



## 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  $((V, E), w : E \rightarrow \mathbf{R})$  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  $f : \mathcal{X} \rightarrow \mathbf{R}$  be so that if  $x \in \mathcal{X}$  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>1</sup>Future editions will include. For now this is an example of a discrete optimization problem.

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



