MI-GLR Homework 5

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1 Problem 1: Nash Equilibrium

3,2	1,1
0,0	**2,3**

Nash Equilibria are in **Bold**.

Mixed Nash Equilibria:
Player 1 plays first action with probability $p1$:
Reward for Player 2:

$$2 * p1 + 0 * (1 - p1) = p1 + 3 * (1 - p1)$$
$$2 * p1 = -2 * p1 + 3$$
$$4 * p1 = 3$$
$$p1 = \frac{3}{4}$$

$\implies$ Strategy for Player 1: $(\frac{3}{4}, \frac{1}{4})$.

Player 2 plays first action with probability $p2$:
Reward for Player 1:

$$3 * p2 + 1 * (1 - p2) = 0 * p2 + 2 * (1 - p2)$$
$$2 * p2 + 1 = 2 - 2 * p2$$
$$4 * p2 = 1$$
$$p2 = \frac{1}{4}$$

$\implies$ Strategy for Player 2: $(\frac{1}{4}, \frac{3}{4})$.

2 Problem 2: Maxmin and minmax

1	2
0	x

Table 1: Matrix A of a zero-sum game.

If some entry a_{ij} of the matrix A has the property that:

1. a_{ij} is the minimum of the ith row and
2. a_{ij} is the maximum of the jth column

then we say a_{ij} is a saddle point. If a_{ij} is a saddle point, then Player I can then win at least a_{ij} by choosing row i, and Player II can keep her loss to at most a_{ij} by choosing column j. Hence a_{ij} is the **value of the game**. Optimal strategy for Player I is to always play action i and for Player II it is to always play action j.

Solution:
Saddle point is a_{11}, therefore value of the game is 1 and optimal strategy for both players is the following pure strategy: (1, 0).

References

[1] Ferguson, S. Thomas "GAME THEORY" UCLA Department of Mathematics. Accessible from: https://www.math.ucla.edu/~tom/Game_Theory/mat.pdf