Subject/Odd Sem 2023-23/Experiment 1

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Title of Experiment : Prisoner's Dilemma in Python

Objective of Experiment : The objective is to implement the Prisoner's Dilemma game in Python, a classic example in game theory, where two players must decide whether to cooperate or betray each other, leading to different payoffs depending on their choices.

Outcome of Experiment : The outcome of this implementation will be a simulation of the Prisoner's Dilemma game, where players make decisions to cooperate or betray in multiple rounds. The simulation will showcase how rational decision-making can lead to complex outcomes in situations where cooperation and self-interest intersect.

Problem Statement :

In the Prisoner's Dilemma, two suspects face a choice: cooperate for lighter sentences or betray each other for potential freedom. If both betray, they get worse outcomes than mutual cooperation

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Description / Theory :

The Prisoner's Dilemma is a classical problem in game theory that illustrates a situation where two individuals making rational decisions can lead to a suboptimal outcome. It's often used to analyze situations in which individuals must decide whether to cooperate or compete, and how their decisions impact each other.

Here's a basic description of the Prisoner's Dilemma:

Two suspects are arrested for a crime, and they are placed in separate interrogation rooms. The police lack sufficient evidence to convict them of the major crime, but they have enough evidence to convict both of a lesser offense. The suspects are presented with the following options:

1. **Cooperate**: If both suspects remain silent (cooperate), they will each serve a short sentence for the lesser offense due to lack of evidence for the major crime.

2. **Defect (Betray)**: If one suspect defects (betrays) the other by confessing to the major crime and implicating their partner, the defector will be set free while the other suspect will receive a heavy sentence for not cooperating.

3. **Mixed Strategy**: Each suspect can also choose a mixed strategy, cooperating sometimes and defecting other times, leading to more complex outcomes.

The dilemma arises because each suspect must decide whether to trust the other suspect to cooperate or betray. Regardless of what the other person does, it is in each suspect's best interest to betray the other, as confessing guarantees a lighter sentence (or freedom) regardless of the partner's choice. However, if both suspects betray each other, they both receive a higher combined sentence than if they had both cooperated.

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Algorithm/ Pseudo Code / Flowchart

Input and output Matrix for Prisoner's Dilemma:

	Prisoner B stays silent	Prisoner B betrays
Prisoner A stays silent	Each serves 1 year	Prisoner A: 3 years Prisoner B: goes free
Prisoner A betrays	Prisoner A: goes free Prisoner B: 3 years	Each serves 2 years

Program :

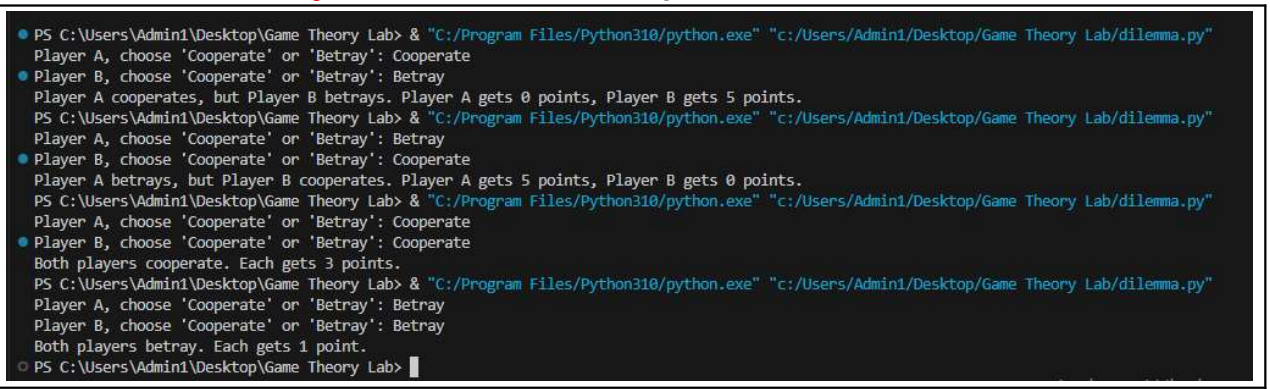
1.

```
def prisoners_dilemma(player_a_choice, player_b_choice):
    if player_a_choice == 'Cooperate' and player_b_choice == 'Cooperate':
        return "Both players cooperate. Each gets 3 points."
    elif player_a_choice == 'Cooperate' and player_b_choice == 'Betray':
        return "Player A cooperates, but Player B betrays. Player A gets 0
points, Player B gets 5 points."
    elif player_a_choice == 'Betray' and player_b_choice == 'Cooperate':
        return "Player A betrays, but Player B cooperates. Player A gets 5
points, Player B gets 0 points."
    elif player_a_choice == 'Betray' and player_b_choice == 'Betray':
        return "Both players betray. Each gets 1 point."

player_a_choice = input("Player A, choose 'Cooperate' or 'Betray': ")
player_b_choice = input("Player B, choose 'Cooperate' or 'Betray': ")

result = prisoners_dilemma(player_a_choice, player_b_choice)
print(result)
```

Output Screenshots :



Results and Discussions : The Prisoner's Dilemma illustrates the tension between individual self-interest and collective cooperation. Despite the rational choice for both players being to betray, the optimal outcome for both is achieved through cooperation. This implementation demonstrates how real-world scenarios can be modeled using game theory concepts and how outcomes can be affected by different choices, leading to insights into strategic decision-making and the interplay between competing interests.