Linear approximation of the objective function (upper-level problem)

maximize
$$\sum_{t} \sum_{t} q_{i,m,t} \left(\lambda_{t} - \widetilde{c} \right)$$

$$\Rightarrow \sum_{t} \sum_{t} q_{i,m,t} \times \lambda_{m,t} - q_{i,m,t} \times \widetilde{c} \quad (0)$$

product of two continuous variables

Linearite binary x conknous 2 2 y- M(1-x) ≥ ∠ My

y=[c;,];]

Approximation of the non-linear term qi, m, t x Am, t

$$\lambda_{m,t} = \sum_{e \mid t, \hat{s}} \delta_{e,m,t} \times C_e + \delta_{i,m,t} \times C_i \qquad (1)$$

$$= \lambda_{m,t} \times C_i \qquad (2)$$

$$= \lambda_{m,t} \times C_i \qquad (3)$$

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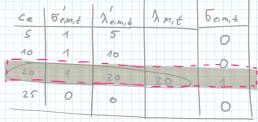
$$\sum_{m=\pm}^{2} \frac{1}{2} q_{i_{1}m_{1}t} \times \left(\sum_{e \in A_{i}} \left[\overline{b}_{e,m_{1}t} \times c_{e}\right] - \overline{c}\right) = \sum_{m=\pm}^{2} \sum_{e \in A_{i}} c_{e} \times q_{i_{1}m_{1}t} \times \overline{b}_{e,m_{1}t} - \sum_{m=\pm}^{2} \frac{1}{2} q_{i_{1}m_{1}t} \times \overline{c}$$

product of continuous and bingen variable

$${}^{2}lim,t \leq q_{i,m,t} : \forall e \mid \forall i,k,m,t$$
 (4)

$$\sum_{e \in M} \delta_{e,m,t} = 1 : \forall m, t \qquad (7)$$

$$q_{em,t} = \mathcal{E} \times \sigma'_{e,m,t} : \forall e(1i), m, t (9)$$



$$\lambda_{m,t} = \sum_{e \mid l,j} \delta_{e,m,t} \times c_e : \forall m, t$$

$$\left| \sum_{m} \sum_{t \in \{i,j\}} C_{e} \times z_{e,m,t} - \sum_{m} \sum_{t} q_{i,m,t} \times C \right| \Rightarrow LINEAR$$