

$$\min \sum_{i=0}^N \sum_{j=0}^N X_{ij}^k * t_{ij} + \sum_{k=0}^K F_k * Y_k + \sum_{i=1}^N w_i * T_i \quad (1)$$

st.

$$\sum_{k=0}^K \sum_{j=0, j \neq i}^N X_{ij}^k = 1, \forall i = 1, \dots, N \quad (2)$$

$$\sum_{i=0}^N \sum_{j=0, j \neq i}^N s_i * X_{ij}^k \leq Q_k * Y_k, \forall k = 0, \dots, K; \quad (3)$$

$$\sum_{j=0}^N X_{0j}^k = Y_k, \forall k = 0, \dots, K; \quad (4)$$

$$\sum_{i=0}^N X_{ih}^k = \sum_{i=0}^N X_{hj}^k; \forall h = 0, \dots, N; \forall k = 0, \dots, K \quad (5)$$

$$A_{ij} + A_{ji} = 1; \forall i, j = 0, \dots, N; i \neq j; \quad (6)$$

$$A_{ij} + A_{jr} + A_{ri} \geq 1; \forall i, j, r = 0, \dots, N; i \neq j \neq r; \quad (7)$$

$$S_k \geq \sum_{i=0, i \neq j}^N (P_i A_{ij}) + P_j - M * (1 - \sum_{i=0, i \neq j}^N X_{ij}^k); \forall j = 0, \dots, N; k = 0, \dots, K; \quad (8)$$

$$D_j - S_k \geq t_{0j} - M * (1 - X_{0j}^k); \forall k = 0, \dots, K; j = 0, \dots, N \quad (9)$$

$$D_j - D_i \geq t_{ij} - M * (1 - \sum_{i=0}^N X_{ij}^k); \forall i, j = 0, \dots, N; \quad (10)$$

$$T_i \geq D_i - d_i; \forall i = 1, \dots, N; \quad (11)$$

$$C_j = \sum_{i=0, i \neq j}^N (P_i * A_{ij}) + P_j; \forall j = 0, \dots, N; \quad (12)$$

$$C_0 = 0; \quad (13)$$

$$X_{ijk} \in \{0, 1\}; \forall i, j = 0, \dots, N, k = 0, \dots, K; \quad (14)$$

$$A_{ij} \in \{0, 1\}; \forall i, j = 1, \dots, N; \quad (15)$$

$$Y_k \in \{0, 1\}; \forall k = 0, \dots, N; \quad (16)$$

$$S_k \geq 0; \forall k = 0, \dots, K; \quad (17)$$

$$T_i \geq 0; \forall i = 1, \dots, N; \quad (18)$$

$$D_i \geq 0; \forall i = 1, \dots, N; \quad (19)$$

$$D_0 = 0; \quad (20)$$

$$T_0 = 0; \quad (21)$$

$$A_{0i} = 0; \forall i = 0, \dots, N; \quad (22)$$

$$A_{i0} = 0; \forall i = 0, \dots, N; \quad (23)$$