

# An iterative method for line planning

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The line planning problem is one of the fundamental problems in strategic planning of public transport. It involves finding the routes(paths) on which the lines are operating in a given public transportation system. There are (at least) two objectives: the passengers want to minimize the travelling time, and the transport company wishes to minimize operating costs.

We minimize the travel times over all customers including penalties for the transfers needed while keeping the operational costs in mind. Penalties for transfers are important since passengers associate inconvenience and the risk of a delay due to missed connection with transfers.

In order to incorporate the penalties for the transfers, we construct a Change & Go network  $\mathcal{N} = (V, A)$  from the public transportation network  $\text{PTN} = (S, E)$ . Finding the shortest path for the OD-pair in Change & Go network includes the penalties for the transfers.

Since the problem of line planning with OD-pairs is strongly NP-hard, a heuristic is introduced, which divides the problem into two subproblems: Routing and solving the line planning problem and these two subproblems are iterated.