Syllabus

Notes:

- The material of the course is divided into blocks termed **units**. Names of m-files I will use to demonstrate the material are listed in square brackets, like [demo01.m].
- Exercises you should be able to solve after each unit are also given in square brackets below, e.g. [E 1.1 - 1.4]. You will have some time to work on them during class, but in general time will not suffice to complete them. In other words, if you want to practise your newly acquired Matlab skills by working on the exercises, plan on doing so outside classes as well.
- At the beginning of each block there will be time for a recapitulation and clarification of the topics of the previous block, and for an explanation of solutions to selected exercises (see below). It is up to you how extensive this part shall be.
- You will have access to all the material I use for the course – demonstration m-files, data files and solutions to the exercises.

April 9, 9-12 AM & 1:30-4:30 PM

Introductory remarks

Unit 1a

- starting up Matlab with custom settings: setting paths, the startup file, creating a shortcut
- the programming environment, particularly
  - the editor
  - help in Matlab
  - executing code in a script (debugging mode, copy & paste, F9, cell mode)
- demonstration of elementary concepts of working with Matlab, using a simple example: loading, reshaping & plotting data
- arrays: generation, manipulation, reshaping, deletion
- column-oriented computation
- plot function
- NaN ('Not a Number')

☞ [demo01.m, E 1.0 - 1.4]

Unit 1b

- more on elementary data manipulation and generation
- linear (single) index vs. subscript
- scalar vs. matrix operations
- multidimensional arrays

☞ [demo02.m, E 1.5 - 1.9]

Unit 1c

- logical data type, logical indexing, logical operators
- relational operators (> < == etc.)
- Inf ('Infinity')
- some is* functions (isempty, isnan, isinf, isfinite)
- set operations, find function
- spy function

☞ [demo03.m, E 1.10 - 1.16]

April 10, 9-12 AM & 1:30-4:30 PM

Unit 2

- Flow Control:
  - if, switch
  - for, while
  - try - catch
- errors, warnings
- relational operators && and || and short-circuiting
- Speed issues (1): vectorization
- Speed issues (2): preallocation of memory (exercise 2.4)

☞ [demo04.m, demo05.m, E 2.1 - 2.8]

Unit 3

- Graphics:
  - command line vs. User Interfaces (UI) in Matlab
  - graphics handles
  - low-level vs. high-level graphics commands
  - examples of specific plot types: semilogx, plot3, contour
  - colormaps
  - saving, exporting & printing graphics

☞ [demo06.m, E 3.1 - 3.4]

April 11, 9-12 AM & 1:30-4:30 PM

Project proposals – I will go through my proposals and the rules and procedures for the programming projects

Unit 4

- More Matlab data types
  - char, struct, cell array, tables
  - example of usage: storing time stamp lists in arrays vs cell arrays

☞ [demo07.m, E 4.1 - 4.6]

Unit 5

- number types (integer vs. floating point) and number conversion
- file formats and data import/export: Matlab, ascii, binary, specialized

☞ [demo08.m, E 5.1 - 5.3]

April 12, 9-12 AM & 1:30-4:30 PM

Unit 6

- Scripts & functions:
  - m-files vs built-in functions
  - function names/m-file names
  - subfunctions, nested functions
  - workspaces
  - varargin, varargout
  - memory issues (1): 'local', persistent and global variables

☞ [demo09.m, E 6.1 - 6.5]

Unit 7

- Matlab, Java and memory issues (2)
- helpful tools: code analyzer report, dependency report, profiler
- (parallel & GPU computing)

☞ [demo10.m, E 7.1 - 7.2]

April 13, 9-12 AM & 1:30-4:30 PM

Project assignments – each team decides on a concrete programming job. The job can be based on your ideas or on one of my proposals.

Unit 8

- Fitting functions to data:
  - linear regression: different ways to do it in Matlab
  - curve fitting (tool)

☞ [demo11.m, E 8.1]

Unit 9

- graphical user interfaces (GUI)

☞ [demo12.m, E 9.1-9.3]

April 27, 1:30 - ca. 5:00 PM

- **Project presentation**