TMA 4115 Matematikk 3
Lecture 14 for MBIOT5, MTKJ, MTNANO

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Matrix operations

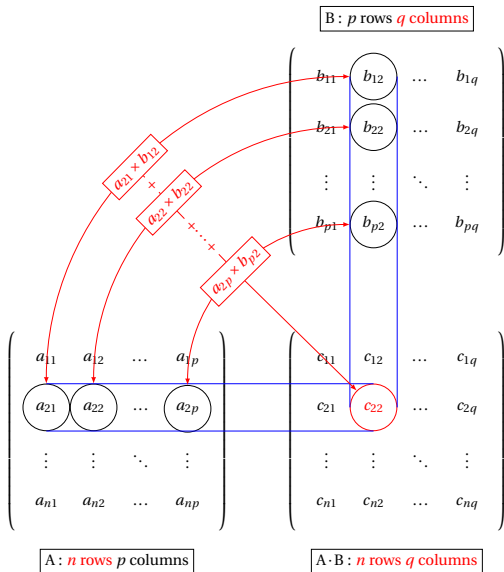For matrices M, N of the same size the following operations are explained "componentwise":

- Multiplication: rM for $r \in \mathbb{R}$
- Addition: $M + N$ (and $M - N = M + (-1)N$)

Operations work as expected (i.e. almost as for real numbers).

Multiplication of matrices is complicated:

If A is $n \times p$ and B is $p \times q$ then $A \cdot B$ is defined and a $n \times q$ matrix.

Matrix multiplication (diagram from Altermundus.com)

Matrix multiplication: Rules

For matrices A, B, C of suitable size the following rules holds:

- $A(BC) = (AB)C$
- $A(B + C) = AB + AC$ and $(B + C)A = BA + CA$,
  $r(AB) = (rA)B = A(rB)$

Even if possible $AB \neq BA$ in general!

There are $A, B \neq 0$ with $AB = 0$

Matrix multiplication does not behave like multiplication in $\mathbb{R}$!

We investigate matrices with "nice" properties concerning multiplication: The **invertible matrices**.