Wardrobe Selection Mathematical Modeling

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Let the input variables be-

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

$topFreshness_i,\ i \in [1,t]$: 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

And the decision variables be-

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

Constraints-

- $1 \leq topOfDay_k \leq t$
- $1 \leq bottomOfDay_k \leq b$
- $(topOfDay_k,\ bottomOfDay_k) \in matchingPairs$
- $\forall\ i \in [1,t],\ \forall\ k' \in [1, d - topFreshness_i]$

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

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

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

Objective function-
Minimize,

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