

Example: Traffic Network

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Reference:

https://ampl.com/MEETINGS/TALKS/2013_08_Lisbon_Thu.A.23.pdf

Problem Definition

Given:

N Set of nodes representing intersections

e Entrance to network

f Exit from network

$A \subseteq N \cup \{e\} \times N \cup \{f\}$

Set of arcs representing road links

b_{ij} Base travel time for each road link $(i, j) \in A$

S_{ij} Traffic sensitivity for each road link $(i, j) \in A$

c_{ij} Capacity for each road link $(i, j) \in A$

T Desired throughput from e to f

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Formulation

Determine

x_{ij} Traffic flow through road link $(i,j) \in A$

t_{ij} Actual travel time on road link $(i,j) \in A$

to minimize

$$\sum_{(i,j) \in A} t_{ij} x_{ij} / T$$

Average travel time from e to f

Subject to

$$t_{ij} = b_{ij} + \frac{s_{ij} x_{ij}}{1 - x_{ij}/c_{ij}} \quad \text{for all } (i,j) \in A$$

Travel times increase as flow approaches capacity

$$\sum_{(i,j) \in A} x_{ij} = \sum_{(j,i) \in A} x_{ji} \quad \text{for all } i \in N$$

Flow out equals flow in at any intersection

$$\sum_{(e,j) \in A} x_{ej} = T$$

Flow into the entrance equals the specified throughput

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