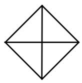


Why

How do we get a joint probability distribution function from marginals?[1]

Definition

The *product distribution* of a sequence $p_1, \dots, p_n : A_i \to [0,1]$ of distributions is the function $p : \prod_i A_i \to [0,1]$ defined by

$$p(x) = \prod_{i=1}^{n} p_i(x_i).$$

Proposition 1. *Let $p_i : A_i \to [0,1]$ be probability distributions. Then the product distribution of $p_1, \dots, p_n$ is a probability distribution with marginals $p_1, \dots, p_n$.*[2]

Example: fair coin repeated flips

Suppose we want to model a coin flipped n times. Supposing the coin is fair (see Probability Distributions) we might use our probability distribution $p : \{0,1\} \to [0,1]$ which assigned $p(0) = p(1) = 1/2$. Then the probability of obtaining a sequence of flips $x \in \{0,1\}$ is

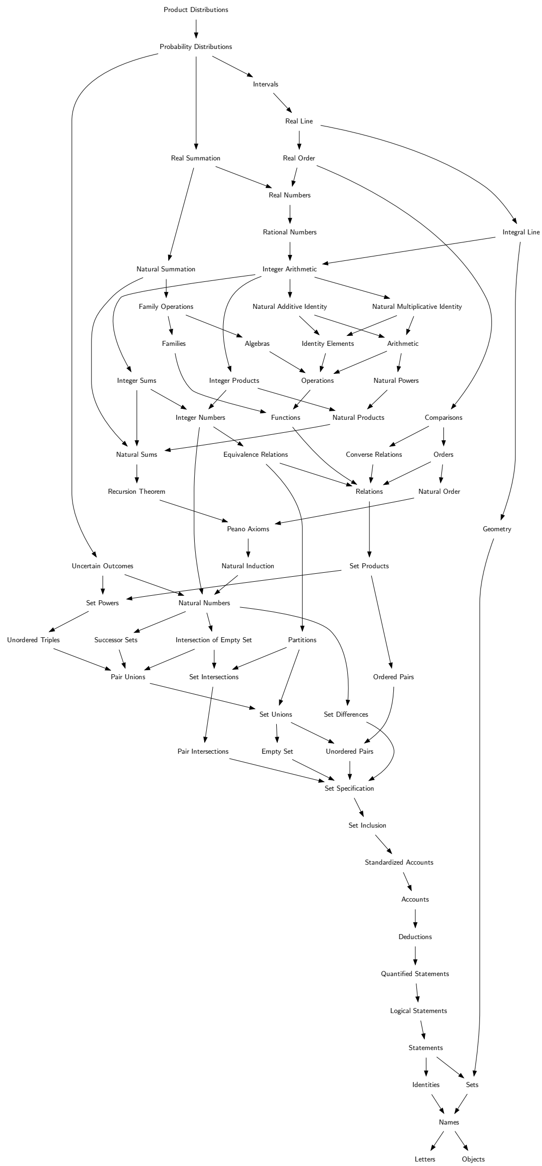
$$p(x) = \prod_{x_i=1} p_i(1) \prod_{x_i=0} p_i(0).$$

[1] Future editions will modify.

[2] Future editions will include.

Notice that if we know $p_i(1) = \rho_i$, then we know $p(0) = (1 - \rho_i)$ and so we can write the above as

$$p(x) = \prod_{x_i=1} \rho_i \prod_{x_i=0} (1 - \rho_i).$$


Product Distributions
Probability Distributions
Intervals
Real Line
Real Summation
Real Order
Real Numbers
Rational Numbers
Integral Line
Natural Summation
Integer Arithmetic
Family Operations
Natural Additive Identity
Natural Multiplicative Identity
Families
Algebras
Identity Elements
Arithmetic
Integer Sums
Integer Products
Operations
Natural Powers
Integer Numbers
Functions
Natural Products
Comparisons
Natural Sums
Equivalence Relations
Converse Relations
Orders
Recursion Theorem
Relations
Natural Order
Peano Axioms
Geometry
Uncertain Outcomes
Natural Induction
Set Products
Set Powers
Natural Numbers
Unordered Triples
Successor Sets
Intersection of Empty Set
Partitions
Pair Unions
Set Intersections
Ordered Pairs
Set Unions
Set Differences
Pair Intersections
Empty Set
Unordered Pairs
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects