

Matrix Calculations

Assignment 5, Wednesday, October 4, 2017

Exercise teachers. Recall the following split-up of students:

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The delivery boxes are located in the Mercator 1 building on the ground floor (where the Computer Science department ICIS is located).

Handing in your answers: There are two options, *depending on your exercise class teacher*:

1. Delivery box (default): Put your solutions in the appropriate delivery box (see above). Before putting your solutions in the box make sure:
 - your name and student number are written clearly on the document.
2. E-mail (if your teacher agrees): Send your solutions by e-mail to your exercise class teacher (see above) with subject ‘*assignment 5*’. This e-mail should only contain a single PDF document as attachment (unless explicitly stated otherwise). Before sending an e-mail make sure:
 - the file is a PDF document that is well readable
 - your name is part of the filename (for example MyName_assignment-5.pdf)
 - your name and student number are included in the document (since they will be printed)

Deadline: Monday, October 9, 16:00 sharp!

Goals: After completing these exercises successfully you should be able to multiply matrices, perform certain transformations by matrix multiplication, and compute inverses. The total number of points is 20.

1. (10 points) For the following matrices:

$$\mathbf{A} := \begin{pmatrix} 1 & 1 \\ 0 & 1 \\ 1 & 0 \end{pmatrix} \quad \mathbf{B} := \begin{pmatrix} 4 & -3 \\ 2 & 0 \end{pmatrix} \quad \mathbf{C} := \begin{pmatrix} 1 & 3 & 3 \\ 2 & 0 & 1 \end{pmatrix}$$

- (a) Compute $\mathbf{A} \cdot \mathbf{B} \cdot \mathbf{C}$ and $\mathbf{C} \cdot \mathbf{A} \cdot \mathbf{B}$. Show intermediate calculations.
 - (b) Find a 2×3 matrix \mathbf{X} and a 3×2 matrix \mathbf{Y} such that $\mathbf{B} = \mathbf{X} \cdot \mathbf{Y}$.
 - (c) Find a matrix \mathbf{D}_1 such that $\mathbf{C} \cdot \mathbf{D}_1$ is the same as \mathbf{C} but with its first column doubled. Similarly, find matrices \mathbf{D}_2 and \mathbf{D}_3 which double the second and third columns of \mathbf{C} .
2. (5 points) Consider the matrix \mathbf{A} :

$$\mathbf{A} = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 0 & 1 \\ 2 & 1 & 1 \end{pmatrix}$$

- (a) Compute the inverse of \mathbf{A} .

(b) Use the inverse of \mathbf{A} to solve the following system of linear equations:

$$x + 2y + 3z = -5$$

$$2x + z = 0$$

$$2x + y + z = 10$$

3. (5 points) The sum of two matrices is just the sum of their elements, for example:

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} + \begin{pmatrix} w & x \\ y & z \end{pmatrix} = \begin{pmatrix} a+w & b+x \\ c+y & d+z \end{pmatrix}$$

Give an example of a pair of 2×2 matrices \mathbf{C} and \mathbf{D} which are both invertible, but where $\mathbf{C} + \mathbf{D}$ is not invertible.