How to study for game theory

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These are some thoughts on how to study for the game theory class. They're a mix of my own experience and research on learning mathematics that I read in Alcock (2021) (which is a fun read). All the empirical claims in this note are documented by research collected in that book. Of course, none of this is compulsory: study in whatever way works for you. I know many of you just "tried" the exam in April — which, by the way, is a bad idea: you may feel it's useful, but psychologically it licenses you to work less consistently. So even if you're only starting to study now, this document may help.

In a nutshell: the best way to prepare for this class is to read the book consistently and carefully, attempt exercises from day one, write definitions and solutions by hand on paper, and continuously ask yourself whether you actually understand what is going on. What follows elaborates on this.

First, studying a mathematical subject is different from studying other subjects. Most of us are not trained to "read" mathematics and engage deeply with its logic as we read. For this reason, studying **should feel hard**. If you are struggling, it means you are learning — not that you are doing something wrong. Conversely, there is no hope of gaining a deep understanding of the subject without struggling. This class is for beginners, so the approach is meant to be gentle, but it may still feel difficult.

There are two fronts to pay attention to: how you organise your study, and how you do it. There is no secret to the first: organise yourself, work consistently, space different topics out, and give things time to sink in. The second deserves more comment. You will not gain a deep understanding by passively attending lectures or skimming notes and the book. If you want to learn how to compute Nash equilibria in mixed strategies and you just skim your notes, you may be tempted to think "ah yes, I remember this" — but probably you don't. You have to pick up a pencil and write down how to compute Nash equilibria in mixed strategies. The same goes for every part of the class.

I suggest the following:

1. Read the book carefully. For each piece of notation, ask yourself: "is it clear to me what this means?" For each definition, try to write it down on paper without looking at the book, and ask: "do I understand what this definition means? Can I explain it to myself in English? Can I come up with a simple example?" For each new concept, ask: "how is this related to concepts I've already studied?"
2. Do as many exercises as you can, mindfully. Read the exercise and attempt it *before* looking at the solution. **This will sometimes be painful.** But if you push through, you will learn the material well. When reviewing exercises, don't just skim the solution and think "yes, I remember this" — chances are you don't.
3. Practice self-explanation. Self-explanation is a technique researchers use all the time (even when they don't know they're doing it). The idea is to explain to yourself what

you are reading and doing. It forces you to notice when you don't understand something, which is uncomfortable but necessary. The questions in points 1 and 2 are meant to guide you in doing this. While self-explaining, don't fall into the trap of paraphrasing the text or telling yourself "I got this". Actively extract and elaborate the ideas. You can find an example in Alcock (2021) if you are interested.

You know what the exam consists of:

1. **A definition.** To get it right, you need to study and understand definitions. In the April exam, more than 90% of students got the definition of Nash Equilibrium wrong — not "roughly wrong", but very wrong. Memorising definitions by heart is risky because there are many of them; understanding them is far safer.
2. **Two true/false/uncertain questions**, one on normal-form and one on extensive-form games. There is no shortcut here: to answer correctly you need to understand the concepts of the class. These are not trick questions. As an example, in the April exam many students asked me about the second true/false/uncertain question: "how can I know the players' strategies if the exercise doesn't give the payoffs?" You don't need the payoffs to list the strategies — but you do need to understand what strategies and payoffs are in order to see that.
3. **Three exercises**, one of which will be slightly harder. There is a relatively small set of "algorithms" we covered in class and that appear in the book's exercises. You need to do many exercises to learn how to apply them to new problems. The vast majority of students in the April exam could not find strategies dominated by mixed strategies, nor compute Nash equilibria in mixed strategies. We did this many times in class, there are plenty of exercises on it, and there was even a very similar problem in the mock exam. But if you don't work through it yourself a few times, you won't be able to do it during the exam.

Lastly, have fun!

Alcock, L. (2021). *How to think about abstract algebra*. Oxford University Press.