

Mathematical Programming: Modelling and Applications

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Writing the mathematical model

Preliminary observations

- Each batch must be dyed in the first bath, then in the second bath,....

The k -th bath must finish before that the $(k+1)$ -th bath can start.

- The time for dyeing in the last bath must be bounded by the completion time for last batch.
- Two different batches cannot be dyed in the same bath at the same time.
- If the bath i is to be dyed before batch j , then j cannot be dyed before i (disjunction).



Mathematical model

- Sets

L : set of fabric batches $L = \{1, \dots, l\}$

V : set of dyeing baths $V = \{1, \dots, v\}$

- Parameters

$\forall i \in L, k \in V$ s_{ik} : time necessary to dye batch i in bath k

M : upper bound to completion time of last bath

- Variables

T : completion time for last batch

t_{ik} : starting time for dyeing batch i in bath k

$y_{ijk} = 1$ if batch i is to be dyed before batch j in bath k ,

0 otherwise.



Mathematical model

- Objective function

we want to *minimize* the completion time of the last batch

$$\min T$$

- Constraints

- sequential: $\forall i \in L, k \in V \setminus \{v\} \quad (t_{ik} + s_{ik} \leq t_{i(k+1)})$

- last bath: $\forall i \in L \quad (t_{iv} + s_{iv} \leq T)$

- non overlapping: $\forall i, j \in L, k \in V, i \neq j \quad (t_{ik} + s_{ik} \leq t_{jk} + M(1 - y_{ijk}))$

- disjunction: $\forall i, j \in L, k \in V, i \neq j \quad (y_{ijk} + y_{jik} = 1)$