Microeconomics II Mock Exam

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Exercise 1

For the following game find all Nash equilibria and indicate which are THP and why.

		P2			
P1		LL	L	M	R
	U	10,3	-10,2	0,0	-10,-10
	D	-10,-10	10,-5	2,0	10,3

Exercise 2

Consider the three-player game with the payoffs given in tables A, B and C. Player 1 chooses rows, player 2 chooses columns, and Player 3 chooses one of the three tables. [1]

1. *What are the pure strategy equilibrium payoffs?*
2. *Show that there is a correlated equilibrium in which player 3 chooses B and players 1 and 2 play (U,L) and (D,R) with equal probabilities.*

	L	R
U	1,1,4	1,1,1
D	2,1,1	1,1,1

(a) Table A

	L	R
U	3,3,3	1,1,1
D	1,1,1	3,3,3

(b) Table B

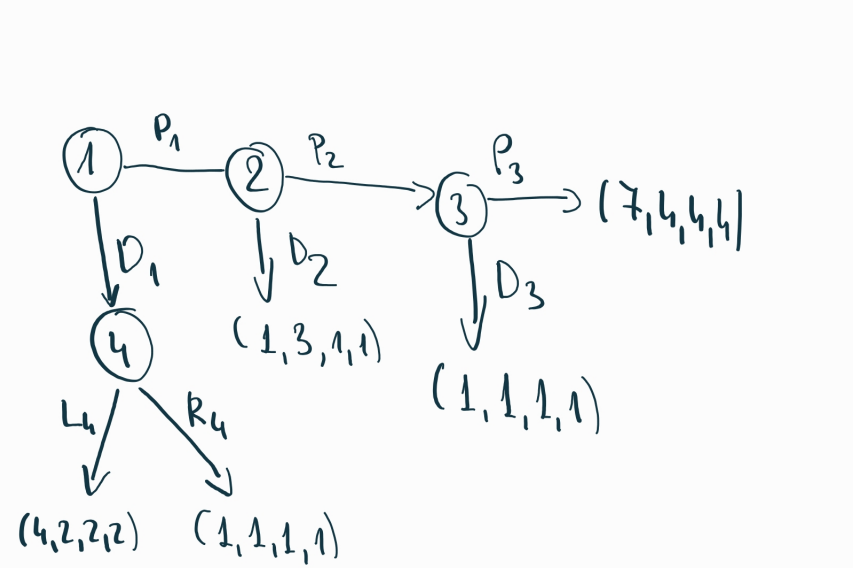
	L	R
U	1,1,1	1,1,1
D	1,2,1	1,1,4

(c) Table C

[1] This exercise is a modification of one of exercises included in "A Course in Game Theory", by A. Rubinstein and M.J. Osborne (1994)

Exercise 3

Consider the following four-player game:



1. *What payoffs are possible in pure strategy Nash equilibria?*
2. *What payoffs are possible in a sequential equilibrium?*
3. *Is it possible to construct a self-confirming equilibrium with the following strategy profile:* $\sigma = [(0.5D_1, 0.5P_1); (D_2); (P_3); (L_4)]$*? If yes, what beliefs we would need to construct? If not, how would you change the strategies of the other players so that we still have P2 playing drop?*

Exercise 4

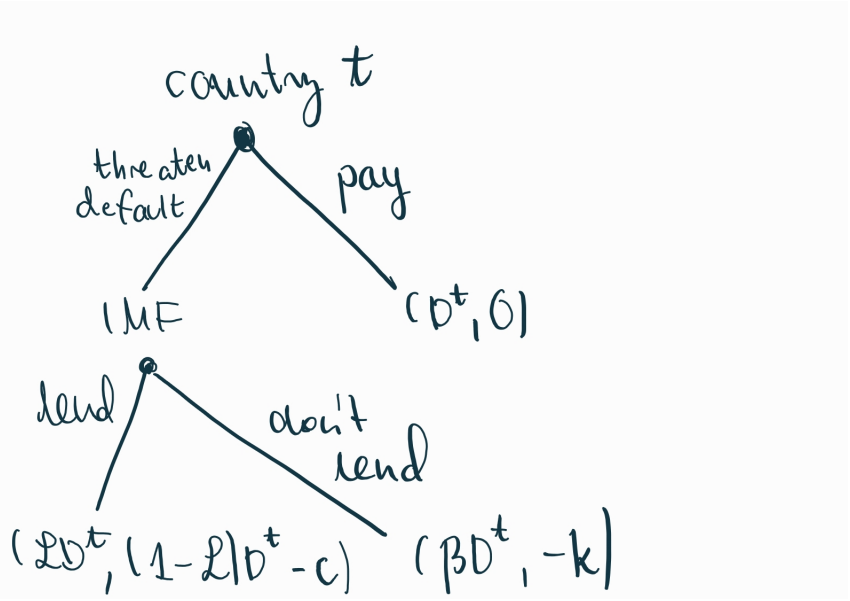
Suppose that the International Monetary Fund considers the situation of public finance in some two countries sequentially. At date $t \in \{1,2\}$*, country* t *decides whether to pay its debt to the IMF,* D^t*, or to threaten default.*[2] *If it threatens default, the IMF can start another lending program or do nothing. If the IMF does nothing, it results in default for the country in trouble. However, if it starts a program, a country needs to introduce some structural reforms which is costly (cost* c*). The stage game is illustrate below. Note that* $1 > \alpha > 0, \alpha > \beta$ *and* $k > c > 0$*. The management of the IMF can be "soft" or "tough" (never lend). Only the management in the headquarters in DC knows whether it is soft or tough. Assume that the IMF's discount factor is equal to one and that* $(1-p)((1-\alpha)D^t - c) - pk > 0$ *for* $t = 1,2$*, where* p *is the prior probability that the IMF is tough.*[3]

1. *Solve for the equilibrium of this two-period game.*
2. *If the IMF had the choice between facing the low-debt country and the high-debt country first, which*

[2] This is not very realistic as debts to the IMF are paid in priority by governments.

[3] This exercise is a modification of an exercise included in "Game Theory" by D. Fudenberg and J. Tirole (1991)

one would it choose?



Exercise 5

Suppose two types of activities:[4]

- *With immediate costs: the cost is realized when the activity is performed, while a benefit comes later (studying for an exam, exercising)*
- *With immediate benefits: the benefit is realized when the activity is performed, while a cost comes later (eating chocolate ice cream, gambling)*

And two types of present-biased agents:

- *naive (N): do not realize the time inconsistency; think that future selves will implement the plan of the current self. They choose a strategy* $\mathbf{s}^n \equiv \left(s_1^n, s_2^n, \ldots, s_T^n\right)$ *that satisfies for all* $t < T$ $s_t^n = Yes$ *if and only if* $U^t(t) \geq U^t(\tau)$ *for all* $\tau > t$*; where* Yes *means that the activity is completed in a given period.*
- *sophisticated (S) do realize the time inconsistency; solve their problem by using subgame-perfect equilibrium. They choose a strategy a strategy* $\mathbf{s}^s \equiv \left(s_1^s, s_2^s, \ldots, s_T^s\right)$ *that satisfies for all* $t < T$ $s_t^s = Yes$ *if and only if* $U^t(t) \geq U^t\left(\tau'\right)$ *where* $\tau' \equiv \min_{\tau > t} \left\{\tau \mid s_\tau^s = Yes\right\}$.

Both of them compare the timing of an action of both types to the timing of time consistent (TC) agents for whom $\beta = 1$ *and time inconsistent, with* $\beta < 1$*. Let's assume:*

[4] This exercise is inspired by the article "Doing It Now or Later" by Ted O'Donoghue and Matthew Rabin (American Economic Review, 1999)

- *the activity must be performed exactly once in one of the time periods* $1,\ldots,T$.
- *Let* $\delta = 1$ *(for simplicity)*
- *Preferences in any period* $t \in \{1,..,T\}$ *:*

$$U_t = u_t + \beta\,[u_{t+1} + \ldots + u_T]$$

- *When evaluating timing of the activity in period* t*, if the person completes the activity in period* $\tau \geq t$
  - *for activities with immediate costs*

$$U_t = \begin{cases} \beta v_\tau - c_\tau & if\, \tau = t \\ \beta v_\tau - \beta c_\tau & if\, \tau > t \end{cases}$$

  - *for activities with immediate rewards*

$$U_t = \begin{cases} v_\tau - \beta c_\tau & if\, \tau = t \\ \beta v_\tau - \beta c_\tau & if\, \tau > t \end{cases}$$

1. *Suppose costs are immediate,* $T = 4$, $\beta = \frac{1}{2}$ *for naifs and sophisticates. Let* $\mathbf{v} = (\bar{v}, \bar{v}, \bar{v}, \bar{v})$*, and* $\mathbf{c} = (3,5,8,13)$*. When the naif, sophisticate and time-consistent agent completes the activity?*
2. *Suppose rewards are immediate,* $T = 4$, $\beta = \frac{1}{2}$ *for naifs and sophisticates. Let* $\mathbf{v} = (3,5,8,13)$ *and* $\mathbf{c} = (0,0,0,0)$*. When the naif, sophisticate and time-consistent agent completes the activity?*
3. *How would you write down utility function for a given period if* $\delta < 1$*?*

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Exercise 6

Consider the following game where player 1 is a long-run player and player 2 is a short-run player:[5]

		P2		
		L	M	R
P1	U	1,3	3,4	-1,0
	D	0,3	2,2	-1,0

1. Find all Nash equilibria of this game.
2. What is the worst dynamic equilibrium of this game?
3. Find the pure and mixed Stackelberg equilibrium in which the long-run player moves first.
4. What is the best dynamic equilibrium and for what discount factor is it attainable?

[5]This exercise is inspired by the article "Repeated Games with Long-Run and Short-Run Players" by D. Fudenberg, D.M. Kreps, E. Maskin (The Review of Economic Studies, 1990)

Exercise 7

Consider a lottery in which you can win 1000 EUR with probability 1/2. Before making a decision you are approached by an insurer who offers you an insurance removing the risk costs of 500 EUR.[6]

1. *At what level of wealth will you be indifferent between taking the gamble or paying the insurance? Consider two utility functions:* $u(Y) = Y^{0.5}$ *and* $u(Y) = ln(Y)$.
2. *How much will you pay to avoid this risk if your current level of wealth is 10,000 EUR? How much would you pay if your level of wealth is 1 million EUR? Did you expect that the premium you were willing to pay would increase/decrease? Why?*

[6] This exercise is a modification of one of exercises found at prof. John Donaldson's website from the Columbia Business School.