

Constraint Model to deal with Process Alternatives

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January 30, 2025

Abstract

This document describes the constraints needed to deal with a generalized scheduling model that allows for alternative processes, bill of materials, intermediate products, and process step choices.

1 Model

1.1 Variables

The model is expressed with task variables, which represent the stature of a task starting at a time point, running until its end, with a variable duration. The task may or may not be present in the solution. We add a preference field which tells us what is our preference if that task is present in the solution.

z_k task variable for order k

y_{jk} task variable for job j of order k

x_{ij} task variable for task i of job j

v_{im} task variable for machineTask of task i on machine m

All task variables have fields

start start of task

end end of task

duration duration of task

present boolean flag that indicates of the task is present in schedule

preference integer preference value to use in the objective

1.2 Constraints

$$z_k.\text{end} \leq \text{due}_k \quad (1)$$

$$z_k.\text{start} \geq \text{release}_k \quad (2)$$

$$\text{endBeforeStart}(t_{i_1,j}, t_{i_2,j}) \quad (3)$$

alternative($z_k, [y_{j,k}$ |job j is based on an alternative process for the manufactured product of order k])
(4)

$$\text{span}(y_{jk}, [t_{ij}]|\text{task } i \text{ belongs to job } j) \quad (5)$$

$$\text{alternative}(t_{i,j}, [t_{i',j}'|t' \text{ is a choice for alternative task } i]) \quad (6)$$

1.3 Objective

$$\min \sum y_{jk} \cdot \text{pref} * y_{jk} \cdot \text{present} + \sum x_{ij} \cdot \text{pref} * x_{ij} \cdot \text{present} + \sum v_{im} \cdot \text{pref} * v_{im} \cdot \text{present} \quad (7)$$