Aalto-yliopisto
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Public transport revenue optimization under no-elongation and no-stopover restrictions

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Background

- Public transport companies want to estimate/maximize revenues.
- Optimal prices for routes can be determined by modeling customer behavior.
- Special interest in no-elongation and no-stopover properties.
- They produce more consistent fare system and reduce possibility for exploitation.

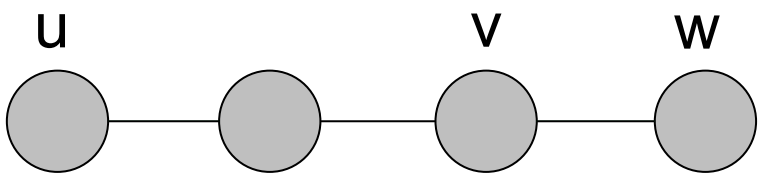
Objectives

- Formulate the problem and build a model
- Find optimal route prices for maximal revenue

Constraints

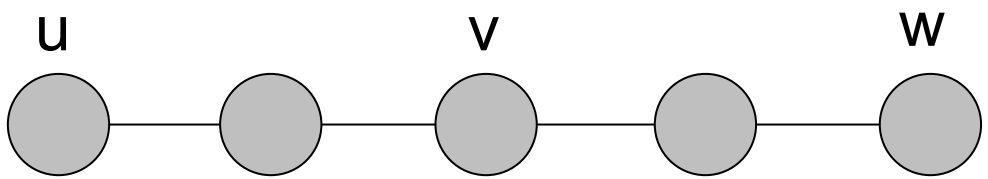
- No-elongation
- No-stopover
- At least B people need to be transported
- Groups have max prices they are willing to pay
- Simplified problem

No-elongation



$P(u,v) \leq P(u,w)$

No-stopover



$P(u,w) \leq P(u,v) + P(v,w)$

Every origin-destination pair i.e. $(u,v)\ \forall\ u,v \in V$ has a separate price

Problem formulation

$$
\begin{aligned}
(P): max & \sum_{u,v \in V} \sum_{i \in I} P(u,v) \cdot d_i(u,v) \cdot \delta_i(u,v) \\
s.t. & \sum_{u,v \in V} \sum_{i \in I} d_i(u,v) \cdot \delta_i(u,v) \geq B \\
& P(u,v) \leq P_i^{max}(u,v) + M \cdot (1 - \delta_i(u,v)) && \forall u,v \in V, \forall i \in I \\
& P(u,w) \leq P(u,v) + P(v,w) && \forall u,v,w \in V : (u,...,v),(v,...,w) \subseteq (u,...,w) \\
& P(u,v) \leq P(u,w) && \forall u,v,w \in V : (u,...,v) \subseteq (u,...,w) \\
& \delta_i(u,v) \in \{0,1\} && \forall u,v \in V, \forall i \in I \\
& P(u,v) \in \mathbb{R}_+ && \forall u,v \in V
\end{aligned}
\tag{1}
$$

Schedule

- 17/06/2024 Topic presentation
- 06-07/2024 Formulating the problem, building the model
- 07-08/2024 Writing the thesis
- 08/2024 Thesis presentation

Literature

- Anita Schöbel, Reena Urban (2022) The Cheapest Ticket Problem in Public Transport. Transportation Science 56(6):1432-1451. https://doi.org/10.1287/trsc.2022.1138