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$$\mathbf{\Lambda} = (\Lambda_1, \dots, \Lambda_n), \quad (1)$$

$$\Lambda(\boldsymbol{\beta}_k, \mathbf{w}) = \left(\frac{1}{W} \right) \sum_{q=1}^n \beta_{k,q} w_q, \quad (2)$$

$$\text{vs}(\boldsymbol{\beta}_k, \mathbf{w}, \mathbf{y}) = \left(\frac{1}{W} \right) \sum_{q=1}^n \beta_{q,k} w_q u(y_q, y_k), \quad (3)$$

$$\beta_{k,q} = \text{eq}(s(\mathbf{a}_k, \mathbf{a}_q), c_q) \quad (4)$$

$$u(y_q, y_k) = \begin{cases} 1, & \text{if } y_k \geq y_q. \\ 0, & \text{otherwise.} \end{cases} \quad (5)$$

$$W = \sum_{q=1}^n w_q \quad (6)$$

$$\mathbf{B} = \begin{bmatrix} 1 & \beta_{2,1} & \dots & \beta_{n,1} \\ \beta_{1,2} & 1 & \dots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ \beta_{1,n} & \dots & \dots & 1 \end{bmatrix} \quad (7)$$

$$\mathbf{B} = \begin{bmatrix} \beta_{1,1} & \dots & \beta_{n,1} \\ \vdots & \ddots & \vdots \\ \beta_{1,n} & \dots & \beta_{n,n} \end{bmatrix} \quad (8)$$

$$\boldsymbol{\beta}_k = (\beta_{k,1}, \dots, \beta_{k,n}) \quad (9)$$

$$\boldsymbol{\beta}_q = (\beta_{q,1}, \dots, \beta_{q,n}) \quad (10)$$

$$\gamma_k = \text{sq}(\tilde{\mathbf{a}}_k) \quad (11)$$

$$c_k = c(\mathbf{a}_k, \gamma_k) = \left(\frac{1}{m} \right) \sum_{i=1}^m \theta_i^k \tilde{a}_i^k, \quad (12)$$

$$\theta_i^k = \text{eq} \left(\frac{a_i^k}{\max_j a_j^k}, \gamma_k \right) \quad (13)$$

$$\boldsymbol{\theta}_k = (\theta_1^k, \dots, \theta_m^k) \quad (14)$$

$$\boldsymbol{\theta}_q = (\theta_1^q, \dots, \theta_m^q) \quad (15)$$

$$\boldsymbol{\theta}_n = (\theta_1^n, \dots, \theta_m^n) \quad (16)$$

$$\boldsymbol{\Theta} = \begin{bmatrix} \theta_1^1 & \dots & \theta_m^1 \\ \vdots & \ddots & \vdots \\ \theta_1^n & \dots & \theta_m^n \end{bmatrix} \quad (17)$$

$$\text{sq}(\mathbf{x}) = \text{mlv}(\mathbf{x}) + \frac{\tilde{\sigma}_x}{2} \left\{ (1 + 2\tilde{\sigma}_x)[1 - \text{mlv}(\mathbf{x})] - \frac{\tilde{\sigma}_x}{2} \right\}, \quad (18)$$

$$\tilde{\sigma}_x = \frac{\sigma_x}{\max \sigma_x}, \quad (19)$$

$$\mathbf{x} \in \frac{[0, 1]}{2} \quad (20)$$