From: **Grudzien, Jakub** jakub.grudzien18@imperial.ac.uk
Subject: Re: Project 3: confusing question
Date: 29 December 2020 at 11:17
To: van Strien, Sebastian J s.van-strien@imperial.ac.uk

JG

Hi Professor

Thank you for your response. The task became clearer now.

I'm also writing with a concern about the paper for question 5.2, by Kvasov. Reading this work carefully, I found that the proofs of the propositions are missing some points, and I am not sure of their overall correctness. The arcane notation that he uses (like sum over dx_j) is confusing as well.

My major concern is the proof of proposition 2, starting in the appendix:

1. In the proof that the function G_{-ij} is strictly continuous, the author considered a point in the function's support closure, but used properties of the support's interior (he took the epsilon-neighbourhood around the point). This is not a big deal, as indeed, the constancy of the function in a point in the closure implies constancy somewhere in the interior. And although I agree with the result, which essentially says "we can get more payoff due to vG_{-ij}(b_{ij}) and pay less due to b_{ij}", the algebraic expression (Sum_{j}dx_j integral_{Hj}... - epsilon/2) in the appendix for the difference of interest seems wrong (Where is v? Where does the denominator 2 come from?). The result seems right, but the conviction that this expression is right propagates (in my opinion errors).
2. In the proof of continuity of G_{-i}, the author didn't actually disprove discontinuity, but rather discontinuity from both left and right. He argues that, in case of discontinuity (from both sides) we can get more payoff by taking small steps to the right, where leaps in G_{-i} are large and small steps to the left, where drops in G_{-i} are small. As you can see, this involves and disproves right discontinuity. This result is, unfortunately, useless as any cumulative distribution function is known to be continuous from the right.
3. Finally, assuming the correctness of all intermediate results, having shown that the marginals must be uniform, and not exceeding 1/v, he infers that (in case v < 2B/N), the uniform distribution that constitutes the marginal is on [0, v]. Why [delta, v + delta], where delta is sufficiently small, is immediately excluded?

I know it's a large email, and there might be gaps in my reasoning. In such a case I apologise for wasting your time. I appreciate your feedback and help.

Best regards
Jakub

From: van Strien, Sebastian J <s.van-strien@imperial.ac.uk>
Sent: 28 December 2020 12:00
To: Grudzien, Jakub <jakub.grudzien18@imperial.ac.uk>
Cc: van Strien, Sebastian J <s.van-strien@imperial.ac.uk>
Subject: Re: Project 3: confusing question

HI Jakub,

You are asked to also consider the case where the armies are not necessarily the same.

Best wishes, Sebastian

> On 27 Dec 2020, at 13:11, Grudzien, Jakub <jakub.grudzien18@imperial.ac.uk> wrote:
>
> Dear Professor Sebastian
>
> I'm doing project 3, and I have found question 5.1 really confusing. It asks us to describe NE of Blotto game with the number of castles N=2 and equal armies of the two players. In this case, a draw is an obvious outcome of the game, and so all possible pairs of strategies form NEs. On the other hand, we were given a paper ("Waging simple wars") that analyses a more general problem in much more detail. Is that anything that I'm missing and explains my confusion?
>
> Best regards
> Jakub