Take home exam Quantitative Economics III

Return date: March 25th 2019, before midnight, German time. Return to nadine.chlass@uni-jena.de

1. You are preparing for an exam on a Monday. The week before, you split the preparation work load for the exam into two equally sized parts. You intend to do one part per day which leaves you the evenings to recuperate and obtain a utility of One per evening. Passing the exam on Monday gives you utility Eight, failing it a utility of Zero. You want to start preparing on Saturday. On Saturday, an old friend rings you up who is passing through your town and asks you to spend the day catching up. You haven't seen your friend in a long while and spending the day with your friend instead of preparing for the exam gives you a utility of Five. Yet, you will have to add Saturday's work load to Sunday's as best you can which will prevent you from enjoying a free evening on Sunday, and also reduce your chance to pass the exam on Monday by 25% (since you expect that you will have to leave 25% of the course contents unprepared).

   (a) If you are an exponential discounter, from Saturday's perspective, for which interval of $\delta$ do you prefer to spend the Saturday with your friend over preparing for the exam?

   (b) From which day's perspective would your preference for Saturday's activity be different than from Saturday's perspective?

2. Consider the following interactive situation $\mathcal{H}$ in normal form:

| $\mathcal{H}$ | | Player 2 | |
|---|---|---|---|
| | | $e$ | $f$ |
| Player 1 | $E$ | 2<br>1 | 1<br>2 |
| | $F$ | 1<br>4 | 3<br>1 |

   (a) Which is the function of best responses for player 1?

   (b) Which is the function of best responses for player 2?

   (c) Find all combinations of best responses (Nash equilibria).

   (d) Suppose both players are inequity-averse over their payoffs in $\mathcal{H}$. How do you search for Nash equilibria now (you do not need to solve the equation system)?

3. Suppose that in situation $\mathcal{H}$, player 2 is a computer. The computer is programmed such that it chooses strategy $e$ with probability 60% and strategy $f$ with probability 40%.

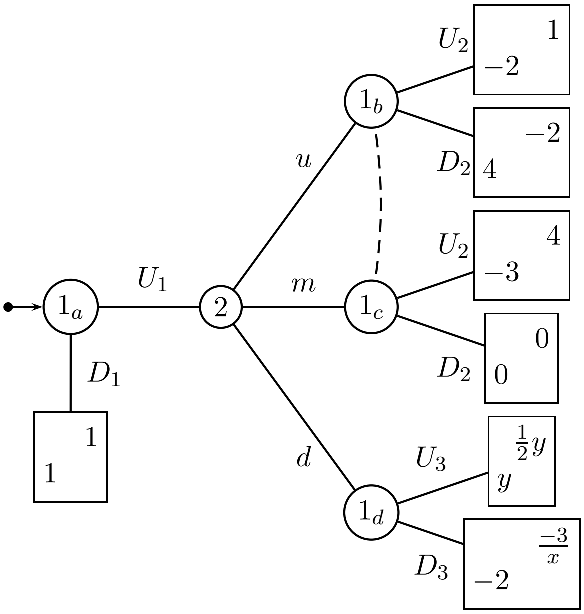
   (a) Which strategy does player 1 choose if she applies a) the maximin criterion, b) the maximax criterion, and c) the minimax-risk criterion?

   (b) Which strategy does she choose if she maximizes expected utility?

   (c) Now, player 1 is given the choice between: i) participating in the game with the computer opponent, or ii) receiving a payoff of 2 for opting out of the game. Illustrate, how player 1's utility function could look like, if she considered her anticipated regret when deciding about her choice.

4. Consider again the situation $\mathcal{H}$. You interact with a player 2 who comes from a population of players that consists of two types. The first type always follows her rational self-interest and plays a Nash-equilibrium (just as you would do yourself). The second type always maximizes social utility (that is, the sum of both players' payoffs). You have no idea how frequent these types are in the population and have uninformed priors, that is, you expect to encounter each type with a 50% chance. You observe the following outcomes from your interaction with your opponent: Round 1: (You: 4, your opponent: 1), Round 2: (You: 4, your opponent: 1), (Round 3: You: 4, your opponent: 1). If you rationally update your beliefs about your opponent's type, what are your posterior beliefs (probabilities) that your opponent maximizes social payoffs (or follows her self-interest and plays a Nash-equilibrium, respectively)?

5. Consider the following sequential strategic situation $\mathcal{Q}$. You find player 1's payoff at the bottom left, and player 2's payoff on the top right of each terminal node (payoff cell).



(a) How many subgames does the game have?

(b) Solve the game by backwards induction for $y = -2$ and $x = -3$.

(c) Suppose $y = 3$ and $x$ is still $-3$. In a subgame perfect equilibrium, what are player 2's first and second order beliefs, after player 1 has chosen $U_1$?