Constraint Programming: Box Wrappig

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1 Variables and Constraints

The following variables are used to solve the box wrapping constraint problem:

- x_b^{tl}, y_b^{tl}: top left corner coordinates of a box.
- x_b^{br}, y_b^{br}: bottom right corner coordinates of a box.
- $width_b$: width of a box (the box may have been rotated).
- $height_b$: height of a box (the box may have rotated).
- $length$: roll length.

The following constraints are used to solve the box wrapping constraint problem:

(i) $length = max(y_b^{br}) + 1$

(ii) $x_b^{tl} \leq W - width_b$

(iii) $x_b^{br} = x_b^{tl} + width_b - 1$

(iv) $y_b^{br} = y_b^{tl} + height_b - 1$

(v) $(x_i^{br} < x_j^{tl}) \vee (y_i^{br} < x_j^{tl})$, for any pair of boxes $(b_i, b_j), i \neq j$. (symmetry)

(vi) $x_0^{tl} \leq \frac{1}{2}(W - w_0)$ (symmetry)

2 Symetries

We can exploid the follow symmetries in order to reduce the combinatorial space of the problem:

- Area overlapping is commutative.
- Placing the first box on the left half-side of the paper is the same, by symmetry, as placing the box on the rigth half-side of the paper.

3 Branching

For **variable selection strategy**, we use *first unassigned* i.e. biggest remaining box first following the *first-fail principle*.

For **value selection strategy**, we use a *custom variable selection strategy* which maximizes the horizontal space in order to explore optimal solutions first following the *first-success principle*.