

## DIRECTED SHORTEST PATH PROBLEMS

## 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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<sup>&</sup>lt;sup>1</sup>Future editions will include. For now this is an example of a discrete optimization problem.

<sup>&</sup>lt;sup>2</sup>Future editions will include the numerous examples.

