Computer Science and Mathematics
Summer term 2018

Exercise Sheet 3

1. Let $A = \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$.

   (a) Calculate $A \cdot \vec{e}_1$, $A \cdot \vec{e}_2$, $A \cdot \begin{pmatrix} 1 \\ -1 \end{pmatrix}$, and $A \cdot \begin{pmatrix} 2 \\ 3 \end{pmatrix}$.

   (b) Give a geometrical description of the linear mapping $\vec{x} \mapsto A \cdot \vec{x}$ which is associated to A.

2. Determine the results:

   (a) $3 \cdot \begin{pmatrix} 1 & -3 & 0 \\ 0 & 1 & 2 \\ 2 & 5 & 0 \end{pmatrix} - \begin{pmatrix} 2 & -1 & 0 \\ 7 & 0 & 0 \\ 1 & 3 & 1 \end{pmatrix}^{\mathrm{T}}$

   (b) $\begin{pmatrix} 2 & 4 & 0 \\ -3 & 1 & -1 \end{pmatrix} \cdot \begin{pmatrix} 2 \\ 1 \\ 3 \end{pmatrix}$

   (c) $rank \begin{pmatrix} -2 & 1 & 6 \\ 0 & 5 & 5 \\ 1 & -\frac{1}{2} & -3 \end{pmatrix}$

3. Evaluate the following determinants:

   (a) $\begin{vmatrix} a+b & 2b \\ 2a & a+b \end{vmatrix}$

   (b) $\begin{vmatrix} 2 & 0 & 8 & 1 \\ 5 & 3 & 1 & 6 \\ 7 & 0 & 2 & 0 \\ 1 & 0 & 0 & -1 \end{vmatrix}$

4. Calculate the result:

   (a) $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \end{pmatrix} \cdot \begin{pmatrix} 0 & 1 & 10 \\ 0 & 2 & 0 \\ 1 & 5 & -3 \end{pmatrix}$