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5.3.1 Lots of Loops

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Homework 5.3.1.1

1/1 point (graded)

Consider the MATLAB function

```
function [ C_out ] = MatMatMult( A, B, C )

[ m, n ] = size( C );
[ m_A, k ] = size( A );
[ m_B, n_B ] = size( B );

for j = 1:n
    for i = 1:m
        for p = 1:k
            C( i,j ) = A( i, p ) * B( p, j ) + C( i, j );
        end
    end
end
```

- Download the files `MatMatMult.m` and `test_MatMatMult.m` into, for example,

```
                LAFF-2.0xM -> Programming -> Week5
```

(creating the directory if necessary).

- Examine the script `test_MatMatMult.m` and then execute it in the Command Window: `test_MatMatMult`.

- Now, exchange the order of the loops:

```
for j = 1:n
    for p = 1:k
        for i = 1:m
            C( i,j ) = A( i, p ) * B( p, j ) + C( i, j );
        end
    end
end
```

save the result, and execute `test_MatMatMult` again. What do you notice?

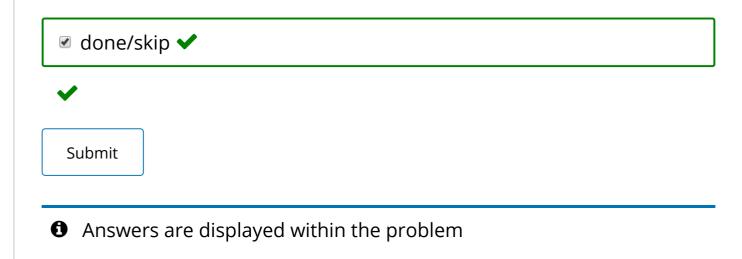Notice that exchanging the loops does not change the answer.

- How may different ways can you order the "triple-nested loop"?

There are six different ways of ordering the triple-nested loop'':

  - Consider the loop indices i, j, and p.

  - For the outer-most loop you can choose any of the three indices.

  - For the next loop you are left with two indices from which to choose.

  - For the inner-most loop, you are left with only one choice.

Thus there are $3 \times 2 \times 1$ (3 factorial) ways to order the loops.

- Try them all and observe how the result of executing `test_MatMatMult` does or does not change the result.

☑ done/skip ✔

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