

Assignment PostNL parcel delivery

To transport parcels from their origin location to their destination location, PostNL consolidates parcel flows to reduce costs. This is done with the use of hubs. Parcels are transported from their origin to an assigned hub, then the consolidated flow is transported to another hub, and from there the parcels are delivered to their destination location. In the parcel delivery problem, two decisions have to be made: 1) which locations will be used as hubs and 2) for each non-hub node, the hub to/from the parcels will be send/received. In order to do so, we have to take two types of costs into account. The first are the transportation costs between the locations and the second are the costs for establishing a hub.

The parcel delivery problem is solved for a network with n nodes given by set N . The costs of transporting parcels is given by c_{ij} with $i, j \in N$ and the amount of flow is given by w_{ij} for $i, j \in N$. From the given n nodes, some are chosen to act as a hub. Then, the path of a parcel consists of three parts: 1) collection from origin node $i \in N$ to hub $k \in N$, 2) transfer from hub $k \in N$ to hub $l \in N$, and 3) distribution from hub $k \in N$ to destination node $j \in N$. The cost per unit flow along this route ($i \rightarrow k \rightarrow l \rightarrow j$) is given by $\chi c_{ik} + \alpha c_{kl} + \delta c_{lj}$ where χ , α , and δ denote cost multipliers for the collection, transfer and distribution, respectively. The fixed cost for establishing a hub at node $k \in N$ is given by f_k . The total flow originating at node $i \in N$ is given by $o_i = \sum_j w_{ij}$ and the total flow with destination $i \in N$ is given by $d_i = \sum_j w_{ji}$.

The goal is to decide which nodes will act as hubs and to assign each node to exactly one of the established hubs such that the total costs of the network is minimized, which consists of the total collection, transfer, and distribution costs, and the fixed costs for establishing hubs.

1. Come up with an intuitive method/algorithm to find a feasible and good solution to this problem. Implement and test this algorithm on the given data sets. This method will be problem specific and only relies on logical thinking.
2. Set up a general Integer Linear Programming model for this problem.
3. Solve this problem to optimality for the given data sets.
4. Expand the basic problem by adding more details, extending it or modifying it.