TECHNISCHE UNIVERSITÄT DRESDEN

Computational Logic ∴ Group

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Algorithmic Game Theory

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exercises 1

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Problem 1.
Consider the games **the battle of the partners** as well as **the prisoner's dilemma** with the payoff tables displayed below. Although you already know the answers to the questions below from the lecture, work closely with the central definitions to answer them again.

- What strategy profiles provide Nash equilibria in both games?
- Is there a difference between the equilibria in both games?
- Are the equilibria Pareto optimal in both games?
- Are there dominant strategies in both games?

Battle of the Partners:

$(Helena, George)$	Soccer	Concert
Soccer	(10,1)	(0,0)
Concert	(0,0)	(0,10)

Prisoner's Dilemma:

$(Smith, Wesson)$	Confession	Silence
Confession	(-4,-4)	(0,-10)
Silence	(-10,0)	(-2,-2)

Problem 2.
Consider the following two exercises.

(a) Imagine that you are a fully rational decision maker facing a (one-shot) prisoner's dilemma. Explain why the outcome of the game will not be affected if you are allowed to meet and discuss with the other player before you make your move.

(b) By definition, a non-cooperative game is a game in which the players are not able to form binding agreements. Why can we not just say that a non-cooperative game is a game in which the players do not actually cooperate?

Problem 3.
Consider the following 3×3 game.

$(Player_1, Player_2)$	l	c	r
T	(1,0)	(3,1)	(1,1)
M	(1,1)	(3,0)	(0,1)
B	(2,2)	(3,3)	(0,2)

(a) Identify all pairs of strategies where one strategy weakly dominates the other.

(b) Assume you are allowed to remove a weakly dominated strategy of some player. Do so, and repeat this process (of iterated elimination of weakly dominated strategies) until you find a single strategy pair of the original game.

(c) Find such an iterated elimination of weakly dominated strategies that results in a strategy pair other than the one found in (b), where both strategies, and the payoffs to the players, are different.

(d) What are the equilibria (in pure strategies) of the game?

Problem 4.
Consider the following three-player game in strategic form.

$(Player_1, Player_2, Player_3(L))$	l	r
T	(3,4,4)	(1,3,3)
B	(8,1,4)	(2,0,6)

$(Player_1, Player_2, Player_3(R))$	l	r
T	(4,0,5)	(0,1,6)
B	(5,1,3)	(1,2,5)

(a) Identify all pairs of strategies where one strategy strictly, or weakly, dominates the other.

(b) Apply iterated elimination of strictly dominated strategies to this game. What are the Nash equilibria of the game?