Why

We want to visualize the probabilistic relations between components of outcomes in probabilistic models over large (e.g., product) outcome sets.[1]

Definition

Let $A = \prod_i A_i$. For $x \in A$ and $S \subset \{1, \ldots, n\}$, denote the subvector of x indexed (in order) by S by x_S.[2]

A distribution $p : A \to [0, 1]$ *factors according to a directed graph* on $\{0, 1\}$ with parent function $\mathrm{pa} : \{1, \ldots, n\} \to \mathcal{P}(\{1, \ldots, n\})$ if

$$p(x) = \prod_{\mathrm{pa}_i = \varnothing} g_i(x_i) \prod_{\mathrm{pa}_i \neq \varnothing} g_i(x_i, x_{\mathrm{pa}_i}),$$

where g_i is a distribution for all i which $\mathrm{pa}_i = \varnothing$ and $g_i(\cdot, \xi)$ is a distribution for all $\xi \in \prod_{j \in \mathrm{pa}_i} A_j$, i for which $\mathrm{pa}_i \neq \varnothing$.

Proposition 1. *p so defined is a distribution, and the g_i are the marginals and conditionals.*[3]

[1] Future editions will modify and expand. The title of the sheet may change, since another interpretation for the words "directed graph distribution" is a distribution on directed graphs.

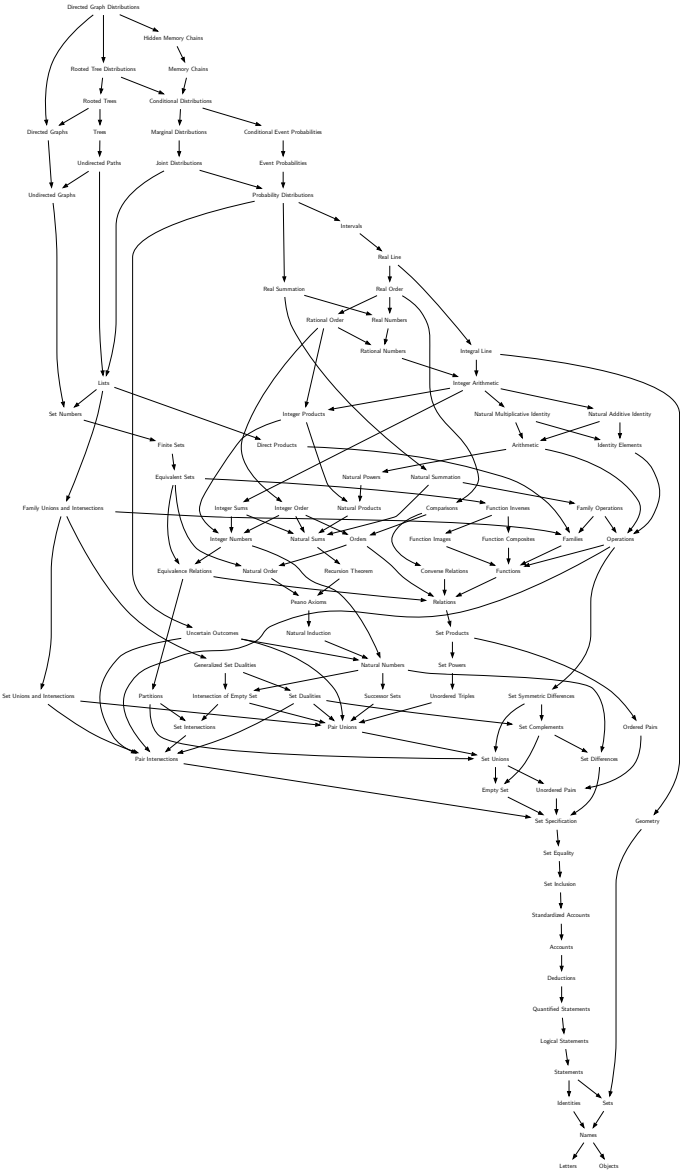
[2] Future editions will rework this treatment, perhaps combining it with the sheet Index Matrices, which will possibly be split up.

[3] Future editions will be precise and give an account.

Examples

Consider a rooted tree distribution (see Rooted Tree Distributions), or a memory chain (see Memory Chains), or a hidden memory chain (see Hidden Memory Chains).[4]

[4]Future editions will expand.


Directed Graph Distributions
Hidden Memory Chains
Rooted Tree Distributions
Memory Chains
Rooted Trees
Conditional Distributions
Directed Graphs
Trees
Marginal Distributions
Conditional Event Probabilities
Undirected Paths
Joint Distributions
Event Probabilities
Undirected Graphs
Probability Distributions
Intervals
Real Line
Real Summation
Real Order
Rational Order
Real Numbers
Rational Numbers
Integral Line
Lists
Integer Arithmetic
Set Numbers
Integer Products
Natural Multiplicative Identity
Natural Additive Identity
Finite Sets
Direct Products
Arithmetic
Identity Elements
Equivalent Sets
Natural Powers
Natural Summation
Family Unions and Intersections
Integer Sums
Integer Order
Natural Products
Comparisons
Function Inverses
Family Operations
Integer Numbers
Natural Sums
Orders
Function Images
Function Composites
Families
Operations
Equivalence Relations
Natural Order
Recursion Theorem
Convene Relations
Functions
Peano Axioms
Relations
Uncertain Outcomes
Natural Induction
Set Products
Generalized Set Dualities
Natural Numbers
Set Powers
Set Unions and Intersections
Partitions
Intersection of Empty Set
Set Dualities
Successor Sets
Unordered Triples
Set Symmetric Differences
Set Intersections
Pair Unions
Set Complements
Ordered Pairs
Pair Intersections
Set Unions
Set Differences
Empty Set
Unordered Pairs
Set Specification
Geometry
Set Equality
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects