Week 5 Tutorial 5

The purpose of this tutorial is show the difference between the dot product (element-wise multiplication) and matrix multiplication.

```
% Always clear workspace variables before a new tutorial or program.
clear
clc
```

Edit the code below and update the variable named **name** with your name for this tutorial in the code below.

```
name="";
fprintf("Output for Tutorial_05_5 run by %s.\n", name)
```

Input

For element-wise multiplication, two arrays/matrices must be of the same size or one be a scalar value.

```
% Create two matrices of different sizes
a = [1 2 4;6 8 10]
b = [1 3 5;7 9 11;13 15 17]
```

Manipulation

Though we will learn about ways to handle errors, for now we can develop a method for making sure two variables satisfy the requirements for element-wise multiplication.

Fill in the appropriate if condition to check that the matrices/arrays are of the same size or that one is a scalar, or both are scalar. Don't forget to see if there is a function to check for any of these conditions.

```
if
    dotProduct = a.*b
else
    disp("a.*b is not allowed")
end
```

We should have already known this was going to fail since b has three rows while a only has two. Modify the matrix b by deleting a row.

```
% Delete a row in matrix b

dotProduct = a.*b
```

In contrast, matrix multiplication is much different. In order to perform matrix multiplication, the number of columns of the first matrix must match the number of rows in the second matrix or, one or the other must be a scalar.

Just as above, but this time for matrix multiplication, fill in the appropriate condition to check that a has a number of rows that match the number of columns in `b`, or that one or the other is scalar.

```
if size(a,2) == size(b,1) || isscalar(a) || isscalar(b)
```

```
    product = a*b;
else
    disp("a*b is not allowed")
end
```

As with before, we should be aware this wasn't going to work since both matrices have two rows and three columns so, it will never satisfy the condition `numCols in a == numRows in b`.

Modify the matrix a by deleting a column so that matrix multiplication may be applied.

```
% Delete a column in matrix a

product = a*b
```

The resulting matrix will be a matrix with the same number of rows as a and same number of columns as b which, in this case would be a matrix of size 2x3.

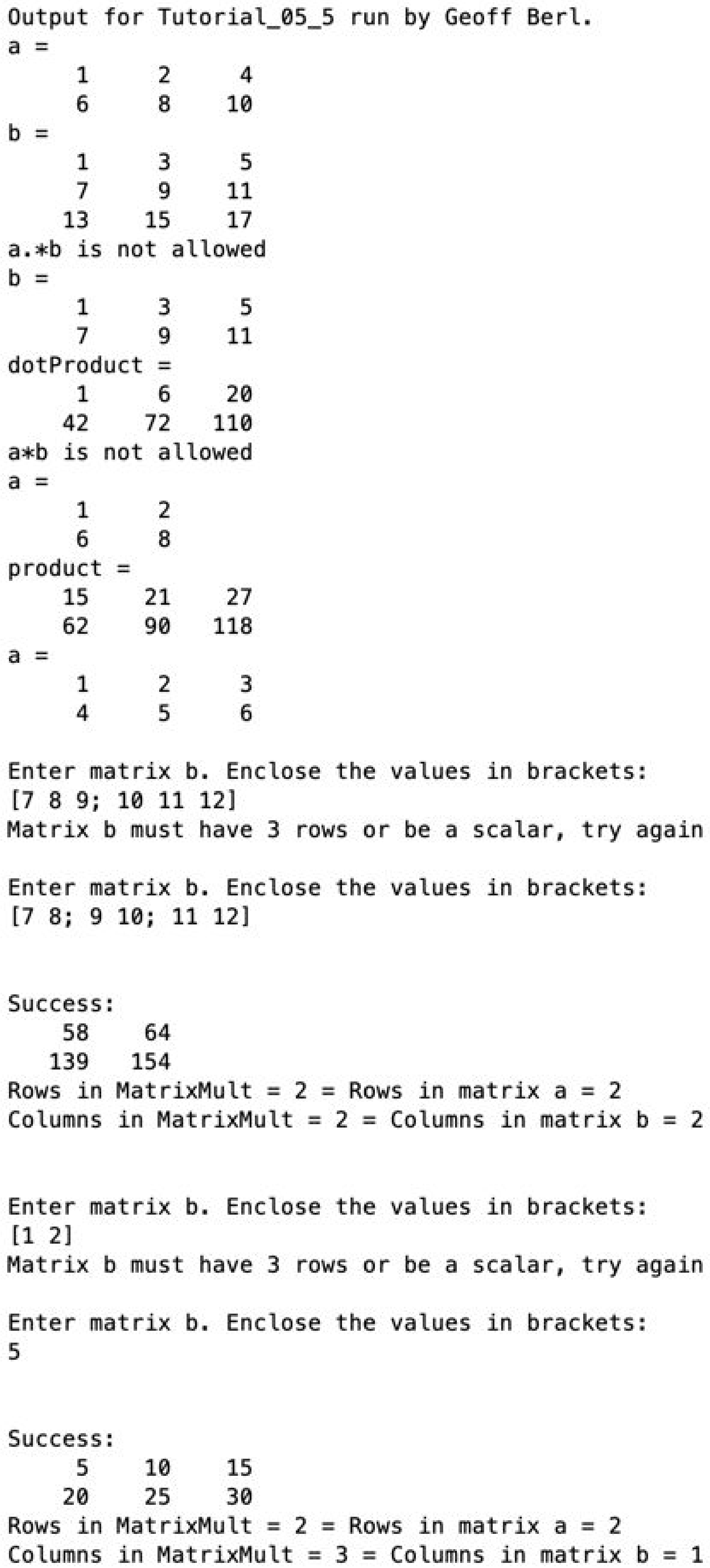
Output

Here's a simple while loop that will keep reading inputs until a*b can be performed. Copy your if condition above for matrix multiplication and paste it in the if statement below. Be sure to run this and test it when b is a matrix as well as when b is a scalar, both conditions should result in successful multiplication. Also, note that a is a 2x3 matrix, so you'll need to know that in order to create a matrix b that's capable of matrix multiplication with a.

```
% Matrix Multiplication Loop Example

% Given
a = [1 2 3;
     4 5 6]
success = 0;

% Continue reading in matrix b until two successful entries are provided
while (success < 2)
    b = input("\nEnter matrix b. Enclose the values in brackets:\n");
    if
        % if satisfied, perform the multiplication and mark as correct
        matrixMult = a*b;
        success = success + 1;

        % Print success message
        fprintf("\n\nSuccess:\n")
        disp(matrixMult)
        fprintf("Rows in MatrixMult = %i = Rows in matrix a = %i\n", size(matrixMult,1
        fprintf("Columns in MatrixMult = %i = Columns in matrix b = %i\n\n", size(matr
    else
        % If not satisfied, notify the user
        fprintf("Matrix b must have %i rows or be a scalar, try again\n",size(a,2));
    end
end
```

Example output

If you were to run your tutorial (enter **Tutorial_05_05** into the command window) your output should appear as follows. Your entries for the while loop exercise may be different. Also, depending on which row and column you chose to delete from matrices a and b will give different values but the print statements and formats should be the same.



```
Output for Tutorial_05_5 run by Geoff Berl.
a =
     1     2     4
     6     8    10
b =
     1     3     5
     7     9    11
    13    15    17
a.*b is not allowed
b =
     1     3     5
     7     9    11
dotProduct =
     1     6    20
    42    72   110
a*b is not allowed
a =
     1     2
     6     8
product =
    15    21    27
    62    90   118
a =
     1     2     3
     4     5     6

Enter matrix b. Enclose the values in brackets:
[7 8 9; 10 11 12]
Matrix b must have 3 rows or be a scalar, try again

Enter matrix b. Enclose the values in brackets:
[7 8; 9 10; 11 12]


Success:
    58    64
   139   154
Rows in MatrixMult = 2 = Rows in matrix a = 2
Columns in MatrixMult = 2 = Columns in matrix b = 2


Enter matrix b. Enclose the values in brackets:
[1 2]
Matrix b must have 3 rows or be a scalar, try again

Enter matrix b. Enclose the values in brackets:
5


Success:
     5    10    15
    20    25    30
Rows in MatrixMult = 2 = Rows in matrix a = 2
Columns in MatrixMult = 3 = Columns in matrix b = 1
```

Additional Notes:

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