TJHSST Computer Systems Lab Senior Research Project Prisoner's Dilemma with N participants and Optional Cooperation 2007-2008

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Abstract

Prisoner's Dilemma is a non-zero sum game that is applicable to game theory. The game is played between two participants or 'prisoners' and the goal is to maximize their own individual payoff at the end of the game. It is normally iterated to play through a number of rounds to determine a winner, while all the prisoners do is determine what their decisions will be with the goal of maximum payoff.

This relatively simplistic game has been through numerous variations. While the classic game itself has only two participants, some have more than two, perhaps "N" participants. My goal is not much different from creating a variation of Prisoner's Dilemma, but I'd like to expand further on the idea of cooperation. Prisoner's Dilemma reveals a potential that can be applied to cooperation as a whole. Since the two prisoners both affect each other's decisions, they not only would have to anticipate their opponent's moves, but also 'cooperate' if they want to maximize their own payoff. However, this is only one possible situation out of a countless many.

Therefore, I would like to create Prisoner's Dilemma to implement a number of parameters including the use of "N" prisoners, enabling cooperation to be known amongst others, and intiating a form of "morality". Alongside that, I would also like to find a general solution to certain scenarios.

Keywords: Prisoner's Dilemma, Agent Based Modeling.

1 Introduction - Elaboration on the problem statement, purpose, and project scope

1.1 Scope of Study

This project will require research delving into the variations of Prisoner's Dilemma, successful strategies, and the psychology of cooperation. Since cooperation is emulated in Prisoner's Dilemma, understanding cooperation is almost essential to understand to simulate a realistic situation depending on parameters. Variables that will need to be included at the very least include enabling 'cooperation' between a number of participants to play in the game.

I want to develop a simulation of Prisoner's Dilemma that will be able to emulate a number of scenarios. Cooperative scenarios where a person may choose to cooperate or defect happens to us all the time, which Prisoner's Dilemma can't emulate by itself due to a restriction in variables. I want to make this version of PD to emulate as many possibilites as I can, and to see how participants will cooperate depending on who is cooperating with them and how many are 'playing' the game.

1.2 Expected results

The results I expect are a variety of scenarios that can be played by 'Prisoner's Dilemma' and numerous strategies that can be implemented optimally to

them. I want to find out what is the best strategy to implement depending on a change in variables. I expect my program to be a visual graph that shows results and choices of the participants to better visualize and keep track of payouts for the player as well.

I want to do this project because I want to better understand the psychology of cooperation.

1.3 Type of research

This type of research falls under applied research, although it has some aspects of user inspired research.

2 Background and review of current literature and research

I have looked into Robert Axelrod's 'Evolution of Cooperation' to gain an understanding of how Prisoner's Dilemma operates and understanding the optimal strategy tit for tat. This has been my main source of research and literature review as of this time, and I plan to continue to refer to the text for aid and reference. Prisoner's Dilemma and the psychology of cooperation are explored very well here, therefore it is an excellent text to use as a reference and an aid.

Another recent research article that has caught my interest revolves around a variation of the Iterated Prionser's Dilemma called Turn Taking Dilemma. This new source is gaining interest from me and if possible, I would like to implement aspects of this project into my own. An interesting result that came through for this project was that the strategies that were optimal in the Iterated Prisoner's Dilemma, was not the case for the Turn Taking Prisoner's Dilemma.

3 Procedures and Methodology

A graph will be constructed to show the current payouts of the prisoners playing and their choices made per turn.

Testing and analyzing will be done at this time by running the program multiple times. Error analyses will be done by reading printed lines to determine the program is running correctly. At the moment, since the graphics structure is still under construction, testing will also be done to ensure that the numbers and statistcs are being displayed properly.

The testing that will be used for verification is by dynamic testing.

Requirements and specifications are currently being discussed.

You could describe particular algorithms you'll be using and learning about.

4 Expected Results

The results I obtain from this project will be not only a simulation that can aid in just about any Prisoner's Dilemma scenario, but also a general look at what strategies are prevalent in certain scenarios. These results will be portrayed as graphs and charts.

I believe this can be a contribution to seniors for next year's tech. lab.