Wardrobe Selection Mathematical Modeling

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Input Parameters and Variables

Parameters

- d : number of days we want to select the wardrobe for
- t : number of available tops
- b : number of available bottoms

Variables

- $topFreshness_i,\ i \in [1, t]$: the number of days for which a top can be worn consecutively
- $bottomFreshness_j,\ j \in [1, b]$: the number of days for which a bottom can be worn consecutively
- $matchingPairs = \{(i, j),\ i \in [1, t],\ j \in [1, b]\}$: set of matching pairs of tops and bottoms

Decision Variables

- $topOfDay_k,\ k \in [1, d]$: assignment of a top to a day
- $bottomOfDay_k,\ k \in [1, d]$: assignment of a bottom to a day

Constraints

- $1 \leq topOfDay_k \leq t$
- $1 \leq bottomOfDay_k \leq b$
- $(topOfDay_k,\ bottomOfDay_k) \in matchingPairs$

- $\forall\ i \in [1, t],\ \forall\ k' \in [1, d - topFreshness_i]$

$$\left(\sum_{k''=k'}^{k''=k'+topFreshness_i} topOfDay_{k''}\right)\ \leq\ topFreshness_i \tag{1}$$

- $\forall\ j \in [1, b],\ \forall\ k' \in [1, d - bottomFreshness_j]$

$$\left(\sum_{k''=k'}^{k''=k'+bottomFreshness_j} bottomOfDay_{k''}\right)\ \leq\ bottomFreshness_j \tag{2}$$

Objective Function

Minimize,

$$Z = w_1 * \left(\sum_{i=1}^{i=t} \left|\left(\sum_{k=1}^{k=d} topOfDay_k == i\right) - (d/t)\right|\right) + w_2 * \left(\sum_{k=1}^{j=b} \left|\left(\sum_{k=1}^{k=d} bottomOfDay_k == j\right) - (d/b)\right|\right) \tag{3}$$