



TLHE Project: An Online MATLAB Course

Pre-knowledge, individual pace and feedback

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Motivation

Content

Theory

Reflections

Abstract

Motivation

- **Experience from prior teaching:** Problems in teaching programming to economics students:
 - ① They have varying pre-knowledge
 - ② They need to work with it themselves
 - ③ They cannot easily see the big picture
- **Our solution:** Online course with
 - ① Exercises where feedback is immediate and automated
 - ② Examples of how simple tools can be combined
 - ③ Case studies solving economic problems second year students should be able to understand



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Additional motivation

- When students know programming it can be used as a **pedagogical tool** in math heavy courses:
 - ① quickly show a solution without nitty-gritty derivations
 - ② visualize solutions for different parameters, assisting the big picture understanding of students
 - ③ allow teachers to introduce models that the students cannot solve by hand, making it easier to bring in real world problems and the research frontier
- (**Finally:** Also a very relevant skill in the labor market)



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Course content

- **Program:** MATLAB
- **Setup:** Consists of 8 exercise books.
 - **Good students:** The good students can *very quickly* solve the first couple of exercises and move on; no need to read up.
 - **Challenged students:** MATLAB will provide feedback and guidance based on the mistakes made by the student.
- **Additional material for each exercise**
- **Case studies:** 3 notebooks illustrating core problems from the bachelor program in economics:
 - 1 Microeconomics: Solve the agent's optimization problem; graph the solution
 - 2 Econometrics: Visualize linear prediction in 3D; show the matrix algebra directly at work
 - 3 Macroeconomics: Solve the AS-AD model; solve the central planner's problem



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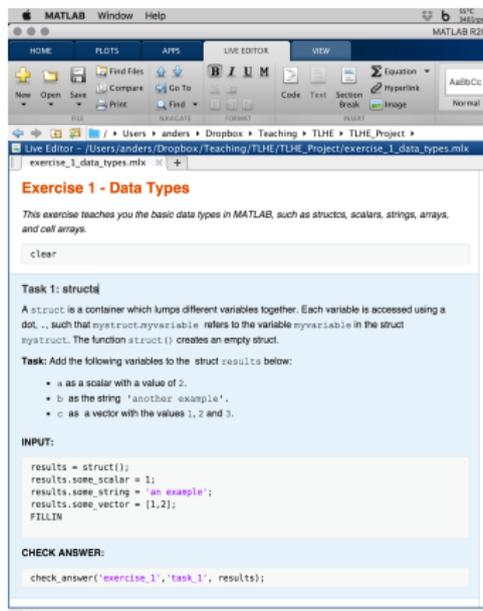
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Showcasing

- **Webpage:** <https://absalon.ku.dk/courses/17483/pages/online-matlab-course-for-students-of-economics>
- **Example:** Exercise 1



The screenshot shows the MATLAB Live Editor window. The title bar reads 'MATLAB Window Help'. The interface includes a ribbon with tabs for HOME, FIGURES, APPS, LIVE EDITOR, and VIEW. The LIVE EDITOR tab is active, displaying the content of a file named 'exercise_1_data_types.mlx'. The content of the file is as follows:

Exercise 1 - Data Types

This exercise teaches you the basic data types in MATLAB, such as structs, scalars, strings, arrays, and cell arrays.

```
clear
```

Task 1: struct

A **struct** is a container which lumps different variables together. Each variable is accessed using a **dot**, such that `mystruct.myvariable` refers to the variable `myvariable` in the struct `mystruct`. The function `struct()` creates an empty struct.

Task: Add the following variables to the struct results below:

- `a` as a scalar with a value of 2.
- `b` as the string 'another example'.
- `c` as a vector with the values 1, 2 and 3.

INPUT:

```
results = struct();
results.some_scalar = 1;
results.some_string = 'an example';
results.some_vector = [1,2];
%FIN
```

CHECK ANSWER:

```
check_answer('exercise_1','task_1', results);
```



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Inspirations / theory

- 1 **Constructive alignment** (Hun and Chalmers (2013), and Biggs and Tang (2011))
 - Knowledge: What MATLAB can do.
 - Skills: Use it.
 - Competencies: Apply it to answer economic questions.
- 2 The importance of **self-study** and **gradual feedback** (Nicol, Thomson, and Breslin, 2014)
- 3 Case studies answering the “what’s in it for me”-question (**self-determination theory** Ryan and Deci, 2000)



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Testing it in practice

- **Three avenues:**
 - ① Made advanced students go through it for the master level course “Dynamic Programming”
 - ② Advertised it on the student page AltAndetLige.dk
 - ③ Presented it to all second economics year students with an example based on material they had just covered
- **Idea:** Encourage them to answer a Google Form → only a single data point...
- **Practice:** We talked with students having completed some of the course



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Observations

- **From advanced students (incl. ph.d.'s):**
 - ① Hard to get started with the first exercise → we made the introduction video
 - ② Too long exercises → we shortened them so that feedback were more gradual
 - ③ Some interesting material not covered → each exercise was extended with bonus material
- **From bachelor students:**
 - ① Confirmed that immediate feedback is useful
 - ② Disagree on whether exercise introductions should be longer and more detailed
 - ③ Automated feedback not always that helpful (tough nut to crack)
 - ④ Want access to solutions if struck



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Summary :)

- **Comment on AltAndetLige.dk on “Online course in programming for economists”**

1 kommentar



Emil Chrisander @ d. 28. marts

#1

Genialt!

Link: <http://altandetlige.dk/blog/1088/online-kursus-programmering-oekonomer-710>



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Next step

- **Autumn 2017:** Mini-course (no ETCS)
 - **Workshop 1:** Getting started.
 - **Workshop 2:** Q&A and course evaluation.
- **Later:**
 - ① **Elective course** → the student council seems to be demanding this inspired by us
 - ② Programming **examples in core courses** → many colleagues have already showed interest



THANK YOU

Abstract

In this project, we have developed an online mini-course in the use of the software MATLAB for students of economics. The course consists of 8 exercises, extra material for each exercise, and three concrete case studies. The course features customized feedback and is intended to be done individually at home. The case studies showcase the capabilities of MATLAB by solving core problems from the core bachelor courses that students have traditionally been doing by hand. The idea is (i) that an online course is good approach to handling the very heterogeneous degrees of pre-knowledge observed, (ii) that immediate automated feedback is essential for self-study, (iii) and that extra material and case studies helps the students see the big picture.

