Aalto-yliopisto
Perustieteiden
korkeakoulu

Travel-time Optimal Line Plans On Trees

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16.06.2023

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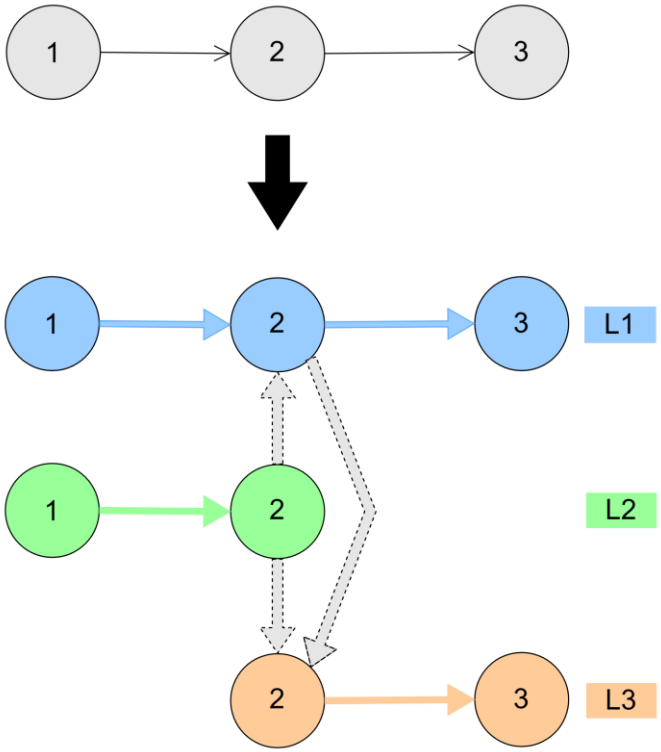
Minimizing Travel Time 1/2

- The aim is to minimize the sum of the travel time for all passengers
- The line plan is modelled as a change & go –graph
- Either binary or integer frequencies are used



Minimizing Travel Time 2/2

The standard IP formulation for binary frequency:

$$\min \sum_{(s,t)\in\mathcal{R}} \sum_{e\in\mathcal{E}} w_{st}\ c_e\ x^e_{st}$$

$$s.t. \quad \sum_{(s,t)\in\mathcal{R}} \sum_{e\in\mathcal{E}^l} x^e_{st} \le |\mathcal{R}||\mathcal{E}^l| y_l \qquad \forall\ l \in \mathcal{L}$$

$$\theta x_{st} = b_{st} \qquad \forall\ (s,t) \in \mathcal{R}$$

$$\sum_{l\in\mathcal{L}} C_l y_l \le B$$

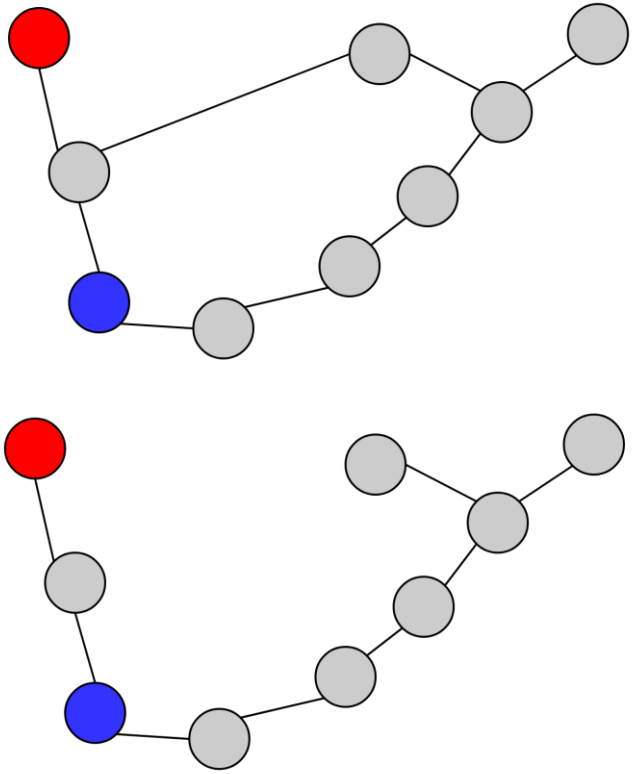
$$x^e_{st}, y_l \in \{0,1\} \qquad \forall\ (s,t) \in \mathcal{R}, e \in \mathcal{E}, l \in \mathcal{L}$$

Schöbel and Scholl, 2006

Objective

If the network is limited to trees, the travel time is minimized, when tranfers are minimized.

The main focus of the study will be on star shaped trees.



Scope And Methodology

Examination of the problem in a star shaped tree

- Development of a compact IP formulation for the problem
- Review of the formulation with different graph sizes and constraint values
- Comparison of the formulation in binary and integer frequencies

Constrasting to the standard IP formulation

- Proof of equivalence
- Comparison of runtime and solution quality

Literature and References

- A. Schöbel and S. Scholl, ”Line Planning with Minimal Traveling Time” in *5th Workshop on Algorithmic Methods and Models for Optimization of Railways,* Dagstuhl, Germany, 2006. Available: https://drops.dagstuhl.de/opus/volltexte/2006/660/
- Schöbel, A. Line planning in public transportation: models and methods. OR Spectrum 34, 491–510 (2012). https://doi.org/10.1007/s00291-011-0251-6

Schedule

- Presentation of the topic 16.6.2023
- Formulation, comparisons and testing ready by August 2023
- Writing thesis June-August 2023
- The results and the thesis ready in September 2023