Computational Project - Theme Proposal

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1 Definitions

1.1 Item

An **Item** ι is a 6-tuple:

$$\iota = \langle \chi, \psi, \omega, x, y, z \rangle \tag{1}$$

in which the components represent the item's[1]:

1. $\chi \in \mathbb{R}_+^*$: dimension in the x direction;
2. $\psi \in \mathbb{R}_+^*$: dimension in the y direction;
3. $\omega \in \mathbb{R}_+^*$: dimension in the z direction;
4. $x \in \mathbb{R}_+$: x position;
5. $y \in \mathbb{R}_+$: y position;
6. $z \in \mathbb{R}_+$: z position;

We represent by $\mathcal{I} = \mathbb{R}_+^{*3} \times \mathbb{R}_+^3$ the set of all items.

1.2 Vehicle

A Vehicle υ is a 3-tuple:

$$\upsilon = \langle \alpha, \eta, L \rangle \tag{2}$$

in which:

1. α is the number of components of the vehicle's loadings;
2. $\eta : \mathcal{I} \to \mathbb{R}_+^\alpha$: a function that associates every item to a vehicle's loading;
3. $L \in \mathbb{R}_+^\alpha$: represents the vehicle's loading limit;

We represent by $\mathcal{V}$ the set of all vehicles.

[1] See a definition for "dimension" in [1]

2 Problem Statement

2.1 Input

1. $I_o \subseteq \mathcal{I}$: the set of items
2. $v \in \mathcal{V}$: the vehicle

2.2 Constraints

Loading Limit Constraint

$$\sum_{\iota \in I_o} \eta(\iota) \leq L \tag{3}$$

Stacking Constraint

An item can only be removed if all items above it have already been removed (4)

Constraints Predicate

Given an $I_f \subseteq I_o$, we represent by $\mathscr{C}(I_f) \in \{true, false\}$ whether I_f satisfy all the above constraints or not.

2.3 Output

A subset $I_f \subseteq I_o$ of the input items.

2.4 Objective

$$min\{|I_o| - |I_f| : I_f \subseteq I_o \ \wedge \ \mathscr{C}(I_f)\} \tag{5}$$

Minimize the number of items removed so that all constraints are satisfied.

Referências

[1] Cambridge Dictionary. dimension, 2022.