# 4te Mathe Hausübung am 27.04.2023 — Stevan Vlajić

**S.34h)** $P = \begin{pmatrix} 0 & 5 & 4 \\ -8 & 0 & -5 \\ 6 & -10 & 2 \end{pmatrix} \quad Q = \begin{pmatrix} -\frac{1}{5} & -\frac{1}{5} & -\frac{1}{10} \\ -\frac{7}{125} & -\frac{12}{125} & -\frac{16}{125} \\ \frac{8}{125} & \frac{3}{25} & \frac{4}{25} \end{pmatrix}$

$$\begin{pmatrix} 0 & 5 & 4 \\ -8 & 0 & -5 \\ 6 & -10 & 2 \end{pmatrix} \cdot \begin{pmatrix} -\frac{1}{5} & -\frac{1}{5} & -\frac{1}{10} \\ -\frac{7}{125} & -\frac{12}{125} & -\frac{16}{125} \\ \frac{8}{25} & \frac{3}{25} & \frac{4}{25} \end{pmatrix} = \underline{\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \in \mathbb{R}_3^3 \quad 3\times3}$$

**S.36b)** $M \cdot \underbrace{\begin{pmatrix} 2 & -4 & 3 \\ 1 & -7 & 5 \\ -5 & 2 & -3 \end{pmatrix}}_{A} = \begin{pmatrix} -18 & 4 & -4 \\ -1 & -13 & 9 \\ -1 & -26 & 17 \end{pmatrix} \cdot A^{-1}$

$M = B \cdot A^{-1}$

**Methode 2:**

$\det(A) = 11$

$A_{11} = (-1)^{1+1} \cdot D_{11} = 1 \cdot \begin{vmatrix} -7 & 5 \\ 2 & -3 \end{vmatrix} = 11$

$A_{12} = (-1)^{3} \cdot D_{12} = -1 \begin{vmatrix} 1 & 5 \\ -5 & -3 \end{vmatrix} = 22$

$A_{13} = (-1)^{4} \cdot D_{13} = 1 \begin{vmatrix} 1 & -7 \\ -5 & 2 \end{vmatrix} = -33$

$A_{21} = (-1)^{3} \cdot D_{21} = -1 \begin{vmatrix} -4 & 3 \\ 2 & -3 \end{vmatrix} = -6$

$A_{22} = (-1)^{4} \cdot D_{22} = 1 \cdot \begin{vmatrix} 2 & 3 \\ -5 & -3 \end{vmatrix} = 9$

$A_{23} = (-1)^{5} \cdot D_{23} = -1 \cdot \begin{vmatrix} 2 & -4 \\ -5 & 2 \end{vmatrix} = +16$

$A_{31} = (-1)^{4} \cdot D_{31} = 1 \begin{vmatrix} -4 & 3 \\ -7 & 5 \end{vmatrix} = 1$

$A_{32} = (-1)^{5} \cdot D_{32} = -1 \begin{vmatrix} 2 & 3 \\ 1 & 5 \end{vmatrix} = -7$

$A_{33} = (-1)^{6} \cdot D_{33} = 1 \begin{vmatrix} 2 & -4 \\ 1 & -7 \end{vmatrix} = -10$

$$A^{-1} = \frac{1}{11} \cdot \begin{pmatrix} 11 & -6 & 1 \\ 22 & 9 & -7 \\ -33 & 16 & -10 \end{pmatrix}$$

$$\begin{pmatrix} -18 & 4 & -9 \\ -1 & -13 & 9 \\ -1 & -26 & 17 \end{pmatrix} \begin{pmatrix} \frac{11}{11} & -\frac{6}{11} & \frac{1}{11} \\ -2 & \frac{9}{11} & -\frac{7}{11} \\ -3 & \frac{16}{11} & -\frac{10}{11} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 4 \\ -2 & 3 & 0 \\ 0 & 4 & 1 \end{pmatrix}$$

$\underline{M} \in \mathbb{R}_3^3 \; 3\times3$

$$\begin{pmatrix} 2 & -4 & 3 \\ 1 & -7 & 5 \\ -5 & 2 & -3 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & -7 & 5 \\ 2 & -4 & 3 \\ -5 & 2 & -3 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad II - 2 \cdot I \rightarrow$$

$$\begin{pmatrix} 1 & -7 & 5 \\ 0 & 10 & -7 \\ -5 & 2 & -3 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 \\ 1 & -2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad III + 5 \cdot I \rightarrow \begin{pmatrix} 1 & -7 & 5 \\ 0 & 10 & -7 \\ 0 & -33 & 22 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 \\ 1 & -2 & 0 \\ 0 & 5 & 1 \end{pmatrix} :10$$

$$\begin{pmatrix} 1 & -7 & 5 \\ 0 & 0{,}1 & -0{,}7 \\ 0 & -33 & 22 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 \\ 0{,}1 & -0{,}2 & 0 \\ 0 & 5 & 1 \end{pmatrix} \quad III + 33 \cdot II \rightarrow \begin{pmatrix} 1 & -7 & 5 \\ 0 & 1 & -0{,}7 \\ 0 & 0 & -1{,}1 \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 \\ 0{,}1 & -0{,}2 & 0 \\ 3{,}3 & -1{,}6 & 1 \end{pmatrix} \quad I + 7 \cdot II \rightarrow \begin{pmatrix} 1 & 0 & 0{,}1 \\ 0 & 1 & -0{,}7 \\ 0 & 0 & -1{,}1 \end{pmatrix} \begin{pmatrix} 0{,}7 & -0{,}4 & 0 \\ 0{,}1 & -0{,}2 & 0 \\ 3{,}3 & -1{,}6 & 1 \end{pmatrix}$$

$III : -1{,}1$

$$\begin{pmatrix} 1 & 0 & 0{,}1 \\ 0 & 1 & -0{,}7 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 0{,}7 & -0{,}4 & 0 \\ 0{,}1 & -0{,}2 & 0 \\ -3 & 1{,}4\overline{5} & -0{,}\overline{90} \end{pmatrix} \quad II + 0{,}7\, III \rightarrow \begin{pmatrix} 1 & 0 & 0{,}1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 0{,}7 & -0{,}4 & 0 \\ -2 & 0{,}\overline{81} & -0{,}\overline{63} \\ -3 & 1{,}4\overline{5} & 0{,}\overline{90} \end{pmatrix} \quad I - III \cdot 0{,}1$$

$0{,}\overline{81}$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & -0{,}\overline{54} & 0{,}\overline{09} \\ -2 & 0{,}\overline{81} & -0{,}\overline{63} \\ -3 & 1{,}4\overline{5} & -0{,}\overline{90} \end{pmatrix}$$

$$\begin{pmatrix} -18 & 4 & -9 \\ -1 & -13 & 9 \\ -1 & -26 & 17 \end{pmatrix} \begin{pmatrix} 1 & -0{,}\overline{54} & 0{,}\overline{09} \\ -2 & 0{,}\overline{81} & -0{,}\overline{63} \\ -3 & 1{,}4\overline{5} & -0{,}\overline{90} \end{pmatrix} = \underline{\begin{pmatrix} 1 & 0 & 4 \\ -2 & 3 & 0 \\ 0 & 4 & 1 \end{pmatrix} = M \in \mathbb{R}_3^3 \; 3\times}$$

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(weiden)

S.41) c)

$\mathrm{I} = 3s + 4t = 16$

$\mathrm{II} = 2r + s - 2t = 8$

$\mathrm{III} = 8r - 3s = 12$

$$A^{-1} = \frac{1}{\det(A)} \cdot A^{T}$$

$$\det(A) = -104$$

$$\underbrace{\begin{pmatrix} 0 & 3 & 4 \\ 2 & 1 & -2 \\ 8 & -3 & 0 \end{pmatrix}}_{A} \cdot \begin{pmatrix} r \\ s \\ t \end{pmatrix} = \begin{pmatrix} 16 \\ 8 \\ 12 \end{pmatrix} \quad \Big| \cdot A^{-1}$$

$$\begin{pmatrix} r \\ s \\ t \end{pmatrix} = A^{-1} \cdot \begin{pmatrix} 16 \\ 8 \\ 12 \end{pmatrix}$$

$A_{11} = (-1)^2 \cdot D_{11} = 1 \cdot \begin{vmatrix} 1 & -2 \\ -3 & 0 \end{vmatrix} = -6$

$A_{12} = (-1)^3 \cdot D_{12} = -1 \begin{vmatrix} 3 & 4 \\ -3 & 0 \end{vmatrix} = -12$

$A_{13} = (-1)^4 \cdot D_{13} = 1 \begin{vmatrix} 2 & 1 \\ 8 & -3 \end{vmatrix} = -14$

$A_{21} = (-1)^3 \cdot D_{21} = -1 \cdot \begin{vmatrix} 3 & 4 \\ -3 & 0 \end{vmatrix} = -12$

$A_{22} = (-1)^4 \cdot D_{22} = 1 \begin{vmatrix} 0 & 4 \\ 8 & 0 \end{vmatrix} = -32$

$A_{23} = (-1)^5 \cdot D_{23} = -1 \begin{vmatrix} 0 & 3 \\ 8 & -3 \end{vmatrix} = 24$

$A_{31} = (-1)^4 \cdot D_{31} = 1 \begin{vmatrix} 3 & 4 \\ 1 & -2 \end{vmatrix} = -10$

$A_{32} = (-1)^5 \cdot D_{32} = -1 \begin{vmatrix} 0 & 4 \\ 2 & -2 \end{vmatrix} = 8$

$A_{33} = (-1)^6 \cdot D_{33} = 1 \cdot \begin{vmatrix} 0 & 3 \\ 2 & 1 \end{vmatrix} = -6$

$$A^{-1} = \frac{1}{104} \cdot \begin{pmatrix} -6 & -12 & -10 \\ -12 & -32 & 8 \\ -14 & 24 & -6 \end{pmatrix}$$

$$\frac{1}{104} \cdot \begin{pmatrix} -6 & -12 & -10 \\ -12 & -32 & 8 \\ -14 & 24 & -6 \end{pmatrix} \begin{pmatrix} 16 \\ 8 \\ 12 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \\ 1 \end{pmatrix}$$

$r = 3$

$s = 4$

$t = 1$