Why

Let $X = \{a, b\}$ and $Y = \{0, 1\}$. Define $f : X \to Y$ by $f \equiv 0$.

Consider "selecting" elements of X so to determine f. Since f is functional, the program is straightforward. Observe f at a and at b, and then any consistent inductor will determine f.

So, in some sense, the dataset $((a, 0), (b, 0))$ is "good" in that "reasonable" learning algorithms (those which are consistent) will determine f from a dataset consistent with f. What of more general domains X?

Definition

Let X and Y be sets. Let $\{G_n : (X \times Y)^n \to (X \to Y)\}_{n \in \mathbf{N}}$ be a family of inductors.

An *input design* (or *experiment design* or *experimental design*) of size n is a sequence of inputs $x_1, \ldots, x_n \in X$. The interpretation is that we will observe a dataset $(x_1, y_1), \ldots, (x_n, y_n)$ consistent with some function and that we will "infer" the function $G((x_i, y_i)_{i=1}^n)$.

Some authors define a design as a sequence $x_1, \ldots, x_\ell$ and nonzero integers $n_1, \ldots, n_\ell$ so that $\sum_{i \leq \ell} n_i = n$. The correspondence with our definition is obvious.

A *conditional input design* (of size k) for a dataset $(x_1, y_1), \ldots, (x_m, y_m)$ is a design $x_{m+1}, \ldots, x_{m+k} \in X$. The interpretation is that we will observe a dataset $(x_1, y_1), \ldots, (x_{m+k}, y_{m+k})$ consistent with some function and that we will "infer" the function $G((x_i, y_i)_{i=1}^{m+k})$.

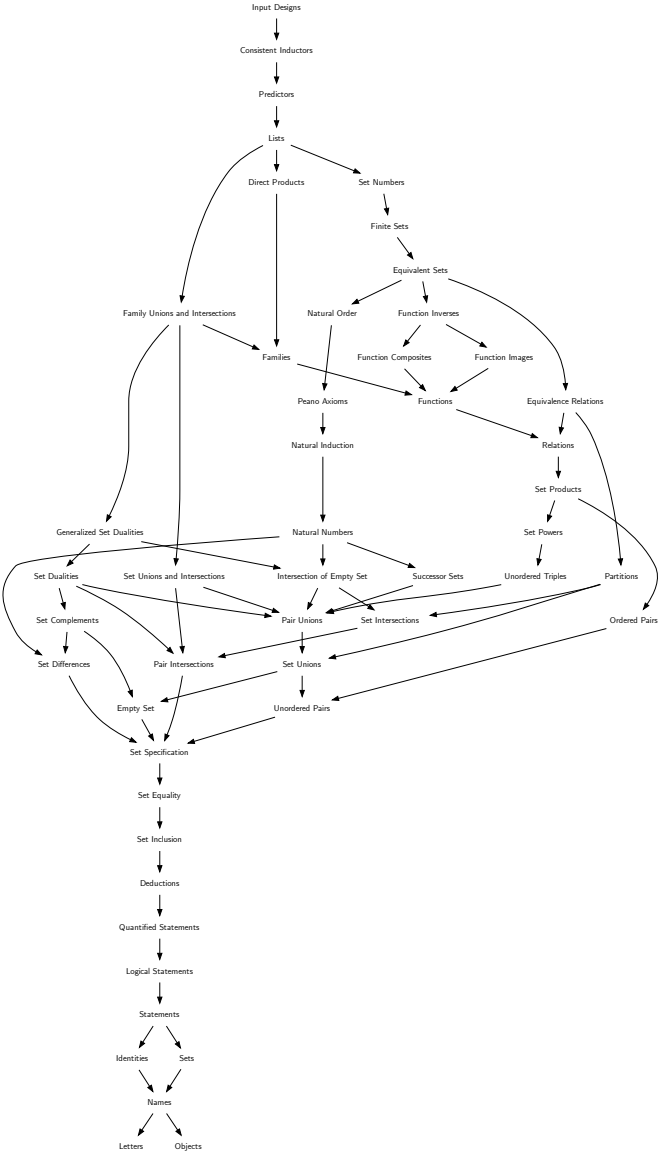
For both of these designs, our interpretation of these objects is "experimental." We call $x \in X$ the *experimental conditions* and we call X the *experimental domain*. We think of "choosing" a design and then "running an experiment" or "collecting data." The experimental conditions are understood to be freely chosen (within the domain X). We call an element of the dataset y_i an *observed response* or *yield*.

Parametrically consistent datasets

Let $f : X \to Y$ and suppose the dataset is consistent with f. Let Θ be a nonempty set. Suppose there exists $\theta^\star \in \Theta$ and $g : \Theta \times X \to Y$ so that $g(\theta^*, x) = f(x)$ for all $x \in X$ (and so denote f by $g_{\theta^\star} : X \to Y$).

In this case we call θ the *parameters* or *parameter system* and we call Θ the *parameter domain* (or *parameter space*). We call the dataset *parametrically consistent*.

This decomposition (θ, x) is interpreted as reflecting what is within and without of the experimenter's control. The conditions can be chosen by the experimenters, but the parameters are fixed, or "chosen by nature." The experimenter "controls" the conditions and nature "controls" the parameters.


Input Designs
Consistent Inductors
Predictors
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
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects