

## Mid-semester survey discussion for Advanced Mathematical Economics

Dear students,

Thank you for taking the time to complete the mid-semester survey. My impression is that most students are happy with the course. For instance many students wrote that they are happy with the lectures, the notes, and the tutorials. In particular, many students wrote that the tutorials are very helpful, both as an opportunity to practice and also to get detailed feedback.

I think the better tutorial structure means that students are learning much more effectively than in previous years. My impression is that almost all students are on track with all of the learning outcomes. I forecast that the final marks will be much higher this year. (Marks are assessed on an absolute, not relative scale.)

But there is always room for improvement. The main points raised in the mid-semester feedback included requesting:

- less jumping between topics in the lectures and notes,
- more detailed sample solutions, especially how solutions were arrived at,
- more down-to-earth examples – especially economics examples,
- more practice questions for the topology topics.

**On jumping.** I think this is an inevitable consequence of the breadth and depth of the course. First, the course covers a wide range of topics (topology, calculus, convex geometry, dynamic programming), so covering these topics involves switching between topics. Second, we cover some of these topics (especially topology and soon dynamic programming) in a great deal of depth, which can be overwhelming. It is easier to break it up into pieces, which then leads to be even more switching. Finally, it is often helpful to introduce a new tool in the context of a problem, e.g. the way the envelope theorem was introduced in the context of the profit maximisation problem. So, while I can see that there is a lot of jumping, I nevertheless think it is optimal.

**On detailed solutions.** I am gradually improving the solutions.

**On down-to-earth examples.** This is surprisingly difficult! The mathemat-

ical ideas are pervasive in economics research. But often the papers and the ideas are used in a rather difficult way. For example, all of the mathematical topics will come together at the end when we study dynamic programming. But it is difficult to use dynamic programming as a running example throughout the introductory topology topics, because the connection only becomes clear after studying Banach's fixed point theorem. Similarly, it is difficult to see why it is important that the budget set is closed until you see the extreme value theorem, which in turn requires understanding compactness.

This is typical. For instance, one of the most important papers – Weinstein and Yildiz's (2007) critique of Bayes-Nash equilibrium – topology issues lie at the centre of the debate. What does it mean for two people to have similar beliefs? If you skim through their paper, you will see lots of topology ideas such as “open sets”, “boundary” and “limit”. On the other hand, this paper is quite inaccessible to undergraduate students.

I think it is possible to find pedagogically useful applications, it will just take me time. For instance, I think the Becker-Mirrlees paradox about criminal enforcement is a good application of discontinuous functions. Indifference curves and budget constraints are a good applications of closed sets.

**On more practice questions.** At the end of each topology and dynamic programming topic, I have included links to more practice questions drawn from the past exam papers.

Good luck with the rest of your semester,

Andrew Clausen