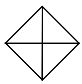


Why

We want to model natural phenomena.[1]

Definition

Let $X_0, X_1, \dots, X_T$ be a sequence of sets and let $f_t : X_t \to X_{t+1}$ for $t = 0, \dots, T-1$. We call $((X_0, \dots, X_T), (f_1, \dots, f_{T-1}))$ a *deterministic discrete-time dynamical system.*

We call the index t the *epoch*, the *stage* or the *period.* We call X_t the *state space* at period t. We call f_t the *transition function* or *dynamics function.*

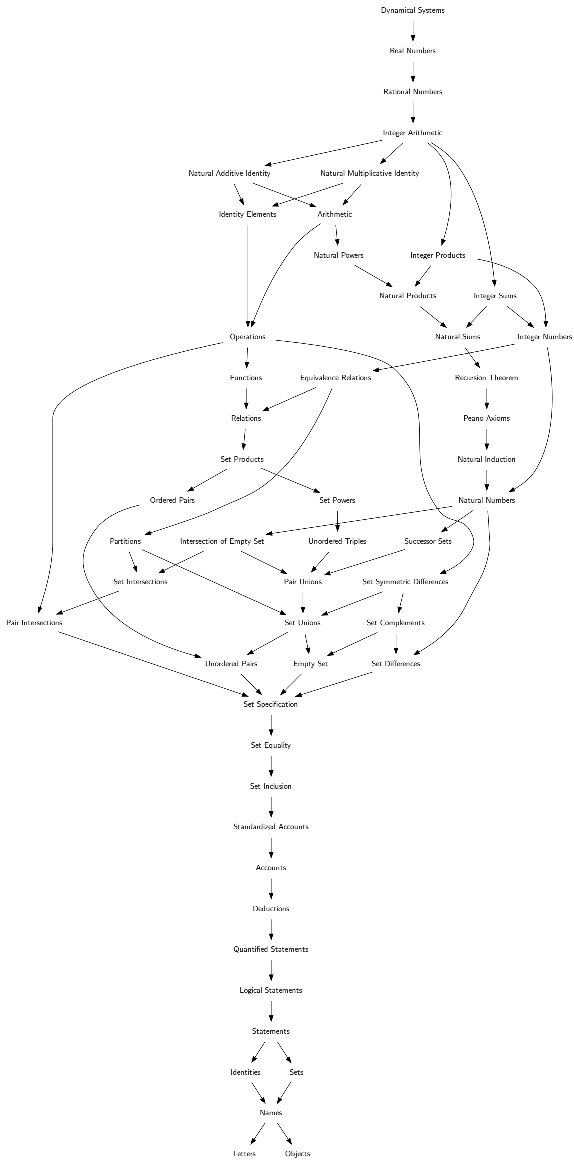
Let $x_0 \in \mathcal{X}_0$. Define a state sequence $x_1 \in \mathcal{X}_1, \dots, x_T \in \mathcal{X}_T$ by

$$x_{t+1} = f_t(x_t, u_t).$$

In this case we call x_0 the *initial state.* We call the x_t the *trajectory* associatd with initial state x_0.

We call T the *horizon.* In the case that we have an infinite sequence of state sets, input sets, and dynamics, then we refer to a *infinite-horizon* dynamical system. To use language in contrast with this case, we refer to the dynamical system when T is finite as a *finite-horizon* dynamical system.

[1] Future editions will modify, and may develop dynamic systems via the genetic approach by appealing to their classical use in Newtonian physics for modeling celestial mechanics.


Dynamical Systems
Real Numbers
Rational Numbers
Integer Arithmetic
Natural Additive Identity
Natural Multiplicative Identity
Identity Elements
Arithmetic
Natural Powers
Integer Products
Natural Products
Integer Sums
Operations
Natural Sums
Integer Numbers
Functions
Equivalence Relations
Recursion Theorem
Relations
Peano Axioms
Set Products
Natural Induction
Ordered Pairs
Set Powers
Natural Numbers
Partitions
Intersection of Empty Set
Unordered Triples
Successor Sets
Set Intersections
Pair Unions
Set Symmetric Differences
Pair Intersections
Set Unions
Set Complements
Unordered Pairs
Empty Set
Set Differences
Set Specification
Set Equality
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects