2-5-Exercise

2020年6月6日 星期六 下午2:41

2-5-Exercise

Example: Mixed Strategy Nash

Game Theory Course:
Jackson, Leyton-Brown & Shoham

Example - Soccer Penalty Kicks

- Mixed strategies in sports and competitive games

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- Mixed strategies in sports and competitive games
- Be unpredictable

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- Mixed strategies in sports and competitive games
- Be unpredictable
- How do equilibrium strategies adjust to skills?

kicks – goali (save)
quickly – simultaneous move game

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- Mixed strategies in sports and competitive games
- Be unpredictable
- How do equilibrium strategies adjust to skills?
- Should a kicker (who kicks penalty kicks) worse to the right than left kick more often to the left than right?

more often: R > L
L > R. worse.

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

Goalie ↓ (1/2, 1/2); Kickers → 1/2, 1/2

Kicker/Goalie	Left	Right
Left	0, 1	1, 0
Right	1, 0	0, 1

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

$q + 0.25(1-q) = 1-q$

$q = 3/7$

Goalie: p (4/7), $1-p$ (3/7); Kicker: q (3/7), $1-q$ (4/7)

Kicker/Goalie	Left	Right
Left	0, 1	1, 0
Right	.75, .25	0, 1

$1-p = 0.75p \Rightarrow 0.75p = 1-p$, $1.75p = 1$, $p = \frac{1}{1.75} = \frac{4}{7}$

kick often to weaker side — low prob of winning - kick right

kicker payoff change - Goalie payoff adjust

→ Goalie made adjustment - equilibrium adjust

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- In a mixed equilibrium, the goalie's strategy must have the kicker indifferent

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- In a mixed equilibrium, the goalie's strategy must have the kicker indifferent
- p probability goalie goes left; Kicker indifferent: $(1-p)1 = p.75$ or $p = 1/1.75 = 4/7$

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- In a mixed equilibrium, the goalie's strategy must have the kicker indifferent
- p probability goalie goes left; Kicker indifferent: $(1-p)1 = p.75$ or $p = 1/1.75 = 4/7$
- Goalie goes Left ~~more often~~ than Right (4/7 to 3/7), kicker ~~still goes Left and~~ Right ~~with equal probability~~ goes 4/7

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- In a mixed equilibrium, the goalie's strategy must have the kicker indifferent
- p probability goalie goes left; Kicker indifferent: $(1-p)1 = p.75$ or $p = 1/1.75 = 4/7$
- Goalie goes Left more often than Right (4/7 to 3/7), kicker still goes Left and Right with equal probability
- Goalie's strategy adjusts, and the kicker actually adjusts to kick more to their weak side!

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- The Goalie has a slight advantage now, and wins $4/7$ of the time

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- The Goalie has a slight advantage now, and wins $4/7$ of the time
- If the goalie still played equal probability, then the kicker could always go left and win 1/2 the time instead of 3/7

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Example - Soccer Penalty Kicks

- The Goalie has a slight advantage now, and wins $4/7$ of the time
- If the goalie still played equal probability, then the kicker could always go left and win 1/2 the time instead of 3/7
- By adjusting the strategy to keep the kicker indifferent, the Goalie takes advantage of the kicker's weak right kick and wins more often!

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash

Summary - Mixed Strategies - Soccer Penalty Kicks

- A players must be indifferent between the actions he or she randomizes over
- Interesting comparative statics
- Do players really do this?!

Game Theory Course: Jackson, Leyton-Brown & Shoham — Example: Mixed Strategy Nash