## Definition

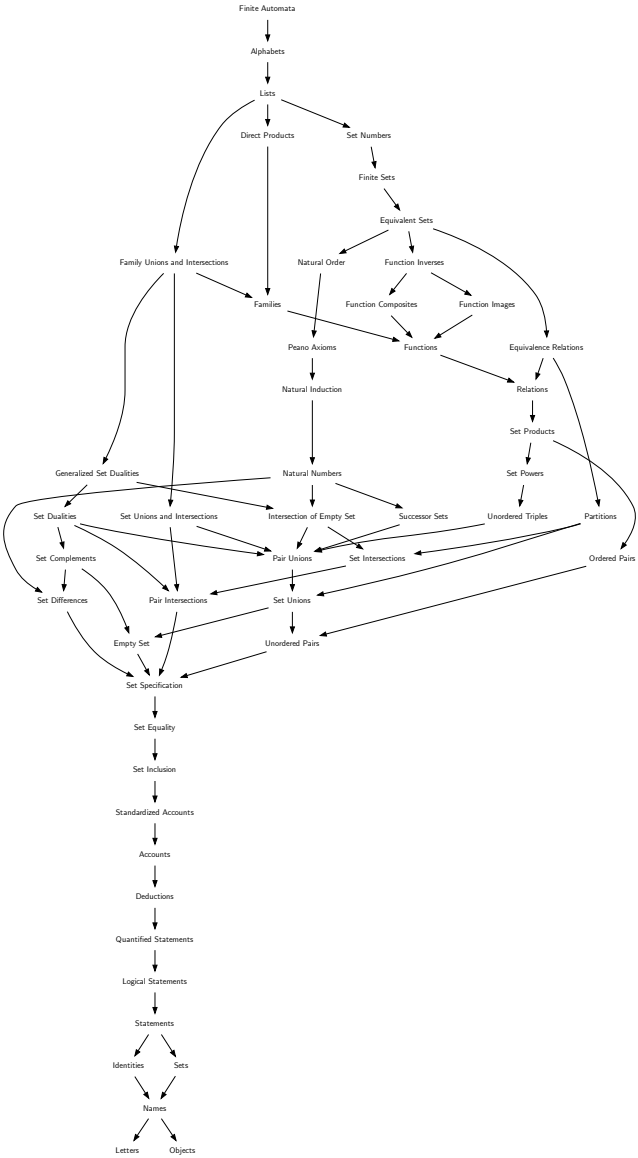
A *finite automaton* (or *machine*, *deterministic finite automaton*) $M = (Q, \Sigma, \delta, q_0, F)$ is a list where $Q$ and $\Sigma$ is are finite sets (alphabets), $\delta : Q \times \Sigma \to Q$, $q_0 \in Q$ and $F \subset Q$.

We call $Q$ the *states*, $\Sigma$ the *alphabet*, $\delta$ the *transition function*, $q_0$ the *start state* (*initial state*), and $F$ the *accept states* (or *final states*). An input $u \in \mathsf{str}(\Sigma)$ results in a state sequence $x \in \mathsf{str}(Q)$ with $x_1 = q_0$ and $x_{i+1} = \delta(x_i, u_i)$ for $i = 1, \ldots, |u|$. $M$ *accepts* $x$ if $x_{|x|+1} \in F$. The set of all strings that $M$ accepts is the *language* of the machine $M$. We say that $M$ *recognizes* or *accepts* this set. Although a language may accept many different strings, it only ever accepts one language. For example, if the machine accepts no strings, then it accepts the language $\varnothing$.

A $L \subset \mathsf{str}(\Sigma)$ is called *regular* if there exists a finite automaton that recognizes it.

### Example

Define $Q = \{q_1, q_2, q_3\}$, $\Sigma = \{0, 1\}$, define $\delta : Q \times \Sigma \to Q$ by $\delta(q$


Finite Automata
Alphabets
Lists
Direct Products
Set Numbers
Finite Sets
Equivalent Sets
Family Unions and Intersections
Natural Order
Function Inverses
Families
Function Composites
Function Images
Peano Axioms
Functions
Equivalence Relations
Natural Induction
Relations
Set Products
Generalized Set Dualities
Natural Numbers
Set Powers
Set Dualities
Set Unions and Intersections
Intersection of Empty Set
Successor Sets
Unordered Triples
Partitions
Set Complements
Pair Unions
Set Intersections
Ordered Pairs
Set Differences
Pair Intersections
Set Unions
Empty Set
Unordered Pairs
Set Specification
Set Equality
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects