Why

We want to discuss interactive decision making.

Example: rock paper scissors

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.

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 the game, each player simultaneously selects an action, and these are compared.

So far we have a set of *players* or *agents* $P = \{A, B\}$ and a set of actions $\{\text{Rock}, \text{Paper}, \text{Scissors}\}$. In this case, both agents have the same set of actions, but they need not.

Example: tic-tac-toe

Consider the game "tic-tac-toe" in which there are two players. Denote the players by X and O. The game starts with an empty 3×3 array, which the players proceed to "fill."

Player O starts and selects a cell in which to "mark her move." From then on, that cell is "occupied," Second, it is player X's turn to pick a cell, any one that is not already occupied. The play proceeds until either all cells are occupied or one of the player has three cells in a row, horizontally, vertically, or diagonally.

1 Definition

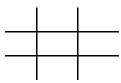
In both these games there is a finite set of *players*, or *agents*, or *controllers*. Let $\mathcal{I}$ be a finite set with $|\mathcal{I}| = n$, the players.

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

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

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*.

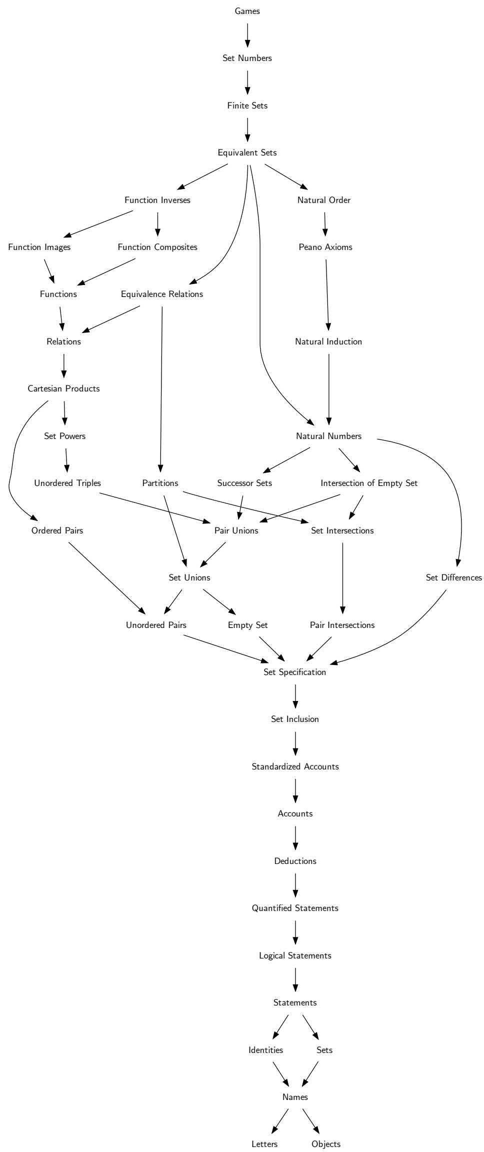


Definition

The first thing to discuss is the set of players. Let P be a finite set with $|P| = n$. The set P is the set of players, and we

We begin with a single-player game.

Let S be a set.


Games
Set Numbers
Finite Sets
Equivalent Sets
Function Inverses
Natural Order
Function Images
Function Composites
Peano Axioms
Functions
Equivalence Relations
Relations
Natural Induction
Cartesian Products
Set Powers
Natural Numbers
Unordered Triples
Partitions
Successor Sets
Intersection of Empty Set
Ordered Pairs
Pair Unions
Set Intersections
Set Unions
Set Differences
Unordered Pairs
Empty Set
Pair Intersections
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects