

Overview

This is a lab for unit V, Game Theory and Behaviors, and does not need to be submitted.

The purpose of this lab is to give you a chance to experiment with different payoffs in 2-player 2-move games within a Processing program.

Instructions

1. Refer to the lecture notes from last class (November 23), which are also posted on the class web page.
2. Download the sample sketch called **pd0.zip** from the class web page (under the “syllabus” section for today’s class, November 28).

Read through the sample code, which demonstrates a very simple version of the Prisoner’s Dilemma game, as discussed in the last class. Note that if you play the game multiple times, you are playing *Iterated Prisoner’s Dilemma* or *IPD*!

Test the sample code to make sure it works for you. You are playing IPD against the computer. If you enter **C** or **c**, then you are “cooperating”. If you enter **D** or **d**, then you are “defecting”. Watch what happens to the accumulated scores when you make different combinations of C and D moves.

The computer player is using a *mixed strategy* called “Tit for Tat”. This strategy became famous when a professor called Robert Axelrod ran a tournament for people to write computer programs to play IPD. The Tit-for-Tat strategy starts by cooperating; then in all subsequent moves, it makes the move that its opponent made in the previous move. This simple strategy turned out to win the tournament! Can you beat Tit-for-Tat? What kind of strategy do you have to use?

3. Modify the **compute_payoff()** function in the **pd0** sketch so that instead of using the Prisoner’s Dilemma payoff matrix, it uses the payoff matrix for the Stag Hunt game (see lecture notes from Nov 23).

Now run the game again and see if your strategy does better or worse using the Stag Hunt payoff scheme as opposed to the IPD payoff scheme.

4. Modify the **compute_payoff()** function again, this time using the Game of Chicken payoff matrix.

Now run the game again and see if your strategy does better or worse using the Game of Chicken payoff scheme as opposed to the IPD and Stag Hunt payoff schemes. Which payoffs work best for which strategies?

Challenges

- **Challenge Problem #1:**

It is hard to compare IPD, Stag Hunt and Chicken because the simple version of the game only shows the results of one payoff matrix at a time. Modify the game to play against 3 different computer players: one uses IPD, one uses Stag Hunt and one uses Chicken. All three use the same strategy to respond to the same human input, but the scores will differ because the scores against each computer player will be computed differently.

- **Challenge Problem #2:**

This game is pretty boring because it just uses text to display the outcomes. Be creative and modify the interface so that the results are displayed graphically somehow. For example, you could draw a bar chart, showing a bar for each player's accumulated score. Or you could draw a line chart. Or you could do something else more creative!

- **Challenge Problem #3:**

Modify the `computer_move()` function to use a different strategy. Some of the other strategies from Axelrod's tournament include:

- "All D" — always defect, no matter what the other player does
- "All C" — always cooperate, no matter what the other player does
- "Tit-for-Two-Tats" — only defect if the other player defects twice in a row

You could emulate any of these. Or you could be creative and design your own strategy for the computer to use.