CONTINUOUS RELAXATION

$$\min \quad \sum_{ij} f_{ij} z_{ij} + \sum_{j} y_j g$$

$$\sum_{k} x_{ijk} \cdot d_k \leq z_{ij} \cdot u \quad \forall (i,j)$$

$$\sum_{ij} x_{ijk} - \sum_{ij} x_{jik} = \begin{cases} 1 & k = s_k \\ -1 & k = t_k \quad \forall k \quad i \\ 0 & \text{otherwise} \end{cases}$$

$$x_{ijk} \cdot l_{ij} \leq \delta (1 - y_i) + M y_i \quad \forall i j k$$

$$\sum_{j \in l_{ij} > \delta} x_{ijk} \cdot d_k \leq y_i \cdot \gamma \quad \forall i$$

$$0 \leq x_{ijk} \leq 1 \quad \forall_{ijk}$$

$$0 \leq y_i \leq 1 \quad \forall i$$

$$z_{ij} \geq 0 \quad \forall_{ij}$$

SEPARATION PROBLEM

$$\zeta = \min \sum_{KJ \,:\, \ell_{ij} > \delta} (1 - \bar{x}_{iJK}) \, X_{KJ}$$

$$\sum_{KJ \,:\, \ell_{ij} > \delta} X_{KJ} \cdot d_{\kappa} \geq \bar{y}_i \cdot \lceil \Gamma \rceil + 1$$

$$X_{KJ} \in \{0,1\}^*$$

IF ζ is $\leq 1 - \varepsilon$

WE ADD THE CONSTRAINT BUILT IN THE FOLLOWING WAY

$$\sum_{\substack{JK \,: \\ \ell_{ij} > \delta}} X_{iJK} \leq \text{card} \, | C_2 | - 1$$

where $C_2 = \{$ ALL $X_{JK} = 1 \}$

ROUTINE IMPLEMENTATION

SOLVE CR $\mapsto X_{iJK}, Y_i, Z_{ij}$
REPEAT
    FOR EACH NODE :
        IF $Y_i > 0$:
            SOLVE SEPARATION PROBLEM $\mapsto X_{JK}$
            IF $\zeta \leq 1 - \varepsilon$:
                ADD CONSTRAINT
                BREAK
UNTIL $(\zeta \geq 1)$