

Prisoners Dilemma Assignment

Matthijs Dorst & Bastiaan Daems

July 4, 2010

Contents

| | | |
|----------|--|----------|
| 1 | Implementation | 2 |
| 1.1 | Strategies | 2 |
| 1.2 | Point overview | 2 |
| 2 | 1 vs 99 | 2 |
| 3 | TIT-FOR-TAT vs. ALL-D | 2 |
| 4 | Best three strategies vs. TIT-FOR-TAT | 3 |
| 4.1 | six strategies | 3 |
| 4.2 | Best strategy: ALL-D | 3 |
| 4.3 | Third strategy: JOSS | 3 |
| 4.4 | Fourth strategy: REPUTATION | 3 |
| 4.5 | Fifth strategy: 50/50 | 3 |
| 5 | Stag Hunt | 3 |
| 5.1 | Point overview | 3 |
| 5.2 | Results six strategies | 4 |
| 5.3 | First and last | 4 |
| 5.4 | Position comparison | 4 |
| | 5.4.1 REPUTATION | 4 |
| | 5.4.2 ALL-D | 4 |
| 6 | Tournament entry | 4 |

1 Implementation

1.1 Strategies

We implemented the following strategies:

- **ALL-D**: Always defect.
- **TIT-FOR-TAT**: When the opponent defected the last play, defect. Otherwise cooperate.
- **JOSS**: Like TIT-FOR-TAT, but once every ten plays automatically defect.
- **TESTER**: On the first run, defect. If the opponent retaliates consequently play TIT-FOR-TAT, if not, play a repeated sequence of cooperating two rounds, and then defecting the next round.
- **50/50**: Defect every other play.
- **REPUTATION**: If the opponent defects on most of his plays, defect. Otherwise cooperate.

1.2 Point overview

If both agents cooperate, both agents receive 3 points.

If one of the agents defects, the other agent receives 5 points.

If both agents defect, both agents receive 2 points.

2 1 vs 99

The average score of a TIT-FOR-TAT agent when playing alone versus 99 ALL-D agents will be nearly 2 (1,93) after 10.000 rounds. The ALL-D agents will average a score of 2 (2,00). This happens because on each first encounter the TIT-FOR-TAT agent will be betrayed by the ALL-D agents it is playing against. Then all agents, including the TIT-FOR-TAT agent, will always defect, gaining 2 points from every encounter.

3 TIT-FOR-TAT vs. ALL-D

When 50 TIT-FOR-TAT agents play against 50 ALL-D agents, the TIT-FOR-TAT are expected to approach a score of 2.5, while the ALL-D agents will reach an average score of 2.

This is because against ALL-D agents the TIT-FOR-TAT always defect after the first encounter, giving 2 points for both agents. The TIT-FOR-TAT agents amongst each other will however always cooperate, resulting in a score of 3 for both agents. The average score then is 2.5.

ALL-D will always defect, and only on the first run fool the TIT-FOR-TAT agents, thus gathering an average of 2 points on each play.

When tested this indeed is the result.

4 Best three strategies vs. TIT-FOR-TAT

4.1 six strategies

STRATEGY (average score)

ALL-D (2,66)

TIT-FOR-TAT (2,57)

JOSS (2,54)

REPUTATION (2,49)

50/50 (2,41)

TESTER (2,35)

4.2 Best strategy: ALL-D

TIT-FOR-TAT (2,46)

ALL-D (2,05)

TIT-FOR-TAT does better against ALL-D in a pair wise setting, as mentioned above.

4.3 Third strategy: JOSS

TIT-FOR-TAT (2,68)

JOSS (2,39)

TIT-FOR-TAT scores better against JOSS in a pair wise setting, because it will cooperate with JOSS until it defects, while JOSS will only receive bonuspoints from cooperating until it decides to defect.

4.4 Fourth strategy: REPUTATION

TIT-FOR-TAT (3,00)

REPUTATION (3,00)

TIT-FOR-TAT scores better in a pair wise setting, because both strategies will cooperate on every play.

4.5 Fifth strategy: 50/50

TIT-FOR-TAT (2,73)

50/50 (2,53)

TIT-FOR-TAT does better against 50/50, because amongst itself it will cooperate, and against 50/50 it will cooperate half of the time.

5 Stag Hunt

5.1 Point overview

If both agents cooperate, both agents receive 3 points.

If one of the agents defects, that agent receives 2 points.

If both agents defect, both agents receive 1 point.

5.2 Results six strategies

REPUTATION (2,15)
TIT-FOR-TAT (1,93)
JOSS (1,63)
TESTER (1,63)
50/50 (1,40)
ALL-D (1,22)

5.3 First and last

The best strategy for this game is REPUTATION, because it tends to cooperate with most of the other strategies.

The worst strategy for this game is ALL-D, because it never cooperates.

5.4 Position comparison

5.4.1 REPUTATION

REPUTATION scored fourth in the Prisoner's Dilemma, and highest in the Stag Hunt. The difference appears because it detects strategies that often defect and protects itself against those, but overall tends to cooperate. In the Prisoner's Dilemma the reward for betraying trust is much higher, making it easier for other strategies to gain the upperhand over REPUTATION.

5.4.2 ALL-D

Because most strategies try to cooperate, ALL-D scores very high in the Prisoner's Dilemma, because defecting when the other tries to cooperate gathers the highest point score. In the Stag Hunt however, cooperating will bring the best result possible, thus ALL-D will now give the worst average score.

6 Tournament entry

Our entry for the tournament is REPUTATION.