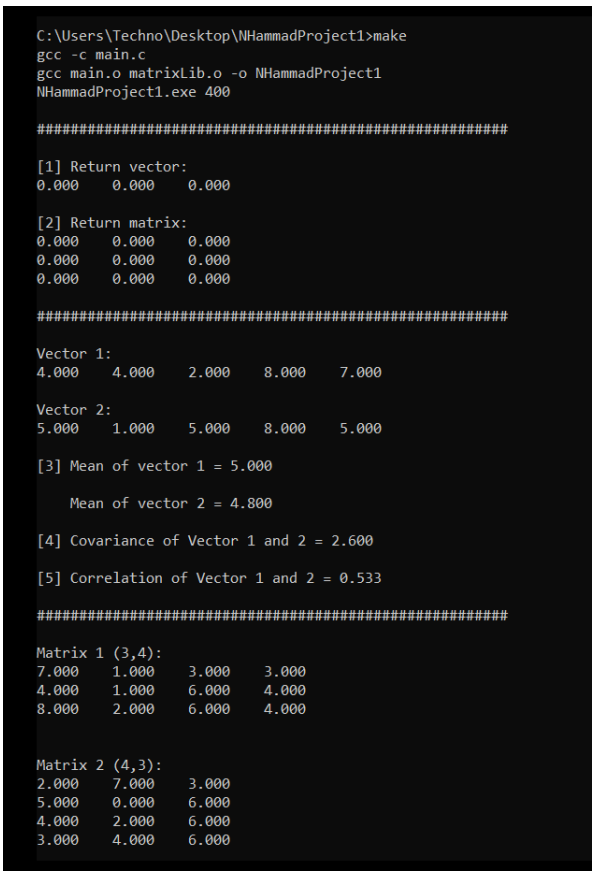


```
C:\Users\Techno\Desktop\NHammadProject1>NHammadProject1.exe 400

#######################################################

[1] Return vector:
0.000    0.000    0.000

[2] Return matrix:
0.000    0.000    0.000
0.000    0.000    0.000
0.000    0.000    0.000

#######################################################

Vector 1:
4.000    4.000    2.000    8.000    7.000

Vector 2:
5.000    1.000    5.000    8.000    5.000

[3] Mean of vector 1 = 5.000

    Mean of vector 2 = 4.800

[4] Covariance of Vector 1 and 2 = 2.600

[5] Correlation of Vector 1 and 2 = 0.533

#######################################################

Matrix 1 (3,4):
7.000    1.000    3.000    3.000
4.000    1.000    6.000    4.000
8.000    2.000    6.000    4.000


Matrix 2 (4,3):
2.000    7.000    3.000
5.000    0.000    6.000
4.000    2.000    6.000
3.000    4.000    6.000
```



```
[6] Matrix 1 multiplied by Matrix 2:
40.000    67.000    63.000
49.000    56.000    78.000
62.000    84.000    96.000


Matrix 2 multiplied by Matrix 1:
66.000    15.000    66.000    46.000
83.000    17.000    51.000    39.000
84.000    18.000    60.000    44.000
85.000    19.000    69.000    49.000


[7] Transpose of Matrix 1:
7.000    4.000    8.000
1.000    1.000    2.000
3.000    6.000    6.000
3.000    4.000    4.000

#######################################################

Matrix 3 (3,3):
1.000    0.000    1.000
5.000    4.000    0.000
1.000    7.000    4.000


[8] Matrix 3's Row Means (vector):
2.333    3.667    1.667

[9] Matrix 3's Column Means (vector):
0.667    3.000    4.000

[10] Matrix 3's Covariance Matrix:
3.556    0.444    -2.222
0.444    8.222    3.222
-2.222    3.222    2.889


[11] Matrix 3's Determinant = 0.000


Matrix 1 after it has been freed:
-116500005757354806925170466991426764
8.000    0.000    -116348394745567510
68875146128806379
52.000    0.000
-116348394745567510688751461288063795
2.000    0.000    -116500005757354806
92517046699142676
48.000    0.000
8.000    2.000    6.000    4.000
```

Running the program with the “make” command:



```
C:\Users\Techno\Desktop\NHammadProject1>make
gcc -c main.c
gcc main.o matrixLib.o -o NHammadProject1
NHammadProject1.exe 400

#######################################################

[1] Return vector:
0.000    0.000    0.000

[2] Return matrix:
0.000    0.000    0.000
0.000    0.000    0.000
0.000    0.000    0.000

#######################################################

Vector 1:
4.000    4.000    2.000    8.000    7.000

Vector 2:
5.000    1.000    5.000    8.000    5.000

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4.000    1.000    6.000    4.000
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Matrix 2 (4,3):
2.000    7.000    3.000
5.000    0.000    6.000
4.000    2.000    6.000
3.000    4.000    6.000
```

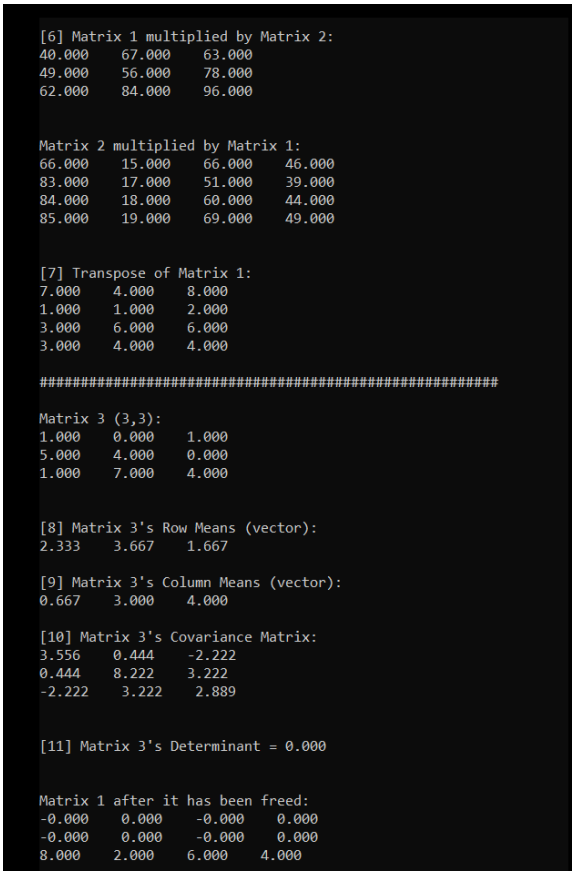

```
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Matrix 1 after it has been freed:
-0.000    0.000    -0.000    0.000
-0.000    0.000    -0.000    0.000
8.000    2.000    6.000    4.000
```