A Stay-in-a-Set Game without a Stationary Equilibrium

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Setting

- Turn-based (perfect information)
- Finite
- Stochastic
- Independent safety goals

Secchi, Sudderth 2002

Exact Nash equilibrium exists with bounded memory

Remember who has lost

Existence proof: overview

Induction

1 player: Markov decision process

Arbitrary positional strategy for each player *in case of loss*

Uniform bound on time until someone loses or loss becomes impossible

Payoffs at that point: by inductive assumption (or obvious)

Question

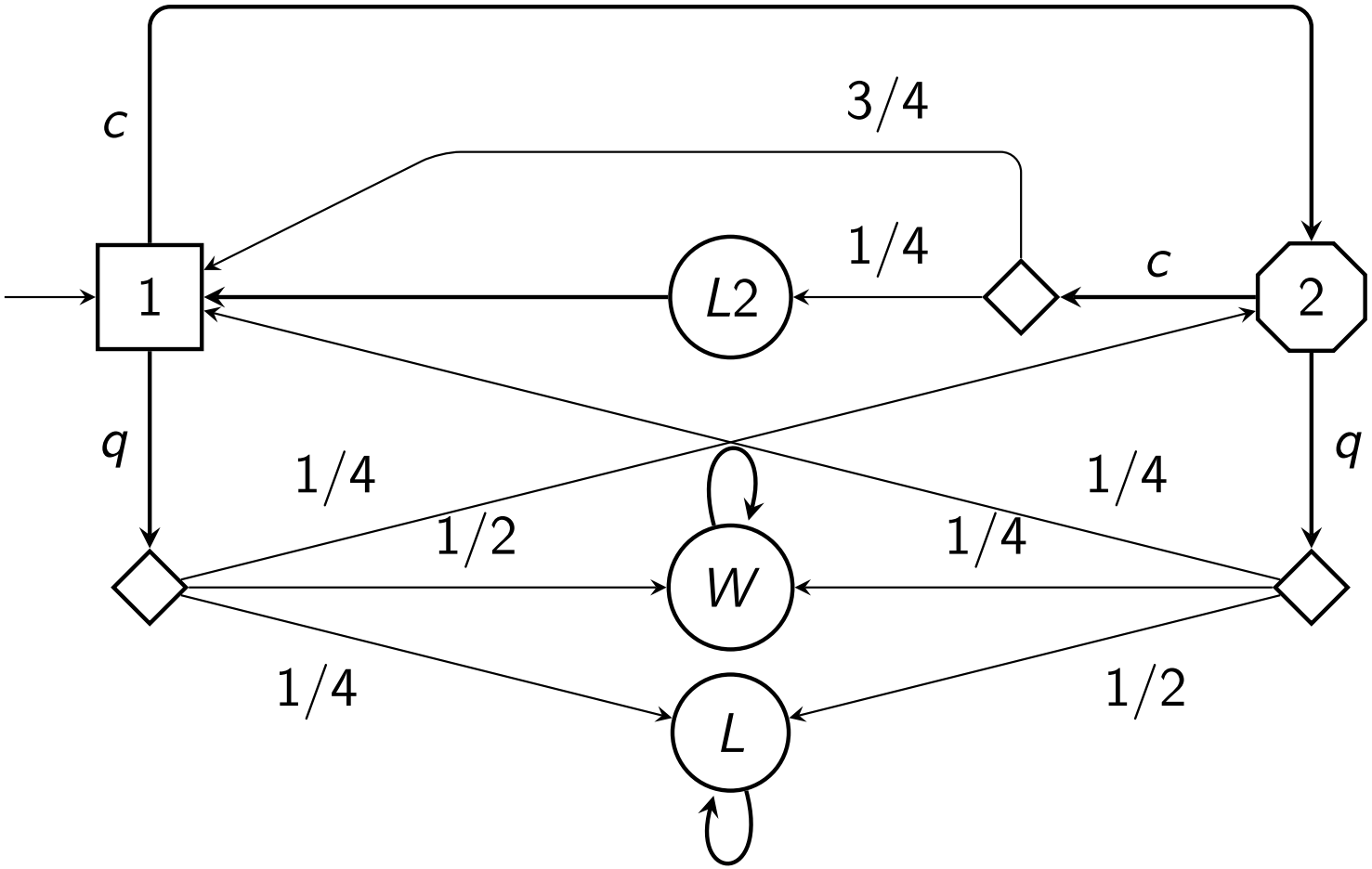
For 2 players, is there always **zero** memory Nash equilibrium (instead of 2 bits of memory)?

(i.e. equilibrium in stationary strategies)

Similar questions

Discounted payoffs: stationary equilibrium
Deterministic game: stationary equilibrium
Recursive/imperfect information games: no stationary ε-Nash equilibrium

Example without stationary equilibrium



Example without stationary equilibrium: incentives

If cycle is left, both P1 and P2 prefer that P1 leaves
For P1 best case is staying
For P2 staying means loss

Note that ε-equilibrium exists

Open questions

(for two players)

Stationary ε-equilibrium?
Stationary equilibrium for reachability conditions?
Stationary equilibrium for deterministic recursive games with reachability conditions?

Thanks for your attention!

Questions?

Summary

Discounted payoffs: stationary equilibrium
Deterministic game: stationary equilibrium
Recursive/imperfect information games: no stationary ε-Nash equilibrium

Two-player turn-based stay-in-a-set game: no stationary equilibrium

Stationary ε-equilibrium?
Stationary equilibrium for reachability conditions?
Stationary equilibrium for deterministic recursive games with reachability conditions?