4.4.3 Computing the Matrix-Matrix Product

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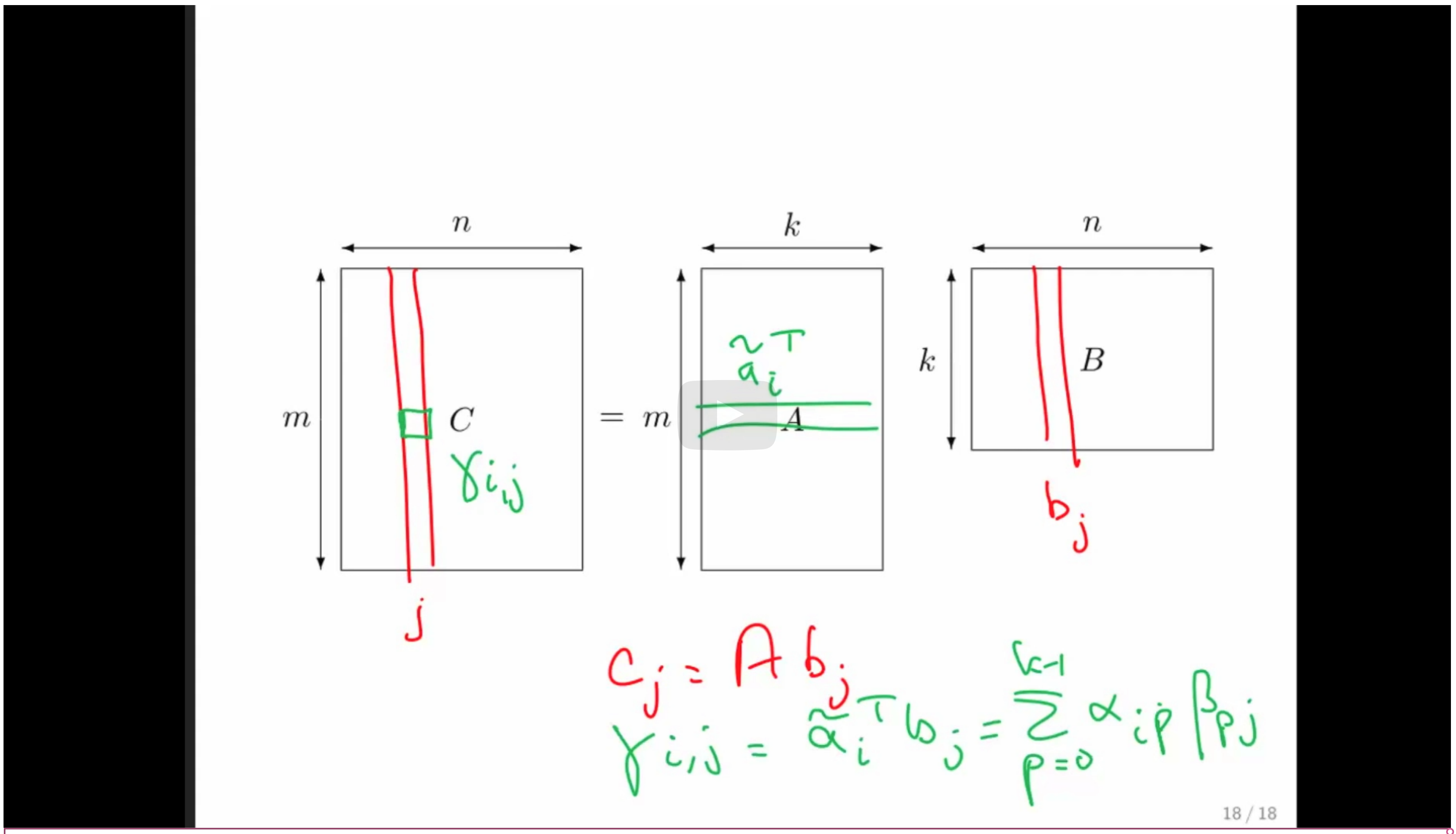
4.4.3 Computing the Matrix-Matrix Product



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Reading Assignment

0 points possible (ungraded)

Read Unit 4.4.3 of the notes. [LINK]

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question about 4.4.3.7
Hello, it seems to me that in order for (AB)C to be well-defined, it would be sufficient for that the number of rows of the resulting matrix of A*B t... 3

? Do not understand the explanation of Homework 4.4.3.5.
Hi Meggie, Base on the explanation of Homework 4.4.3.3, we could know AB = BA per the preconditions A is m x k and B is k x n. What's the rea... 2

Homework 4.4.3.1

9/9 points (graded)

Compute $Q = P \times P = \begin{pmatrix} .4 & .3 & .1 \\ .4 & .3 & .6 \\ .2 & .4 & .3 \end{pmatrix} \begin{pmatrix} .4 & .3 & .1 \\ .4 & .3 & .6 \\ .2 & .4 & .3 \end{pmatrix} =$

Hint: you may want to use MATLAB to do some of the computations.

.3 ✔ Answer: 0.3	.25 ✔ Answer: 0.25	.25 ✔ Answer: 0.25
.4 ✔ Answer: 0.4	.45 ✔ Answer: 0.45	.4 ✔ Answer: 0.4
.3 ✔ Answer: 0.3	.3 ✔ Answer: 0.3	.35 ✔ Answer: 0.35

Explanation

$$Q = P \times P = \begin{pmatrix} 0.4 & 0.3 & 0.1 \\ 0.4 & 0.3 & 0.6 \\ 0.2 & 0.4 & 0.3 \end{pmatrix} \begin{pmatrix} 0.4 & 0.3 & 0.1 \\ 0.4 & 0.3 & 0.6 \\ 0.2 & 0.4 & 0.3 \end{pmatrix} = \begin{pmatrix} 0.30 & 0.25 & 0.25 \\ 0.40 & 0.45 & 0.40 \\ 0.30 & 0.30 & 0.35 \end{pmatrix}.$$

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Answers are displayed within the problem

Homework 4.4.3.2

25/25 points (graded)

Let $A = \begin{pmatrix} 2 & 0 & 1 \\ -1 & 1 & 0 \\ 1 & 3 & 1 \\ -1 & 1 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 1 & 2 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{pmatrix}$. Evaluate

$AB =$

5 ✔ Answer: 5	2 ✔ Answer: 2	5 ✔ Answer: 5	2 ✔ Answer: 2
-2 ✔ Answer: -2	0 ✔ Answer: 0	-2 ✔ Answer: -2	0 ✔ Answer: 0
3 ✔ Answer: 3	4 ✔ Answer: 4	3 ✔ Answer: 3	4 ✔ Answer: 4
-1	0	-1	0

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Answer: -1 Answer: 0 Answer: -1 Answer: 0

$BA =$

4 Answer: 4	8 Answer: 8	5 Answer: 5
-2 Answer: -2	2 Answer: 2	1 Answer: 1
3 Answer: 3	3 Answer: 3	2 Answer: 2

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Answers are displayed within the problem

Homework 4.4.3.3

1/1 point (graded)

Let $A \in \mathbb{R}^{m \times k}$ and $B \in \mathbb{R}^{k \times n}$ and $AB = BA$.

A and B are square matrices.

Always

Answer: Always

Explanation

Answer: Always

The result of AB is a $m \times n$ matrix. The result of BA is a $k \times k$ matrix. Hence $m = k$ and $n = k$. In other words, $m = n = k$.

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Homework 4.4.3.4

1/1 point (graded)

Let $A \in \mathbb{R}^{m \times k}$ and $B \in \mathbb{R}^{k \times n}$.

$AB = BA$.

Sometimes

Answer: Sometimes

Explanation

Answer: Sometimes

If $m \neq n$ then BA is not even defined because the sizes of the matrices don't match up. But if A is square and $A = B$, then clearly $AB = AA = BA$.

So, there are examples where the statement is true and examples where the statement is false.

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Answers are displayed within the problem

Homework 4.4.3.5

1/1 point (graded)
Let $A, B \in \mathbb{R}^{n \times n}$.

$AB = BA$.

Sometimes ✔ Answer: Sometimes

Explanation

Answer: Sometimes
Almost any random matrices A and B will have the property that $AB \neq BA$. But if you pick, for example, $n = 1$ or $A = I$ or $A = 0$ or $A = B$, then $AB = BA$. There are many other examples.
The bottom line: Matrix multiplication, unlike scalar multiplication, does not necessarily commute.

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Homework 4.4.3.6

1/1 point (graded)
A^2 is defined as AA. Similarly $A^k = \underbrace{AA \ldots A}_{k \text{ occurrences of } A}$. Consistent with this, $A^0 = I$ so that $A^k = A^{k-1}A$ for $k > 0$.

A^k is well-defined only if A is a square matrix.

TRUE ✔ Answer: TRUE

Explanation
Answer: True
Just check the sizes of the matrices.

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Homework 4.4.3.7

1/1 point (graded)
Let A, B, C be matrix "of appropriate size" so that $(AB)\,C$ is well-defined.

$A\,(BC)$ is well defined.

Always ✔ Answer: Always

Explanation
Answer: Always
For $(AB)C$ to be well defined, $A \in \mathbb{R}^{m_A \times n_A}$, $B \in \mathbb{R}^{m_B \times n_B}$, $C \in \mathbb{R}^{m_C \times n_C}$, where $n_A = m_B$ and $n_B = m_C$. But then BC is well defined because $n_B = m_C$ and results in a $m_B \times n_C$ matrix. But then $A(BC)$ is well defined because $n_A = m_B$.

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