

**Übungen zur Vorlesung Numerische Mathematik, WS 2014/15**  
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Inhalt...

**Aufgabe 3**

a)

b)

c)

## Aufgabe 4

Gegeben:

$$A = \begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$$

Nach Vorlesung gilt:  $\text{cond}_{||\cdot||}(A) = ||A|| * ||A^{-1}||$

Wir berechnen also  $A^{-1}$  mithilfe des Gauss-Jordan-Verfahren und erhalten:

$$(A|I) = \left( \begin{array}{cc|cc} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 1 & 0 \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 & 1 \end{array} \right) \Rightarrow (I|A^{-1}) = \left( \begin{array}{cc|cc} 1 & 0 & \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} \\ 0 & 1 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{array} \right)$$

Daraus folgt:

Spaltensummennorm:

$$||A||_1 = \max\{|\frac{1}{\sqrt{2}}| + |-\frac{1}{\sqrt{2}}|, |\frac{1}{\sqrt{2}}| + |\frac{1}{\sqrt{2}}|\} = \frac{2}{\sqrt{2}}$$

$$||A^{-1}||_1 = \max\{|\frac{\sqrt{2}}{2}| + |\frac{\sqrt{2}}{2}|, |-\frac{\sqrt{2}}{2}| + |\frac{\sqrt{2}}{2}|\} = \sqrt{2}$$

$$\text{cond}_{||\cdot||_1}(A) = ||A||_1 * ||A^{-1}||_1 = \frac{2}{\sqrt{2}} * \sqrt{2} = 2$$

euklidische Norm:

$$||A||_2 = \sqrt{|\frac{1}{\sqrt{2}}|^2 + |-\frac{1}{\sqrt{2}}|^2 + |\frac{1}{\sqrt{2}}|^2 + |\frac{1}{\sqrt{2}}|^2} = \sqrt{2}$$

$$||A^{-1}||_2 = \sqrt{|\frac{\sqrt{2}}{2}|^2 + |\frac{\sqrt{2}}{2}|^2 + |-\frac{\sqrt{2}}{2}|^2 + |\frac{\sqrt{2}}{2}|^2} = \sqrt{2}$$

$$\text{cond}_{||\cdot||_2}(A) = ||A||_2 * ||A^{-1}||_2 = \sqrt{2} * \sqrt{2} = 2$$

Zeilensummennorm:

$$||A||_\infty = \max\{|\frac{1}{\sqrt{2}}| + |\frac{1}{\sqrt{2}}|, |-\frac{1}{\sqrt{2}}| + |\frac{1}{\sqrt{2}}|\} = \frac{2}{\sqrt{2}}$$

$$||A^{-1}||_\infty = \max\{|\frac{\sqrt{2}}{2}| + |-\frac{\sqrt{2}}{2}|, |\frac{\sqrt{2}}{2}| + |\frac{\sqrt{2}}{2}|\} = \sqrt{2}$$

$$\text{cond}_{||\cdot||_\infty}(A) = ||A||_\infty * ||A^{-1}||_\infty = \frac{2}{\sqrt{2}} * \sqrt{2} = 2$$

$$B = \begin{pmatrix} 1 & 2 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$$

## Aufgabe 5

## Aufgabe 6