Optimization Model

Constraints

$$
\begin{aligned}
&\text{(Max Battery Limit)} && b_n^k \leq b_{\text{full}} && (1)\\
&\text{(Min Battery Limit)} && b_n^k \geq e_{\text{base}} && (2)\\
&\text{(Turn vs Move)} && y_{\text{turn},n}^k + y_{\text{mov},n}^k \leq 1 && (3)\\
&\text{(Exchange vs No-Exchange)} && Y_{\text{exchange},n}^k + Y_{\text{noexchange},n}^k \leq 1 && (4)\\
&\text{(Binary Turn Limit)} && y_{\text{turn},n}^k \geq 0 && (5)\\
&\text{(Binary Move Limit)} && y_{\text{mov},n}^k \geq 0 && (6)\\
&\text{(Binary Exchange Limit)} && Y_{\text{exchange},n}^k \geq 0 && (7)\\
&\text{(Binary No-Exchange Limit)} && Y_{\text{noexchange},n}^k \geq 0 && (8)\\
&\text{(Exchange implies station presence)} && Y_{\text{exchange},n}^k \leq z_{\text{base\_station},n}^k && (9)
\end{aligned}
$$

Battery Update Rule

$$
\begin{aligned}
b_n^{k+1} = {} & Y_{\text{noexchange},n}^k \cdot \left(b_n^k - y_{\text{turn},n}^k \cdot b_{\text{turn}} - y_{\text{mov},n}^k \cdot b_{\text{mov}} \right) \\
& + Y_{\text{exchange},n}^k \cdot b_{\text{full}} \qquad (10)
\end{aligned}
$$

Objective Function (Multi-Objective)

$$
\max \quad \sum_{i=1}^{M} c_i \ , \qquad (11)
$$

$$
\min \quad \sum_{n,k} \left(y_{\text{turn},n}^k \cdot b_{\text{turn}} + y_{\text{mov},n}^k \cdot b_{\text{mov}} + Y_{\text{exchange},n}^k \cdot \left(b_{\text{full}} - b_n^k \right) \right) \qquad (12)
$$