Ami Sheet 9 **Maximilian von Sternberg**

1. (a)

$$\begin{pmatrix}1&0&0&0&0\\0&1&0&0&0\\0&0&1&0&0\\0&0&0&1&0\\0&0&0&0&1\end{pmatrix}\cdot\begin{pmatrix}1&3&1&2&5\\3&13&7&8&17\\1&7&21&8&15\\2&8&8&7&16\\5&17&15&16&40\end{pmatrix}=\begin{pmatrix}1&0&0&0&0\\3&1&0&0&0\\1&0&1&0&0\\2&0&0&1&0\\5&0&0&0&1\end{pmatrix}\cdot\begin{pmatrix}1&3&1&2&5\\0&4&4&2&2\\0&4&20&6&10\\0&2&6&3&6\\0&2&10&6&15\end{pmatrix}$$

$$=\begin{pmatrix}1&0&0&0&0\\3&1&0&0&0\\1&1&1&0&0\\2&\frac{1}{2}&0&1&0\\5&\frac{1}{2}&0&0&1\end{pmatrix}\cdot\begin{pmatrix}1&3&1&2&5\\0&4&4&2&2\\0&0&16&4&8\\0&0&4&2&5\\0&0&8&5&14\end{pmatrix}=\begin{pmatrix}1&0&0&0&0\\3&1&0&0&0\\1&1&1&0&0\\2&\frac{1}{2}&\frac{1}{4}&1&0\\5&\frac{1}{2}&\frac{1}{2}&0&1\end{pmatrix}\cdot\begin{pmatrix}1&3&1&2&5\\0&4&4&2&2\\0&0&16&4&8\\0&0&0&1&3\\0&0&0&3&10\end{pmatrix}$$

$$=\begin{pmatrix}1&0&0&0&0\\3&1&0&0&0\\1&1&1&0&0\\2&\frac{1}{2}&\frac{1}{4}&1&0\\5&\frac{1}{2}&\frac{1}{2}&3&1\end{pmatrix}\cdot\begin{pmatrix}1&3&1&2&5\\0&4&4&2&2\\0&0&16&4&8\\0&0&0&1&3\\0&0&0&0&1\end{pmatrix}$$

(b) The matrix is symmetric and regular

(c)

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

(d)

$$\begin{pmatrix}1&0&0&0&0\\3&2&0&0&0\\1&2&4&0&0\\2&1&1&1&0\\5&1&2&3&1\end{pmatrix}\cdot y=(11111)^T$$

$$y=\begin{pmatrix}1\\-1\\\frac{1}{2}\\-\frac{1}{2}\\-\frac{5}{2}\end{pmatrix}$$

$$\begin{pmatrix}1&3&1&2&5\\0&2&2&1&1\\0&0&4&1&2\\0&0&0&1&3\\0&0&0&0&1\end{pmatrix}\cdot x=\begin{pmatrix}1\\-1\\\frac{1}{2}\\-\frac{1}{2}\\-\frac{5}{2}\end{pmatrix}$$

$$x=\begin{pmatrix}7\\-\frac{19}{8}\\-\frac{3}{8}\\7\\-\frac{5}{2}\end{pmatrix}$$

(e) If you direktly wanted to calculate, you would have to use the Gauss algorithm, to transform the matrix into a unit matrix and perform these transformations on another unit matrix. The unit matrix will then transform into the inverse of the matrix.

2. (a)

$$
\begin{aligned}
x_1 &= \frac{1}{1}(1-(3+1+2+5)) = -10 \\
x_2 &= \frac{1}{13}(1-(3+7+8+17)) = 2.26 \\
x_3 &= \frac{1}{21}(1-(1+7+8+15)) = 1.43 \\
x_4 &= \frac{1}{7}(1-(2+8+8+16)) = 3.29 \\
x_5 &= \frac{1}{40}(1-(5+17+15+16)) = 1.3
\end{aligned}
$$

   (b) Julia

   (c) Julia

   (d)

3. (a)