Prison Dilemma

Sandeep Bharani
MTech-I- CMS1420
Center for Modeling and Simulation
University of Pune

Pratiksha Pawar
MTech-I- CMS1414
Center for Modeling and Simulation
University of Pune

Introduction

The prisoner's dilemma (PD) game is a method of indicating the results of the possible pairings of the cooperative and non-cooperative choices of two players. In PD game there are two players, a column player 1 and a row player 2, each of whom has two choices, C or D, resulting in four possible combinations of choices with each combination yielding a different set of payoffs or outcomes. Payoffs or outcomes can be thought of as rewards or as some index of player satisfaction. The usual convention is that numbers above the diagonal in each cell represent the outcomes for the column player, and numbers below the diagonal in each cell represent the outcomes for the row player. In the example matrices, the numbers, or outcomes, can be thought of as dollars or points or rewards points.

How it is played

1. **Two Players Game**

The Prisoner's Dilemma model postulates a condition in which the rational action of each individual is to not cooperate (that is, to defect), yet, if both parties act rationally, each party's reward is less that it would have been if both acted irrationally and cooperated.

2. **Iterated "Prisoner's Dilemma" with multiple participants**

If the game is played only once there is no incentive for either player to do anything but defect, as discussed above. In fact, if the game is to be played a known number of rounds, there is no better choice than to defect. Why? Because you both know you will defect on the last move. So, scratch off the last move. That puts you in the same situation for the next to the last move - and so on for all. But if the game is to be played an indefinite number of times, under certain conditions, cooperation can evolve as the best policy.

Strategy

Initially the game is played between two players for multiple iterations with only choices of either to Co-operate or Defect with opponent player.

And at the sophisticated level game is played among the multiple players to understand each other strategy and their thinking of winning this game.

A matrix is developed to understand and signify the strategies of both the players.

If both players cooperate, they both receive the reward, as 20 points each, for cooperating.

If both the players play defensive then each player will get will get 10 reward points each.

- **Option 1 (Cooperates):** Both players in the project decide to do their best work and grade each other honestly and accurately.

- **Option 2:** Player 1 decides to grade accurately (Cooperate), while Player 2 decides to give the best grades possible (Betrayal), because he is unsure as to the motives of Player 1 and don't want to give a bad grade in fear of some form of retaliation.

- **Option 3 (Betrayal):** both players, because of the unknown decision of the other player, decides not to grade accurately but instead just give good grades, regardless of effort and substance of work.

Prisoner's Dilemma			
	Player2		
Player1		Cooperate (C)	Defect (D)
	Cooperate (C)	20,20	0,30
	Defect (D)	30,0	10,10

Here are some of the simplest strategies which were applied

Tit For Tat (TFT)

		Other	
		C	D
ME	C	C	D
	D	C	D

Always Defect (ALL-D)

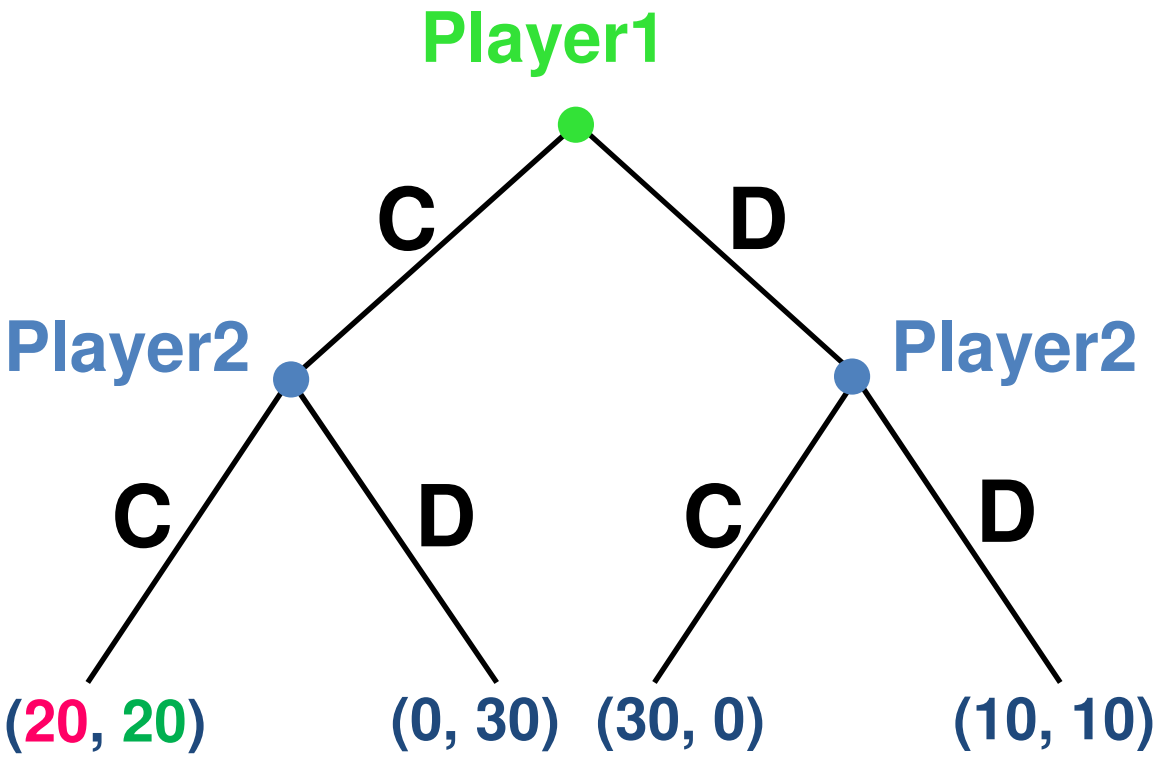
		Other	
		C	D
ME	C	D	D
	D	D	D

Always Cooperate (ALL-C)

		Other	
		C	D
ME	C	C	C
	D	C	C

A Sequential Game Example

Player A \ Player B	C	D
C	(20, 20)	(0, 30)
D	(30, 0)	(10, 10)



Our Algorithm

step1. We will start with "C", if opponent co-operate then we will continue with C. If in case opponent put "D" in 2nd iteration I will still continue with C.

step2. In third iteration I will put "C". If opponent co-operate will continue with C. Else from 4th iteration I will continue with "D".

step3. Then same strategy will continue for 4 more iteration. 4. From 9th Iteration I will get the idea of opponent behavior. If numbers of "C" is more than D from opponent then I will co-operate. If no. of D is more than C from Opponent then I will continue with D".

Strategy applied with individual group.

I started with 'C' for first three iterations and noted the strategy of opponent; in fourth iteration I put 'D' and same strategy applied for four iteration. Later I continued with number that input by looking at the output which is greater.

Observation:

Table for 10, 000 iterations

Group	Scores of interacting with other group	Scores of our group	Total Score
g1	968200	100000	1068200
g2	666540	122310	788850
g3	966270	196950	1163220
g4	966110	100010	1066120
g5	966020	100000	1066020
g7	965970	200000	1165970
g8	965920	100000	1065920
g9	898700	100000	998700
g10	949200	100000	1049200
g11	961390	101400	1062790
g12	968200	100000	1068200

Appendix 1: Source Code.

```
/*################################################

##########################################

Assignment:- Prison Dilemma
Algorithm- 1
Group No:- 09
#######################################

/*

#include<stdio.h>
#define array 10000
char x1[array],x2[array];

int i;

char group_09(char C)
 {
   /*In the first three iterations to Co-operate with opponent
char group_09(char C)
  {

   if(i<3)
     {
        x2[0]='C'; //In the first three iterations put C
        x2[1]='C';
        x2[2]='C';
        x2[i]='C';
      }
        //Then do as my opponent is doing fot three more iterations

     if ((i>3))
       {

         while(i<9)

          {

             if(x1[i]=='C')
                 {
                   x2[i]='C';
                 }
             else
                  x2[i]='D';

          }
  }
  return x2[i];

 }
```

Appendix 2: Source Code.

```
########################################

Assignment:- Prison Dilemma
Algorithm- 2
Group No:- 09
########################################
// function prototypes
/*

#include<stdio.h>
#define array 10000
char x1[array];
int i;
char system_gen(char C)

{
  if(i<10)
    {
       if(i%2==0)
        {
          x1[i]='C';
        }
       else
        {
          x1[i]='D';
        }
    }
   else if(i>10)
        {
           if(i%3==0)
             {
               x1[i]='C';
             }
           else
          {
             x1[i]='D';
          }
    }
  return x[i];
}
```

Conclusion

The most interesting thing about the Prisoners Dilemma is that it shows how cooperation can emerge without intelligence. If you aren't forced to assume intelligence, you can make a lot more conclusions about the system. Making a single combined move forces us to assume intelligence the two players agreeing to make this move together and that really doesn't shed any light on cooperation; we've known that intelligent people cooperate for thousands of years. The most interesting fact is that this same level of cooperation would arise even if we weren't intelligent creatures. Another interesting fact is that these strategies are stable. It doesn't matter how scheming or devious the other strategies are, or how complicated their hidden agendas are, a simple TFT strategy will still beat them in the long run. What happens when you *have* to interact with someone or something that you don't have control over? Without understanding the game of two independent players, you won't get many insights.

References.

1. Anatol rapport online books

2. Hawk and Doves.
   http://www.learner.org/courses/