Why

Often we care about multiple criteria at once.[1]

Definition

A *multiobjective optimization problem* is a pair $(X, f : X \to \mathbf{R}^d)$. As before, X is the *constraint set* and f is called the *objective function*. Since f is vector valued, and there is no natural order on $\mathbf{R}^d$, there may exist $x \in X$ with non-comparable images under f.

Scalarization

The $\alpha \in \mathbf{R}^d$ *scalarization* of a multiobjective optimization problem (X, f) is the optimization problem (X, g) where $g : X \to \mathbf{R}$ is defined by $g(x) = \alpha^\top f(x)$. We call g the *scalarized objective*.

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[1]Future editions will modify.

A diagram (directed concept graph) of mathematical concepts with the following node labels:

Multiobjective Optimization Problems · Combined Orders · Matrix Transpose · Multivariable Functions · Vectors as Matrices · Real Inner Product · Real Norm · Real Matrices · Linear Equations · Optimization Problems · N-Dimensional Space · Space Inner Product · Space Norm · Real Vectors · Linear Functions · Arrays · Extended Real Numbers · Right Triangle Sides Relation · Plane Inner Product · Space Vectors · Plane Vector Sums and Differences · Optimizers · Distance · Plane Norm · Real Squares · Real Limits · Space Distance · Plane Vectors · Real Arithmetic · Absolute Value · Real Multiplication Inverses · Plane Distance · Interval Length · Real Functions · Intervals · Real Products · Real Space · Greatest Lower Bounds · Square Numbers · Real Addition Inverses · Real Sequence · Real Plane · Real Summation · Natural Summation · Squares · Real Line · Real Order · Natural Arithmetic · Real Sums · Rational Multiplicative Inverses · Sequences · Geometry · Integral Line · Rational Order · Rational Sums · Real Number · Natural Products · Set Numbers · Direct Products · Integer Order · Comparison · Rational Numbers · Finite Sets · Orders · Integer Product · Natural Addition Identity · Natural Multiplication Identity · Natural Functions · Income Elements · Natural Equations · Equivalent Sets · Family Operations · Family Unions and Intersections · Integer Sum · Identity Elements · Natural Arithmetic · Element Functions · Function Inverses · Equations · Function Images · Function Composites · Functions · Natural Powers · Integer Numbers · Operations · Natural Order · Natural Products · Concrete Relations · Equivalence Relations · Natural Sums · Relations · Recursion Theorem · Pluses Axioms · Ordered Pair Projections · Natural Induction · Set Products · Generalized Set Dualities · Natural Numbers · Set Powers · Successor Sets · Unordered Triples · Set Dualities · Intersection of Empty Set · Partitions · Set Unions and Intersections · Set Symmetric Differences · Ordered Pairs · Set Complements · Pair Unions · Pair Intersections · Set Intersections · Set Differences · Set Unions · Unordered Pairs · Empty Set · Set Specification · Set Equality · Set Inclusion · Deductions · Quantified Statements · Logical Statements · Statements · Sets · Identities · Names · Letters · Objects