Modelling and Solving a Multi-Trip Multi-Distribution Center Vehicle Routing Problem with Lower-Bound Capacity Constraints

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DATA DESCRIPTION

Table 1: The MILP instance description.

Line	Description
#nbCustomers w	Comment line The number of customers
#nbParkings y	Comment line The number of parking areas
#nbCentralDepots z	Comment line The number of distribution centers
#nbVehicles t	Comment line The number of vehicles
#nbProducts $|P|$	Comment line The number of products
#parking info $n(pk)\ e(pk)\ l(pk)$	Comment line y lines. $n(pk)$: the number of vehicles rested at parking area $pk \in PK$. $e(pk)\ l(pk)$: the working time at parking area $pk \in PK$.
#central depot info $e(dp)\ l(dp)\ t_{wait}(dp)\ t_{unit}(dp)$	Comment line z lines. $e(dp)\ l(dp)$: the time window of distibution center $dp \in D$. $t_{wait}(dp)\ t_{unit}(dp)$: the waiting duration for starting service and the time duration for loading a weight unit at distribution center $dp \in D$.
#vehicle info $e(k)\ l(k)\ \underline{c}(k)\ \overline{c}(k)\ q(k)\ f_k$	Comment line t lines. $e(k)\ l(k)$: the time window of vehicle $k \in K$. $\underline{c}(k)\ \overline{c}(k)$: the capacity boundaries of vehicle $k \in K$. $q(k)\ f_k$: the number of trips and the priority cofficient for using vehicle $k \in K$.
#weight of products $w(p)$	Comment line $|P|$ lines. The weight of product $p \in P$.
#customer demand $dm(c,p)$	Comment line w rows, $|P|$ columns. The demand for product $p \in P$ at customer $c \in C$.
#customer info $e(c)\ l(c)\ t_{wait}(c)\ t_{unit}(c)$	Comment line w lines. $e(c)\ l(c)$: the time window of customer $c \in C$. $t_{wait}(c)\ t_{unit}(c)$: the waiting duration for starting service and the time duration for loading a weight unit at customer $c \in C$.
#vehicle - product $rp(k,p)$	Comment line t rows, $|P|$ columns. $rp(k,p) = 1$ if vehicle $k \in K$ can carry product $p \in P$, 0 otherwise.
#vehicles - customer $rc(k,c)$	Comment line t rows, w columns. $rc(k,c) = 1$ if vehicle $k \in K$ can access to customer $c \in C$, 0 otherwise.
#vehicle - remain customers $vc(k,c)$	Comment line t rows, w columns. $vc(k,c) = 1$ if customer $c \in C$ is the specified customer of vehicle $k \in K$, 0 otherwise.
#travel distance matrix $(y + z + w) * (y + z + w - 1)$ $d_{I,j}$	Comment line The number of travel distance lines. $(y + z + w) * (y + z + w - 1)$ lines. The travel distance from point i to point i, $(i \neq j)$

Table 2: The heuristic instance description.

Field name	Type	Description
customer	list	List of customers
customerCode	string	Customer ID
endWorkingTime	datetime	The end working time of the customer
limitedWeight	int	Limited weight of a vehicle to access the customer
locationId	string	Physical location ID of the customer
startWorkingTime	datetime	The start working time of the customer
unloadDurationPerUnit	double	The time duration for unloading a weight unit at the customer
waittingDuration	int	The waiting duration for delivery at the customer
distance	list	Distance matrix
d	int	The travel distance from point A to point B
from	string	Point A
t	int	The travel time from point A to point B
to	string	Point B
distributionCenter	list	List of distribution centers
endWorkingTime	datetime	The end working time of a distribution center
loadDurationPerUnit	double	The time duration for loading a weight unit at the distribution center
locationId	string	Physical location ID of the distribution center
startWorkingTime	datetime	the start working time of a distribution center
waittingDuration	int	The waiting duration for loading at the distribution center
order	list	List of orders
orderCode	string	Order ID
orderItem	string	Product ID
quantity	int	The number of units
shiptoCode	string	Physical location ID of the customer
parking	list	List of parking areas
endWorkingTime	datetime	The end working time of a parking area
locationId	string	Physical location ID of the parking area
startWorkingTime	datetime	The start working time of a parking area
product	list	List of products
grssWeight	double	Gross weight of the product
productCode	string	Product ID
type	string	KHO: dry
		LANH: cool
		DONG: freeze"
vehicle	list	List of vehicles
locaionId	string	Physical location of the parking area
lowerLoadRate	double	The lower bound of the vehicle capacity = lowerLoadRate * weight
nbTrips	int	The number of trips
ownership	int	1: inhouse
		2: outsourced"
restrictedProducts	list	List of products that cannot carry by the vehicle
upperLoadRate	double	The upper bound of the vehicle capacity = upperLoadRate * weight
vehicleCode	string	Vehicle ID
weight	int	The original load of the vehicle
remainedCustomers	list	The specified customer list of the vehicle