Bio144, 6./7. April 2017

Practical part 7: Exercise on linear algebra

1. Let us use the following matrices and vectors:

$$\mathbf{A} = \begin{bmatrix} 4 & 2 & 3 \\ 1 & 4 & 6 \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 0 & 3 & 6 \\ -1 & -1 & 0 \end{bmatrix}, \quad \boldsymbol{x} = \begin{bmatrix} -1 \\ 2 \\ -3 \end{bmatrix}, \quad \boldsymbol{y} = \begin{bmatrix} 5 \\ 3 \\ -2 \end{bmatrix}$$

Calculate all of the following expressions, if they are defined. Solve at least a)-d) by hand.

a) $2 \cdot \mathbf{A}$ **b)** $\mathbf{A} + \mathbf{B}$ **c)** $\mathbf{A} \cdot \mathbf{B}^{\mathrm{T}}$ **d)** $\mathbf{A} \cdot \boldsymbol{x}$

e) $\mathbf{A} \cdot \mathbf{B}$ **f)** $\mathbf{B}^{\mathrm{T}} \cdot \boldsymbol{y}$ **g)** $\mathbf{A} \cdot \mathbf{A}^{\mathrm{T}}$ **h)** $\mathbf{A}^{\mathrm{T}} \cdot \mathbf{A}$

i) $\boldsymbol{x}^{\mathrm{T}} \cdot \boldsymbol{x}$ **j)** $\boldsymbol{x} \cdot \boldsymbol{x}^{\mathrm{T}}$

R-hints:

- A matrix can be created for example like
  `A <- matrix(c(4,2,3,0,3,6),byrow=TRUE,nrow=2)` .
- `t(A)` corresponds to $\mathbf{A}^{\mathrm{T}}$.
- Make sure you understand the difference between **A*B** and **A%*%B** .