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5.3.1 Lots of Loops

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Week 5 due Nov 6, 2023 22:42 IST

5.3.1 Lots of Loops

Summary A matrix-matrix multiplication can be expressed as an algorithm with a "triple-nested loop". The loops can be ordered in six different ways We will in the next units relate these different orderings to operations that we have encountered before. It may pay to review last week's unit on "Special Matrix-Matrix Multiplication" 2:44 / 2:44 X 66 ▶ 2.0x CC Video ▲ Download video file **Transcripts** <u>★ Download Text (.txt) file</u> Reading Assignment O points possible (ungraded) Read Unit 5.3.1 of the notes. [LINK] Done Submit

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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 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.

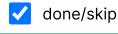
How may different ways can you order the "triple-nested loop"?

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.





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