Why

We want to discuss interactive decision making.

Discussion

We are interested in talking about situations in which there are several *decision makers*, *agents* or *players*, each of which are making decisions that will affect the outcome for all involved.

Example: rock paper scissors

Consider the game "rock-paper-scissors" in which there are two players A and B. Each player may choose one of the three actions Rock, Paper, Scissors. To play, each player simultaneously selects an action, and these are compared. Here, both agents have the same actions.

Definition

There is a finite set of *players*, or *agents*, or *controllers*. Let $\mathcal{I}$ be a finite set with $|\mathcal{I}| = n$, the players.

In rock-paper-scissors, for example, $\mathcal{I} = \{A, B\}$. There, each player could pick one of the three actions. Define $\mathcal{A}_A = \mathcal{A}_B = \{$Rock, Paper, Scissors$\}$. We call $\mathcal{A}_A$ the actions of A and $\mathcal{A}_B$ the actions of B.

We have a set of outcomes $\mathcal{O} = \{$A Wins, B Wins, Tie$\}$. Let $f : \mathcal{A}_A \times C_B \to \mathcal{O}$ defined by $f(\text{Rock, Scissors}) = $A Wins

The set of *players*. Let S be a finite set, the set of *states*. For $i = 1, \ldots, n$, let $\{A_s^p\}_{s \in S}$ be a family of sets, the *action sets by state*. Define $\mathcal{A}^i = \cup_s A_s^p$ the set of *actions* for player $i = 1, \ldots, n$.

Let $f : S \times \prod_i \mathcal{A}^i \to S$, the *game dynamics* or *transition function*.

Games

Arrays

Decisions

Lists

Set Numbers

Direct Products

Finite Sets

Orders

Equivalent Sets

Natural Order

Function Inverses

Family Unions and Intersections

Function Composites

Function Images

Families

Peano Axioms

Functions

Equivalence Relations

Relations

Natural Induction

Set Products

Uncertain Outcomes

Set Powers

Natural Numbers

Generalized Set Dualities

Partitions

Unordered Triples

Intersection of Empty Set

Successor Sets

Set Dualities

Set Unions and Intersections

Ordered Pairs

Set Intersections

Pair Unions

Set Complements

Set Unions

Set Differences

Pair Intersections

Unordered Pairs

Empty Set

Set Specification

Set Equality

Set Inclusion

Deductions

Quantified Statements

Logical Statements

Statements

Identities

Sets

Names

Letters

Objects