

IE 310

Project (Deadline: December 31, 23:59)

A company based in İstanbul has customers all over Turkey. Every day a number of customers indexed by $j \in \{1, \dots, 56\}$ place their orders where the amount of order of customer j in terms of volume and weight are given respectively as d_j^v and d_j^w . The order must be delivered the next day, therefore a plan must be prepared which is executed by a third-part logistics company. There are two possibilities for delivering the items that are referred to as direct delivery and indirect delivery.

Direct delivery: In case of direct delivery a customer is visited by a small or large truck to drop off the products. The cost of visiting a customer depends on the location of the customer and the type of truck. Let c_j^k denote the cost of visiting customer j by direct delivery by a type k vehicle. $k=1$ implies a small truck and $k=2$ implies a large truck with a volume capacity of q_k . Obviously, $q_2 > q_1$. At most three customers may be visited by a vehicle (small or large) for direct delivery. When a number of customers (three or less) are visited by a truck, the cost of this vehicle is computed as follows: the largest cost of the customers visited plus the number of other customers visited multiplied by 125 for a small truck and by 250 for a large truck. For example, when Adana, Antalya and Burdur are visited by a small truck, and the costs are $c_{Adana}^1 = 200, c_{Antalya}^1 = 150, c_{Burdur}^1 = 100$, the total cost associated with this vehicle is $200 + 2 * 125 = 450$. The logistics company has identified a matrix which shows that which customers can be visited together by a vehicle, namely $a_{jj'} = 1$ if customers j and j' can be visited by the same vehicle, $a_{jj'} = 0$ otherwise.

Indirect delivery: In this case, the demand of customer j is sent to the transshipment center that works with that customer. There is a total of 24 transshipment centers, and each customer is assigned to one of the transshipment centers. The cost incurred is computed by multiplying the weight of the customer demand d_j^w by unit cost u_j . The trucks departing from İstanbul and going to transshipment centers are very large trucks and you can assume that their capacity is never exceeded.

Formulate a mathematical model for a given day to determine which customers are served by direct delivery and which customers are served by indirect delivery in order to minimize the total delivery cost.

Customer IDs exist in the file `customers.txt`

Demands of customers in terms of weight exist in the file `demand-weight.txt`

Demands of customers in terms of volume exist in the file `demand-volume.txt`

Direct delivery cost of visiting customers by vehicle type exist in the file `direct-shipment-cost.txt`

Volume capacity of small and large trucks is 18 and 33 m³, respectively

The matrix showing which customers can be visited together exist in the file `clusterability.txt`

Transshipment centers exist in the file `trcenters.txt`

Assignment of customers to transshipment centers exist in the file `customer-TC.txt`

Unit costs for indirect delivery exist in the file `trans_cost.txt`