

# ECE421 - Problem Set 1

Micol Altomare

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## Problem 3

3.1. Computing the matrix product  $\mathbf{AB}$  (where  $\mathbf{A} \in \mathbb{R}^{2 \times 3}$  and  $\mathbf{B} \in \mathbb{R}^{2 \times 3}$ ) is not possible since the inner dimensions are not equal. For  $\mathbf{A} \in \mathbb{R}^{a \times b}$  and  $\mathbf{B} \in \mathbb{R}^{c \times d}$ ,  $b \neq c$ .

3.2. Given:

$$\mathbf{A} = \begin{bmatrix} 2 & 4 & 6 \\ 0 & -2 & 4 \end{bmatrix} \text{ and } \mathbf{B} = \begin{bmatrix} 2 & -0.5 \\ 1 & 0 \\ 1 & 0.5 \end{bmatrix},$$
$$\mathbf{AB} = \begin{bmatrix} 2 & 4 & 6 \\ 0 & -2 & 4 \end{bmatrix} \begin{bmatrix} 2 & -0.5 \\ 1 & 0 \\ 1 & 0.5 \end{bmatrix}$$
$$= \begin{bmatrix} 14 & 2 \\ 2 & 2 \end{bmatrix}$$

3.3 Given:

$$\mathbf{A} = \begin{bmatrix} 4 & 0 & -2 \\ 1 & 3 & -2 \\ 1 & 2 & -1 \end{bmatrix},$$
$$\mathbf{A} - \lambda \mathbf{I} = \begin{bmatrix} 4 - \lambda & 0 & -2 \\ 1 & 3 - \lambda & -2 \\ 1 & 2 & -1 - \lambda \end{bmatrix}$$
$$\det(\mathbf{A} - \lambda \mathbf{I}) = (4 - \lambda)[(3 - \lambda)(-1 - \lambda) + 4] - 2[2 - (3 - \lambda)]$$
$$0 = \boxed{-\lambda^3 + 6\lambda^2 - 11\lambda + 6} \text{ is the characteristic polynomial.}$$
$$= -(\lambda - 3)(\lambda - 2)(\lambda - 1)$$
$$\implies \boxed{\lambda_0 = 1, \lambda_1 = 2, \lambda_2 = 3} \text{ are the eigenvalues of } \mathbf{A}.$$