# 2nd Tournament - Report

Pedro Pais
48247

June 3, 2020

## 1 Introduction

This is a report on the second tournament for the Computational Game Theory class. In this tournament, the class was challenged with the same two Prisoner's Dilemma games from the first tournament and a mystery game which is only known to be a **MxN Normal Form Game**.

## 2 Prisoner's Dilemma

Prisoner's Dilemma is an interesting game in the sense that the Nash Equilibrium gives a terrible utility payout. As such, in a Tournament where players play each other several rounds, if there are some instances where players cooperate during most rounds (as is the case with the Tit for Tat and Grim Trigger strategies), these players can collect several points ahead of the players that only played the equilibrium. In this specific case, a round where both players Cooperate nets a utility gain of 3 and a round where both players Defect nets a utility gain of 1, a difference of 2 points **every round**.

### 2.1 Last Tournament

In the last tournament, the strategies ended up being mainly the same. Most players played a version of Tit for Tat or Grim Trigger where they played Defect somewhere close to the last round. In this case, most players played Defect in the round before last except for one player (the winner) who played Defect two rounds before the last. This provides an interesting insight on the second tournament as now players have a different estimation (one could call it *more precise*) and can change their strategies accordingly.

### 2.2 Rematch

This time, I assumed players would follow the last tournament winner's strategy and decided to play Tit for Tat but Defect two rounds sooner than they did (the 5th round counting from the end).

This put me on the top places but wasn't enough to win the tournament. Some players seemed to have tried some more "ambitious" strategies. Some played Defect right at the beginning, others played Defect much sooner than I did.

Overall, it seemed that the round at which players Defected was not so uniform as it was on the first tournament.

# 3 Mystery Game

This game is completely unkown to the players until the tournament begins. The only thing that every player knew was that it was a **MxN Normal Form Game**.

For this game, the strategy I used depended on if the game was a Zero-Sum or a General-Sum. There could be other ways to define the game (in search of better strategies, perhaps) but that would make the computation more complex and could possibly take too long to run. As such, these options were not pursued.

## 3.1 Zero-Sum game

If the game was a Zero-Sum game, then the strategy used would be a simple MinMax. As this would ensure that other player has the least amount of points (increasing my points in return).

## 3.2 Fictitious Play

In case the game wasn't a Zero-Sum Game and considering that there was nothing defined about the game, the chosen strategy was to make the best response to what the other player has played so far. This, of course, assumes that the player is playing some defined strategy and not some fully random strategy. Even if the player is playing a random strategy, though, this algorithm just ends up playing the best response to it.

## 3.3 After the games

This strategy was implemented by the top players. There was a clear distinction between who implemented and who didn't (who implemented it got a positive score at around 200 and those who didn't got a negative score). In the end, the fact that players ended up in different places can be a attributed to the randomness that is inherent to a mixed strategy.

# 4 Conclusions

In the end, as the teacher so strongly remarked, the Nash Equilibria doesn't have to be a good strategy. All it means is that once the players reach that point, none of them has an incentive to deviate from it. Interestingly, the Fictitious Play strategies converge to an equilibrium. In the last game, sometimes it meant that players got stuck in a bad equilibrium (payoffs of [-1,-1]) but it converged to a mixed strategy equilibrium (in this case, a much better one).