Why

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Definition

Suppose we want to find the shortest path on a weighted graph from a given starting vertex to a given terminal vertex.

Let $((V, E), w : E \to \mathbf{R})$ be a weighted directed graph. Let v be a source and w be a sink. Let $\mathcal{X}$ denote the set of (directed) paths from v to w. Let $f : \mathcal{X} \to \mathbf{R}$ be so that if $x \in X$ is a path from v to w, then $f(x)$ is the weight of the path. In other words, $f(x)$ is the sum of weights on the edges. Then we call the problem $(\mathcal{X}, f)$ a *directed shortest path problem.*

Examples

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[1]Future editions will include. For now this is an example of a discrete optimization problem.

[2]Future editions will include the numerous examples.

Directed Shortest Path Problems

Directed Paths — Optimization Problems — Weighted Graphs

Directed Graphs

N-Dimensional Space

Distance — Extended Real Numbers

Real Functions — Space Distance — Real Limits

Undirected Graphs — Plane Distance — Absolute Value

Optimizers — Interval Length

Intervals — Real Space

Greatest Lower Bounds — Real Line — Real Plane — Real Sequences

Real Order — Sequences — Integral Line — Geometry — Real Numbers

Lists — Rational Order

Set Numbers — Direct Products — Rational Numbers

Comparisons — Finite Sets — Integer Order — Integer Arithmetic

Orders — Equivalent Sets — Integer Products — Natural Additive Identity — Natural Multiplicative Identity

Natural Order — Function Inverses — Integer Sums — Family Unions and Intersections — Arithmetic — Identity Elements

Function Images — Function Composites — Families — Integer Numbers — Natural Powers — Operations

Converse Relations — Functions — Equivalence Relations — Natural Products

Relations — Natural Sums

Ordered Pair Projections — Recursion Theorem

Set Products — Peano Axioms

Set Powers — Natural Induction

Partitions — Unordered Triples — Natural Numbers — Generalized Set Dualities

Ordered Pairs — Intersection of Empty Set — Successor Sets — Set Unions and Intersections — Set Dualities — Set Symmetric Differences

Set Intersections — Pair Unions — Set Complements

Set Unions — Set Differences — Pair Intersections

Unordered Pairs — Empty Set

Set Specification

Set Equality

Set Inclusion

Deductions

Quantified Statements

Logical Statements

Statements

Identities — Sets

Names

Letters — Objects