Definition

An optimization problem is (X, f) is an *inequality constrained space optimization problem* if $X \subset \mathbf{R}^n$, $f : \mathbf{R}^n \to \mathbf{R}$, and there exists $g : \mathbf{R}^n \to \mathbf{R}^m$ so that

$$X = \{x \in \mathbf{R}^n \mid g(x) \leq 0\}$$

For this reason, (f, g) is sometimes called the *problem data* (*abstract problem data*) of the problem.

Notation

We often write such problems as: given $f : \mathbf{R}^n \to \mathbf{R}$ and $g : \mathbf{R}^n \to \mathbf{R}^m$, find $x \in \mathbf{R}^n$ to

$$\begin{array}{rl} \text{minimize} & f(x) \\ \text{subject to} & g(x) \leq 0 \end{array}$$

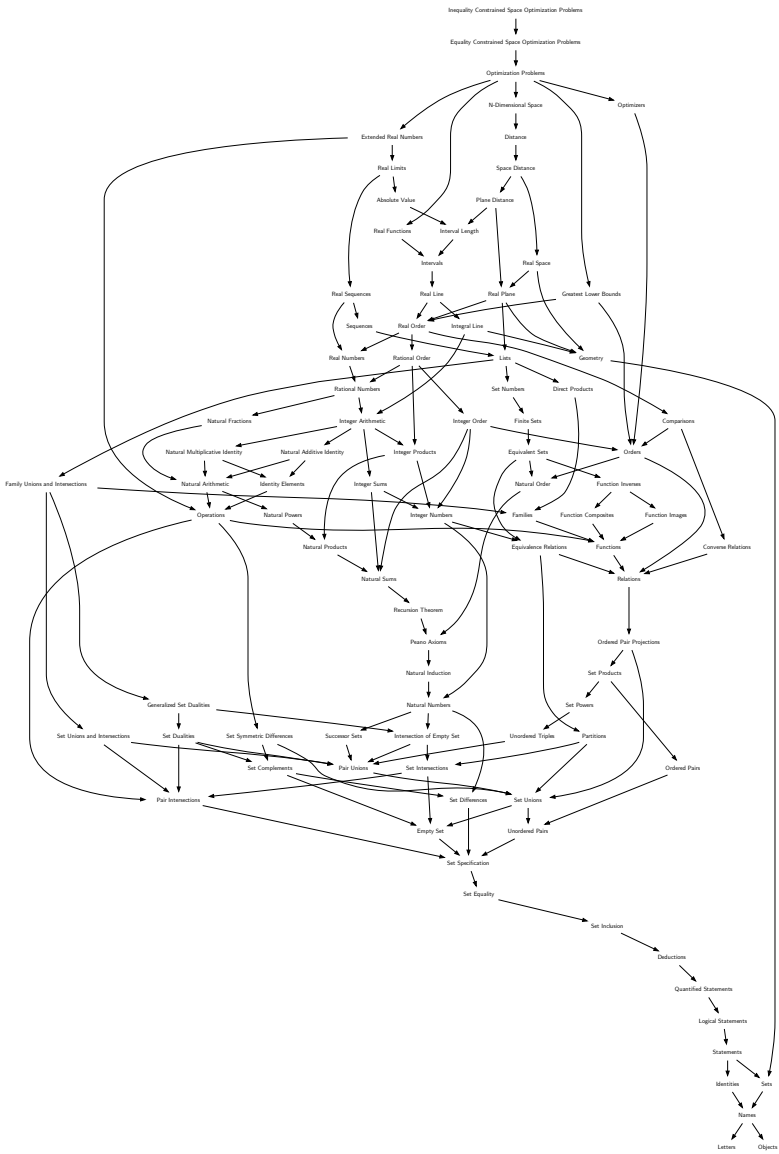
Some authors abbreviate inequality constrained space optimization problem as ICP.

Handles equality constraints

Suppose $f : \mathbf{R}^n \to \mathbf{R}$ and $h : \mathbf{R}^n \to \mathbf{R}^m$ are the (abstract) problem data for an *equality* constrained space optimization problem. Define $g : \mathbf{R}^n \to \mathbf{R}^{2m}$ so that

$$g(x) = (h(x), -h(x)) \quad \text{for all } x \in \mathbf{R}^n$$

Then the ECP (f, h) and ICP (f, g) have the same feasible set and optimal solutions. In other words, given an equality constrained problem we can always write it as an inequality constrained problem.


Inequality Constrained Space Optimization Problems
Equality Constrained Space Optimization Problems
Optimization Problems
N-Dimensional Space
Optimizers
Extended Real Numbers
Distance
Real Limits
Space Distance
Absolute Value
Plane Distance
Real Functions
Interval Length
Intervals
Real Space
Real Sequences
Real Line
Real Plane
Greatest Lower Bounds
Sequences
Real Order
Integral Line
Real Numbers
Rational Order
Lists
Geometry
Rational Numbers
Set Numbers
Direct Products
Natural Fractions
Integer Arithmetic
Integer Order
Finite Sets
Comparisons
Natural Multiplicative Identity
Natural Additive Identity
Integer Products
Equivalent Sets
Orders
Family Unions and Intersections
Natural Arithmetic
Identity Elements
Integer Sums
Natural Order
Function Inverses
Operations
Natural Powers
Integer Numbers
Families
Function Composites
Function Images
Natural Products
Equivalence Relations
Functions
Converse Relations
Natural Sums
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Recursion Theorem
Peano Axioms
Ordered Pair Projections
Natural Induction
Set Products
Generalized Set Dualities
Natural Numbers
Set Powers
Set Unions and Intersections
Set Dualities
Set Symmetric Differences
Successor Sets
Intersection of Empty Set
Unordered Triples
Partitions
Set Complements
Pair Unions
Set Intersections
Ordered Pairs
Pair Intersections
Set Differences
Set Unions
Empty Set
Unordered Pairs
Set Specification
Set Equality
Set Inclusion
Deductions
Quantified Statements
Logical Statements
Statements
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