

1 CP model

$X_{ij} = 1$: item i in bin j

$Z_j = 1$: bin j has been used

$R_i = 1$: item i rotated 90 degree

l_i, r_i, b_i, t_i : left, right, bottom and top coordinates of item i

1.1 Constraints

1. Each item has to be placed in 1 bin:

$$\sum_{j=1}^m X_{ij} = 1 \text{ for } i \text{ in } n$$

2. No two items overlap:

if $X_{i_1j} = X_{i_2j} = 1$

$$r_{i_1} \leq l_{i_2} \text{ or } r_{i_2} \leq l_{i_1} \text{ or } t_{i_1} \leq b_{i_2} \text{ or } t_{i_2} \leq b_{i_1}$$

3. Items cannot exceed the bin:

if $X_{ij} = 1$

$$\Rightarrow \begin{cases} w_i \leq r_i \leq W_j \\ h_i \leq t_i \leq H_j \end{cases}$$

4. If item i rotated:

if $R_i = 0$

$$\Rightarrow \begin{cases} r_i = l_i + w_i \\ t_i = b_i + h_i \end{cases}$$

else $R_i = 1$

$$\Rightarrow \begin{cases} r_i = l_i + h_i \\ t_i = b_i + w_i \end{cases}$$

1.2 Another way to approach

Keep constraints: 1, 2, 3

4. If item i rotated:

if $R_i = 0$

$$\Rightarrow \begin{cases} w_i = w_i \\ h_i = h_i \end{cases}$$

else $R_i = 1$

$$\Rightarrow \begin{cases} w_i = h_i \\ h_i = w_i \end{cases}$$

I will show how to implement this constrain in CP solver in the solver file