

Planning work schedules for ticket inspectors in Danish S-trains

DSB S-trains use the S-train network in Greater Copenhagen. The problem is concerned with constructing work schedules and assigning them to a fixed number of ticket inspectors. The ticket inspectors inspect the tickets of passengers on the trains while they are driving. A work schedule for a ticket inspector is a route in the network with a starting time at a starting station and an end time at an end station. The work schedule also states which trains to travel with and when to change trains.

The objective is to maximize the number of departures covered with respect to a predefined priority of the departures. The priorities reflect the desire to inspect as many passengers as possible. A solution approach to this max-covering problem is the following: A dynamic programming algorithm is used to construct single work schedules and a greedy heuristic constructs the set of work schedules one by one. Local search heuristics are then used to improve the greedy solutions. The problem can be modelled as an integer multicommodity flow problem with side constraints. The flow version is not easily solved due the size of instances, but using Lagrangian relaxation on the multicommodity flow formulation yields good upper bounds on the problem. Solutions found on test instances from DSB S-train are within 2-6% of upper bounds.