

VORträge zum Operations Research

Kolloquium des Instituts für Operations Research

Zeit: Donnerstag, 30. März 2017, 17:30 Uhr

Ort: Raum 1C-01, Gebäude 05.20

Es spricht: Prof. Dr. Sven Müller, Hochschule Karlsruhe

Zum Thema: **Revenue Maximizing Tariff Zone Planning for Public Transport Organizations**

Abstract: In this presentation we introduce the revenue maximizing tariff zone planning problem. We presented a novel model formulation and showed by numerical examples that real world instances are solvable (up to optimality) using GAMS/CPLEX. In contrast to the representation in scientific literature we find the (spatial) design of tariff systems in public transportation to be very important in terms of managerial relevance: by appropriate design of the tariff system a public transport company is expected to increase its revenue remarkably. The counting zones tariff system is the prevailing system in metropolitan areas, such as London, Boston, and Perth. For the counting zones tariff system, the corresponding tariff is determined by the product of the number of zones passed on the trip from origin to destination and the price per zone. The price per zone denoted as fare might be decreasing in the number of zones passed. In this paper, we contribute to the scant literature on public transport tariff zone design by a new model for the tariff zone design problem. The objective is to maximize the expected total revenue (demand \times tariff) taking into account contiguous tariff zones and discrete fare levels. The literature on public transport demand provides strong evidence that public transport customers are price sensitive. Demand as a function of tariff (i.e., demand depends on the tariff to be paid) - is measured as the number of public transport trips between origin and destination. Customers are assumed to choose the time shortest-path (which is confirmed by numerous empirical studies). For a given fare we compute the expected revenue for each origin-destination pair and the number of tariff zones passed. As a consequence, we are able to model the original non-linear problem as a MIP. The problem has to be solved for each fare level separately. Contiguity is a complex task in spatial optimization. Here, contiguity is achieved by using primal and dual graph information. Therefore, we consider flow conservation constraints using the dual graph of the public transport graph. Our approach is general in the vein that demand can be determined by any arbitrarily chosen demand model (i.e., no assumptions about the functional form have to be made). By additional valid inequalities we are able to induce certain patterns of the zones, i.e., a ring pattern, for example. We perform a series of numerical investigations using GAMS/CPLEX and artificial data to show the applicability of our approach. In particular, we investigate the impact of enforcing certain patterns on the solvability of the problem. Further, we employ our approach to the San Francisco Bay Area, California using a simple version of the MTC Travel Model One as the demand model. We can show that revenue can be increased by 9% without decreasing transit ridership.

Die Vorträge zum Operations Research wenden sich an alle Interessierten!

Bei Rückfragen wenden Sie sich bitte an:
Prof. Dr. Stefan Nickel, Institut für Operations Research.