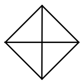


Why

[1]

Definition

Let $A \in \mathbf{R}^{n \times n}$ be real symmetric. An *lower upper triangular decomposition* A is a matrix $L \in \mathbf{R}^{n \times n}$ that is lower triangular and satisfies

$$A = LL^\top.$$

Other terminology includes *lower triangular factorization*, *LU decomposition*, *LU factorization*, and (most universally) *Cholesky decomposition* or *Cholesky factorization.*

Basic properties

Proposition 1. *Let $A \in \mathbf{R}^{m \times m}$ be positive definite. Then there exists unique lower triangular matrix $L \in \mathbf{R}^{n \times n}$ so that*

$$A = LL^\top.$$

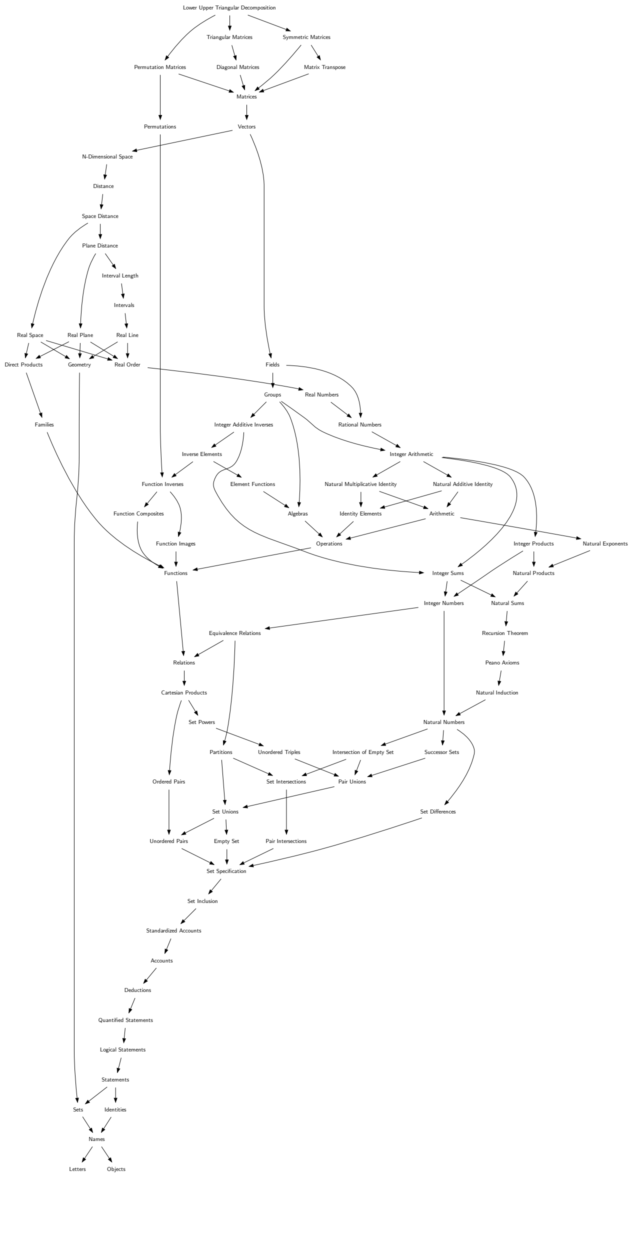
In other words, the Cholesky decomposition exists and is unique when the matrix A is positive definite.

Proposition 2. *If A is positive semisemidefinite, there exists a permutation matrix P for which there is a unique L so that*

$$P^\top AP = LL^\top.$$

[1]Future editions will include.

This second proposition says that there is a unique Cholesky decomposition for a particular permutation (or pivoting) of A.


Lower Upper Triangular Decomposition
Triangular Matrices
Symmetric Matrices
Permutation Matrices
Diagonal Matrices
Matrix Transpose
Matrices
Permutations
Vectors
N-Dimensional Space
Distance
Space Distance
Plane Distance
Interval Length
Intervals
Real Space
Real Plane
Real Line
Direct Products
Geometry
Real Order
Fields
Groups
Real Numbers
Families
Integer Additive Inverses
Rational Numbers
Inverse Elements
Integer Arithmetic
Function Inverses
Element Functions
Natural Multiplicative Identity
Natural Additive Identity
Function Composites
Algebras
Identity Elements
Arithmetic
Function Images
Operations
Integer Products
Natural Exponents
Functions
Integer Sums
Natural Products
Integer Numbers
Natural Sums
Equivalence Relations
Recursion Theorem
Relations
Peano Axioms
Cartesian Products
Natural Induction
Set Powers
Natural Numbers
Partitions
Unordered Triples
Intersection of Empty Set
Successor Sets
Ordered Pairs
Set Intersections
Pair Unions
Set Unions
Set Differences
Unordered Pairs
Empty Set
Pair Intersections
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Sets
Identities
Names
Letters
Objects