Self-study session 2, Linear algebra

First year mathematics for the technology and science programmes
Aalborg University

The present self-study is supported by screencasts 4 and 5. These screencasts are only available in Danish but you might still benefit from viewing them. It might be a good idea to watch the screencasts before continuing. When needed during the exercise solving you can watch them again. Links to these two movies can be found here: Screencast 4 Screencast 5

In this self-study we shall work with m-files in MATLAB. Consider the following example of the contents of such a file:

```
% This file solves Exercise x
'Exercise x'
A=[ 1 2
    3 6]
B=[ 7  8
   -1 -2]
'The product is:'
A*B
```

If this file is saved as `exerciseX.m` in the MATLAB directory, it can be executed in MATLAB simply by typing `exerciseX` in the Command Window. Note that lines where the first character is `%` mark comments that are only visible in the text file itself. This for instance is the case for the line:

```
% This file solves Exercise x
```

Note also that by using quotation marks you can make MATLAB write a text string. This for instance is the case for the line:

```
'The product is:'
```

Use m-files when answering the self-study below.

Task 1

In a text-editor, create a small m-file, where you define two matrices *A* and *B* and compute their product. You may use the template above. Call the file `myFirstMFile.m` and save it in the MATLAB library. It is important that the file has the `.m`-extension and that it is saved in your current working directory ("Current Directory") of MATLAB. Otherwise, you will have to change the working directory, for instance by using the `cd` command as described here:

https://se.mathworks.com/help/matlab/ref/cd.html

Run your m-file from MATLAB.

Task 2

We first investigate Kirchoff's laws, which describe how electrical current behaves in electrical circuits. It turns out this can be described by a system of linear equations, and that we may use Gaussian elimination to determine the current flowing through each wire.

Read the section named "CURRENT FLOW IN ELECTRICAL CIRCUITS" at pages 60–62 in GEIL. Notice that the solutions to Practice Problems 2 and 3 can be found at page 65. You may also find the following YouTube video helpful:

https://youtu.be/VYSR_2uC5pc

Solve Exercises 25, 27, 29 and 30 at page 64: Determine the corresponding linear equations and solve them using MATLAB.

Task 3

We next consider $(0, 1)$-matrices, which can be used to represent how to sets of objects are related. For instance, a $(0, 1)$-matrix may indicate whether a flight route exists between two airports.

Read the section named "$(0, 1)$-MATRICES" at pages 112–115 in GEIL. Notice that the solution to Practice Problem 3 can be found at page 122. The concept of $(0, 1)$-matrices is also explained in the following video:

https://youtu.be/xE5uPEVqMpc

Using MATLAB solve Exercises 21, 26, 22 at pages 120–121.

Task 4

Solve the MATLAB-exercises at pages 195–196: 1, 3, 5, 7.