EV Fleet Route Planning - Optimization (Write-up in progress)

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1 Variables

1.1 Constants:

- N : Number of Vehicles
- T : Number of Time Steps to Run Optimization For
- C : Number of Charging Stations
- K : Number of Chargers Per Charging Station
- $MROC$: Max Rate of Charge

1.2 Optimization Variables:

- X, (Vehicle Trajectories)
- B (Battery Level of Cars)
- C (How much charge is being provided at a given time step),
- D (Helper var for encapsulating L1 Distance).

1.3 Variables Dimensions:

- $|X| : [N, T, 2]$
- $|B| : [N, T]$
- $|C| : [N, C, T]$
- $|C_{cond}| : [N, C, T]$
- $|C_{diff}| : [N, C, T, 2]$
- $|D| : [N, C, 2]$

2 Constraints

Subject to: (1)

$$0 \leq X_{i,j,k} \leq Size \quad \forall i \in \{1,2,\ldots,N\}, j \in \{1,2,\ldots,T\}, k \in \{1,2,\ldots,D\} \tag{2}$$

$$10 \leq B_{i,j} \leq 100 \quad \forall i \in \{1,2,\ldots,N\}, j \in \{1,2,\ldots,T\} \tag{3}$$

$$D_{i,j,k} \geq 0 \quad \forall i \in \{1,\ldots,N\}, j \in \{1,\ldots,T-1\}, k \in \{1,2,\ldots,D\} \tag{4}$$

$$0 \leq C_{i,c,t} \leq \text{MROC} \quad \forall c \in \{1,\ldots,C\}, i \in \{1,\ldots,N\}, t \in \{1,\ldots,T-1\} \tag{5}$$

$$0 \leq Ccond_{i,c,t} \leq 1 \quad \forall c \in \{1,\ldots,C\}, i \in \{1,\ldots,N\}, t \in \{1,\ldots,T-1\} \tag{6}$$

$$B_{i,0} = starting\_battery_i \quad \forall i \in \{1,2,\ldots,N\} \tag{7}$$

$$B_{i,T-1} = end\_battery_i \quad \forall i \in \{1,2,\ldots,N\} \tag{8}$$

$$C_{\text{diff}i,ci,t,0} \geq x_{i,t,0} - charger\_loc_{ci,0} \tag{9}$$

$$C_{\text{diff}i,ci,t,0} \geq -(x_{i,t,0} - charger\_loc_{ci,0}) \tag{10}$$

$$C_{\text{diff}i,ci,t,1} \geq x_{i,t,1} - charger\_loc_{ci,1} \tag{11}$$

$$C_{\text{diff}i,ci,t,1} \geq -(x_{i,t,1} - charger\_loc_{ci,1}) \tag{12}$$

$$b_{i,j} = b_{i,j-1} + \sum_{k=1}^{D} d_{i,j-1,k} - \sum_{ci=1}^{C} c_{i,ci,j-1} \quad \forall i \in \{1,2,\ldots,N\}, j \in \{1,2,\ldots,T\} \tag{13}$$

$$c\_cond_{i,ci,t} = c\_diff_{i,ci,t,0} + c\_diff_{i,ci,t,1} \tag{14}$$

$$c_{i,ci,t} \leq c\_cond_{i,ci,t} - 1 \tag{15}$$

$$b_{i,0} = b_{i,0}^{initial} \quad \forall i \in \{1,2,\ldots,N\} \tag{16}$$

(to be continued)