Exercise class 8

Introduction to Programming and Numerical Analysis

Class 3 and 6

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Spring 2024

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Feedback on inaugural project

Data Project

Feedback on inaugural project

In general:

- Everyone did well on questions 1 and 2
- Question 3 was ok
- Questions 4 and 5 were **hard**
- Questions 6 and 7 were ok
- Question 8 was **hard**

Remember to show your reflections about you choice of method!

Remember to seed the random number generator so you can generate the same "random" numbers again.

Question 4

A chooses price to maximize:

$$\max_{p_1} u^A(1 - x_1^B(\mathbf{p}, \omega^B), 1 - x_2^B(\mathbf{p}, \omega^B))$$

So A sets a price, B buys, and A consumes what's left.

Many of you have solved this problem instead:

$$\max_{p_1} u^A(x_1^A(\mathbf{p}, \omega^A), x_2^A(\mathbf{p}, \omega^A))$$

See the difference?

Recap on optimization: Grid search vs. numerical optimizer

Grid search/loop:

- Searching over *discrete* points in a grid.
- Will not get you the exact solution, but will get you close.
- Relatively secure against non-global minima.

Numerical optimizer

- Searching over *continuous* range.
- Solution can be very precise.
- Can be sensitive to choice of starting values.

Questions 4-5

4a and 5a ask you to search for an optimum in a list of potential optima (prices in 4a, consumption bundles in 5a)

- Which method would be appropriate here?

4b and 5b no longer restricts to a discrete set.

- Which method would be appropriate here?

Tips for numerical optimizers

Sometimes, optimizers can be sensitive to the choice of initial values. This can be because:

- Best case: The function is flat so it's difficult to find the precise optimum.
- Worst case: Multiple minima!

Therefore, it's important to check if the optimum depends on the starting values (this can be the case in 5b)

How do we deal with this?

- Try out different starting values. If the solution changes, be aware of non-global minima!
- Be smart about starting values! Do we know a point that might be close to the solution?

Question 7-8

7. Draw a set $\mathcal{W}$ with 50 elements.
8. Find the market equilibrium allocation for each $\omega^A \in \mathcal{W}$ and plot them in the Edgeworth box.

In question 8:

- You are asked to find 50 prices - one for each element in $\mathcal{W}$.
- Each price gives a unique market allocation.
- You can use the same approach (maybe also the same code) as in question 3.
- If done correctly, you should get a nice looking curve in the Edgeworth box (contract curve)

Inaugural project: Practicalities

I've approved the project if you've attempted to answer all questions.

- I've been a bit lenient with question 8 - just remember that it's mandatory for the exam.

If the project is not approved, you are welcome to resubmit (Deadline May 10th)

The inaugural project will be part of your exam portfolio. You can and should incorporate feedback from me and your peers before the exam.

Data project

Objectives: In your data project, you should show that you can:

- Apply data cleaning and structuring methods.
- Apply data analysis methods.
- Structure a code projects.
- Document code.
- Present your results in text form and figures.

Data project

Content: From a subject **of your choice** find some data that can help answer some (economic) question. You should at a minimum:

- Import data from an online source of your own choosing (through download or an API).
- Present the data visually.
- Apply some method(s) from descriptive economics ("samfundsbeskrivelse"). That is, make a report that tells a story in numbers and graphs about an economic phenomenon or trend.

Data project

- **Hand-in:** On GitHub by uploading to your group folder, deadline April 14th.
- **Peer feedback**: After handing in, you will be asked to give peer feedback on the projects of two other groups, deadline April 21st.
- **Exam:** Your data analysis project will be a part of your exam portfolio. You can incorporate feedback before handing in the final version.

Tips for the data project

Objective: Download and clean data then do some empirical analysis - but how, what and why is **entirely up to you**!

Choose something **interesting but manageable**. Since each project is different, the possibility to copy code from lectures will be limited.

Quality over quantity - a nicely structured descriptive project is better than a over-complicated econometric project. Focus on the methods you've learned in this course.

For the analysis, focus on presenting your data in a nice way, eg. through a pretty figure or table. **Think about the point you want to get across** - how can you best illustrate that?

Tips for the data project

Be clear about your data sources. I need to be able to see where you found your data.

Tell me a story with your data! You are writing a report - remember to describe the methods and the results in text.

Please hand in the data in a .csv file jointly with the notebook. If your data set is too big to upload to Github, it's alright to just hand in a sample (just let me know).

As always, make sure that the **notebook can run** from top to bottom before you hand in.

Inspiration for data

- Statistics Denmark, or dstapi (see lecture on fetching data)
- Pandas-datareader can access many data sources, including Federal Reserve, NASDAQ, World Bank, Yahoo Finance etc. (see lecture on fetching data)
- Our World in Data, or the package owid-catalog
- Understat (European Football Leagues)
- European professional football
- IMDB-data and the Cinemagoer package
- FiveThirtyEight hosts all code and data on their GitHub
- This list of publicly available API's (You may need to interact with the API directly instead of using a package.)
- Google Mobility Data describing mobility trends during COVID19

Next time

Physical lecture:

- Data project

Video lectures:

- Algorithms basics
- Searching and recursion
- Sorting

Exercise class:

- Problem set 5: Writing your own algorithms