Iterative Prisoner's Dilemma Report

Abstract

The goal of this tournament was to develop a strategy for iterative prisoner's dilemma using finite state machines written in verilogHDL to simulate the game. The tournament was between 11 teams and the winning criteria was the following:

Average(Win %, Cooperation %, Points %)

Strategy

The strategy that I submitted was a modified version of Forgiving Tit-for-Tat. The strategy works on two variables, opponent cooperation rate (OCR) and forgiveness threshold (FT). Apart from these, the strategy was standard Tit-for-Tat; if the opponent deflects, we deflect in the next round, if the opponent goes back to cooperation, we go back to cooperation in the next round, unless we are in the last two rounds where we will deflect regardless. The only difference is that there may be an instance where our strategy chooses to forgive a deflection. Such an instance will occur when the OCR is greater than or equal to FT.

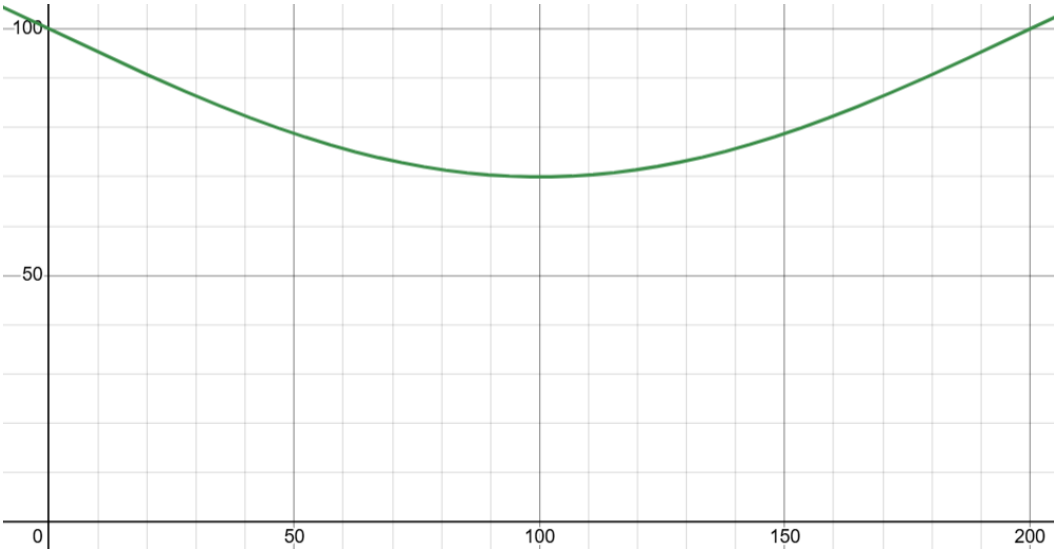
The calculation of OCR is straightforward,

$$OCR = \frac{opponent\_cooperation\_count}{total\_rounds\_elapsed}$$

FT, on the other hand, is based on being less forgiving during the start and end of the 200 rounds and being more forgiving in the middle. Such a strategy was chosen to avoid being taken advantage of by malicious strategies that may start off deflective or may become deflective during endgame for their own benefit. Being more forgiving during the middle of the rounds allows for a more cooperative environment between strategies that have behaved well so far. This behavior was calculated by the following sin wave equation,

$$FT = 100\left(1 - 0.3\sin\left(\frac{\pi \cdot x}{200}\right)\right)$$

Which is represented by the graph,



The graph highlights how the opponent must meet a forgiveness threshold of 100% at the start and end in order to be forgiven, which lowers to 70% during midgame.

Result

Out of the 11 teams, our strategy was placed 4th. The following is the summary of the 11 marches.

	Rounds		**Score**
wins	5	**Cooperations**	1984
losses	5	**Deflects**	216
draws	1	**Points**	10298

Analysis

Our strategy did the worst against more complex and random strategies that manage to take advantage of the lowered FT during the midgame, however, even against them, the score difference wasn't very far off, indicating the fact that despite the forgiveness aspect of our strategy, we still managed to keep a stricter approach to malicious strategies by varying the FT throughout the game. This can also be seen by the fact that more forgiving strategies did significantly worse against such strategies when compared to ours.