%% This is an optional exercise to familiarize yourself with matrix operations and for loops in your coding platform of choice. All matrices below are printed as csv’s. You should get the same answers in any coding program.

% Define two variables. **X** is a 2x5 matrix as follows:

98,47,38,4,15

42,98,72,5,21

% **Y** is a 5x2 matrix as follows:

8,13

12,17

20,13

9,18

19,16

% First, make sure you can index your data. If you are working in Matlab and want to get the entry in the third row, second column of Y, you should type **Y(3,2)**. Try this and make sure you get:

13

% **\*\*NOTE\*\*** if you are working in python, indexing starts at 0 not 1, so if you want to get the entry in the third row, second column of Y, you should type **Y[2,1]**. Try this and make sure you get:

13

% To index a stretch of numbers, use the **:** operator. For instance, get the first three numbers from the second row of X with **X(2,1:3)** (Matlab). Try this in your platform and make sure you get:

42,98,72

% Now try multiplying **X\*Y** without changing the dimensions. If your program automatically performs matrix multiplication, this will give you the following result:

2429,2879

3396,3574

% In python, I believe you can obtain this result (with numpy) using **np.dot(X,Y)** or **X @ Y**

% In R, I believe you can get this with the same command **X \* Y** or with the operator **X %\*% Y**

% Next, try an element-by-element multiplication. In Matlab: **X.\*Y**

% This should not work and gives an error because the matrices are not the same size

% Instead, do element-by-element multiplication with the transpose of one matrix: **X.\*Y’**

% You should get the following:

784,564,760,36,285

546,1666,936,90,336

% Now try adding 5 to each element of **X**. In Matlab **X+5**

% You should get the following:

103,52,43,9,20

47,103,77,10,26

% Finally, let’s write some for loops. Write a simple for loop that creates a new variable, Z, which is a 5x1 vector, where each element of Z is the sum of the two columns of Y, divided by the corresponding element in the second row of X. Here’s what the loop should look like in Matlab:

**for i = 1:5**

**Z(i,1) = sum(Y(i,:))/X(2,i);**

**end**

% Make sure you get the following:

Z =

0.5000

0.2959

0.4583

5.4000

1.6667

% Note that you can get the same answer with matrix operations:

**Z = sum(Y,2)./X(2,:)’**

Z =

0.5000

0.2959

0.4583

5.4000

1.6667

% Now try nesting two for loops. This time, make a new variable, W, which is a 5x2 matrix. The first column of W is the sum of the two columns of Y, divided by the corresponding element in the first row of X and the second column of W is the sum of the two columns of Y, divided by the corresponding element in the second row of X. In Matlab:

**for i = 1:5**

**for j = 1:2**

**W(i,j) = sum(Y(i,:))/X(j,i);**

**end**

**end**

W =

0.2143,0.5000

0.6170,0.2959

0.8684,0.4583

6.7500,5.4000

2.3333,1.6667