

Discrete Mathematics II

Fifth take-home assignment

Luca Aceto

Deadline: Friday, 13 March 2015 at 23:00
Late solutions will *not* be accepted.

Please note the following points before you start working on this assignment.

1. **This assignment can be delivered in groups of two students. (In fact, I strongly encourage you to do so, for the sake of peer instruction and peer learning.) You only need to deliver one set of solutions per group. Remember to write the names of the authors of the assignment on what you deliver on paper or as a PDF file.**
2. Your solutions *must* be your own work. Remember that the main aim of these assignments is to improve your understanding of the course material by working actively with it. If you do not submit solutions that *you* worked out, you will be cheating yourself, not us. See <http://www.ru.is/hugverk/> for the university's rules.
3. Deliver either a readable hand-written solution in the course mailbox close to the reception in the Sun or a PDF file with your solutions in MySchool by the stated deadline. The instructions for delivering hand-written home assignments in the appropriate mailbox in the Sun are as follows:
 - If you are in group 4, you deliver in the mailbox marked 'Ragnar'.
 - If you are in group 6, you deliver in the mailbox marked 'Erla'.
 - If you are an HVM student, you deliver in the mailbox marked 'Luca'.
 - If you are in any other group, you deliver in the mailbox marked 'Steinunn Gróa'.

Regardless of whether you deliver a hand-written or an electronic assignment, do remember to signal the fact that you delivered in MySchool under the appropriate assignment!

Distance students deliver electronically. Of course, electronic delivery is welcome by anyone.

4. If you deliver a PDF file, please name your file as follows, where I assume that the student names are John Coltrane and Dave Douglas:

John-Coltrane-Dave-Douglas-Handin5-STR2.pdf.

Problem 1: Matrix inverses (45 points)

- **Problem 1(a) (10 points)** Solve Exercise 3(c) on page 59 (Chapter 2.3) of Nicholson's book.
- **Problem 1(b) (5 points)** Solve Exercise 4(a) on page 59 (Chapter 2.3) of Nicholson's book.
- **Problem 1(c) (15 points)** Solve Exercises 21(a) and 21(c) on page 61 (Chapter 2.3) of Nicholson's book. Provide an example showing that the statement in Exercise 21(c) is false when A is not invertible.
- **Problem 1(d) (15 points)** Solve Exercise 22 on page 61 (Chapter 2.3) of Nicholson's book.

Problem 2: Matrix transformations (55 points)

- **Problem 3(a) (10 points)** Solve Exercise 2(a) on page 80 (Chapter 2.5) of Nicholson's book.
- **Problem 3(b) (10 points)** Solve Exercise 7(a) on page 81 (Chapter 2.5) of Nicholson's book.
- **Problem 3(c) (10 points)** Solve Exercise 13 on page 81 (Chapter 2.5) of Nicholson's book.
- **Problem 3(d) (15 points)** Let $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ be a linear transformation such that

$$T\left(\begin{bmatrix} 0 \\ 3 \end{bmatrix}\right) = \begin{bmatrix} 3 \\ 3 \end{bmatrix} \quad \text{and} \quad T\left(\begin{bmatrix} 1 \\ 1 \end{bmatrix}\right) = \begin{bmatrix} 2 \\ 0 \end{bmatrix}.$$

What is the matrix that induces T ?

- **Problem 3(e) (10 points)** Give the two-by-two matrices that induce the following transformations:
 1. reflection on the y -axis followed by a counterclockwise rotation by 45 degrees;
 2. a counterclockwise rotation by 60 degrees followed by an x -shear with $a = 1/2$.