

## Aufgabe 2:

a) I:  $\begin{pmatrix} 0.8 & 2.2 & 3.6 \\ 2.0 & 3.0 & 4.0 \\ 1.2 & 2.0 & 5.8 \end{pmatrix}$   $P = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

II:  $\begin{pmatrix} 2.0 & 3.0 & 4.0 \\ 0.8 & 2.2 & 3.6 \\ 1.2 & 2.0 & 5.8 \end{pmatrix}$   $P = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

$$z_2 = z_2 - \frac{0.8}{2} \cdot z_1$$

$$z_3 = z_3 - \frac{1.2}{2} \cdot z_1$$

$$\Rightarrow \begin{pmatrix} 2.0 & 3.0 & 4.0 \\ 0 & 1 & 2 \\ 0 & 0.2 & 3.4 \end{pmatrix}$$

III:  $\begin{pmatrix} 2.0 & 3.0 & 4.0 \\ 0 & 1 & 2 \\ 0 & 0.2 & 3.4 \end{pmatrix}$   $P = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

$$z_3 = z_3 - \frac{0.2}{1} \cdot z_2$$

$$\Rightarrow \begin{pmatrix} 2.0 & 3.0 & 4.0 \\ 0 & 1 & 2 \\ 0 & 0 & 3 \end{pmatrix}$$

$$\Rightarrow L = \begin{pmatrix} 1 & 0 & 0 \\ 0.4 & 1 & 0 \\ 0.6 & 0.2 & 1 \end{pmatrix} \quad R = \begin{pmatrix} 2 & 3 & 4 \\ 0 & 1 & 2 \\ 0 & 0 & 3 \end{pmatrix} \quad P = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

b)  $Ly = Pb \Rightarrow \begin{pmatrix} 1 & 0 & 0 \\ 0.4 & 1 & 0 \\ 0.6 & 0.2 & 1 \end{pmatrix} \cdot y = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 2.4 \\ 1 \\ 4 \end{pmatrix} = \begin{pmatrix} 1 \\ 2.4 \\ 4 \end{pmatrix}$

$$\begin{pmatrix} 1 & 0 & 0 & | & 1 \\ 0.4 & 1 & 0 & | & 2.4 \\ 0.6 & 0.2 & 1 & | & 4 \end{pmatrix} \Rightarrow y_1 = 1 \quad \Rightarrow y = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

$$0.4 \cdot y_1 + y_2 = 2.4 \Rightarrow y_2 = 2.4 - 0.4 = 2$$

$$0.6 \cdot y_1 + 0.2 y_2 + y_3 = 4 \Rightarrow y_3 = 4 - 0.4 - 0.6 = 3$$

$$Rx = y \Rightarrow \begin{pmatrix} 2 & 3 & 4 & | & 1 \\ 0 & 1 & 2 & | & 2 \\ 0 & 0 & 3 & | & 3 \end{pmatrix} \Rightarrow x_3 = 1 \quad \Rightarrow x = \begin{pmatrix} -1.5 \\ 0 \\ 1 \end{pmatrix}$$

$$x_2 = 2 - 2x_3 = 0$$

$$x_1 = \frac{1 - 4 - 0}{2} = -1.5$$

c) Unsere Lösung ist identisch mit dem mit `scipy.linalg.lu()`.