Model Description:

1. Problem Analysis

Given the time for each rack in the tanks, and the requirement that each rack only grasps one PartStyle, each processed rack is sequentially carried out according to the given processing steps, that is, Prime Dip - Top Coat Tank-Offload. To make the total processing time the shortest, the working time of each rack is continuous. The total time is the time from when the first rack starts going into the Prime Dip tank to when the last rack goes out of the Top Coat Tank.

2. Model assumption

2.1 Line 1 and 2 work normally, without failure and not to be maintained in the middle of processing.

2.2 Each rack must go through two stages, namely dipping in two tanks and offload, and the sequence is not allowed to be disturbed.

2.3 When waiting for dipping into the tanks, each rack will be processed in the original order, and the racks those are queued behind are not allowed to "jump in the queue".

2.4 All machine setup times (neglected) are zero, i.e., all racks go into tanks immediately.

3. Symbols Explanation

|  |  |
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| Symbol | Meaning |
|  | The optimized time required for the Jth process of the Ith processed rack |
|  | The optimized moment when the Ith processed rack starts the Jth process |
|  | The time required for the jth process of the ith rack |
|  | The moment when the ith processed rack starts the jth process |
|  | The optimized ordering (sequence or permutation) of the racks number 1, 2, …, n. |
|  |  |
| T | Total time |
|  | The time utilization efficiency of 4 sublines of the L2 |

Some examples of the symbols. . If the optimized solution , which corresponds to the 3rd rack is in the 1st position of . So means the times for the 1st processed rack dipped in Prime and TopCoat Tanks. If line 1 starts at t=0, then the total time used to dip all racks is  *.*

Let , be the measure of jth HandID and rack density for part i respectively, then the measure of racks . There are n racks with n! possible orderings. Construct an nn 0-1 matrix, each row has one and only one element 1, and the rest of the elements are 0, so does the column. There is n! kinds of matrices in total. Assume that the optimal solution has been found.

s.t.

Constrains (1) and (2) are the completion time of the (i+1)th rack in the Prime Tank before and after any rack dips into Top Coat Tank respectively. (3) supposes the Line 1 starts at t=0. (4)- (6) guarantee that each rack only appears once in the permutation , (7) guarantee one rack can’t be processed by 2 tanks simultaneously, and one rack can only grasp one PartStyle of parts.