

Format Description

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1 Single Picker Routing Problem and Single Picker Routing Problem with Scattered Storage

As an example, we explain the instance file `example_sprp.txt`. The warehouse layout is depicted in Figure 1 and a detailed instance description can be found in Table 1. The instance file `example_sprp.txt` is as follows:

```
1  NAME : example_sprp.txt
2  TYPE : Single_picker_routing
3  COMMENT : Weidinger (2018); Goeke and Schneider (2021); Heßler and Irnich (2022)
4  LAYOUT : single-block
5  NUM_AISLES : 4
6  NUM_CELLS : 10
7  DEPOT_AISLE : 2
8  DEPOT_LOCATION : bottom
9  DISTANCE_AISLE_TO_AISLE : 3
10 DISTANCE_CELL_TO_CELL : 1
11 DISTANCE_TOP_TO_CELL : 1
12 DISTANCE_BOTTOM_TO_CELL : 1
13 DISTANCE_TOP_OR_BOTTOM_TO_DEPOT : 1.5
14 ARTICLE_SECTION
15 NUM_ARTICLES : 13
16 ID 0
17 ID 1
18 ID 2
19 ID 3
20 ID 4
21 ID 5
22 ID 6
23 ID 7
24 ID 8
25 ID 9
26 ID 10
27 ID 11
28 ID 12
29 SKU_SECTION
30 NUM_SKUS : 13
31 ID 0 AISLE 0 CELL 2 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
32 ID 1 AISLE 0 CELL 4 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
33 ID 2 AISLE 0 CELL 8 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
34 ID 3 AISLE 1 CELL 0 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
35 ID 4 AISLE 1 CELL 2 QUANTITY 1 LEFT_RIGHT_HAND_SIDE right
36 ID 5 AISLE 1 CELL 8 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
37 ID 6 AISLE 2 CELL 0 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
38 ID 7 AISLE 2 CELL 9 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
39 ID 8 AISLE 3 CELL 1 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
40 ID 9 AISLE 3 CELL 3 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
```

```

41 ID 10 AISLE 3 CELL 5 QUANTITY 1 LEFT_RIGHT_HAND_SIDE right
42 ID 11 AISLE 3 CELL 7 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
43 ID 12 AISLE 3 CELL 9 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
44 ORDER_SECTION
45 NUM_ARTICLES : 13
46 ID 0 QUANTITY 1
47 ID 1 QUANTITY 1
48 ID 2 QUANTITY 1
49 ID 3 QUANTITY 1
50 ID 4 QUANTITY 1
51 ID 5 QUANTITY 1
52 ID 6 QUANTITY 1
53 ID 7 QUANTITY 1
54 ID 8 QUANTITY 1
55 ID 9 QUANTITY 1
56 ID 10 QUANTITY 1
57 ID 11 QUANTITY 1
58 ID 12 QUANTITY 1
59 EOF

```

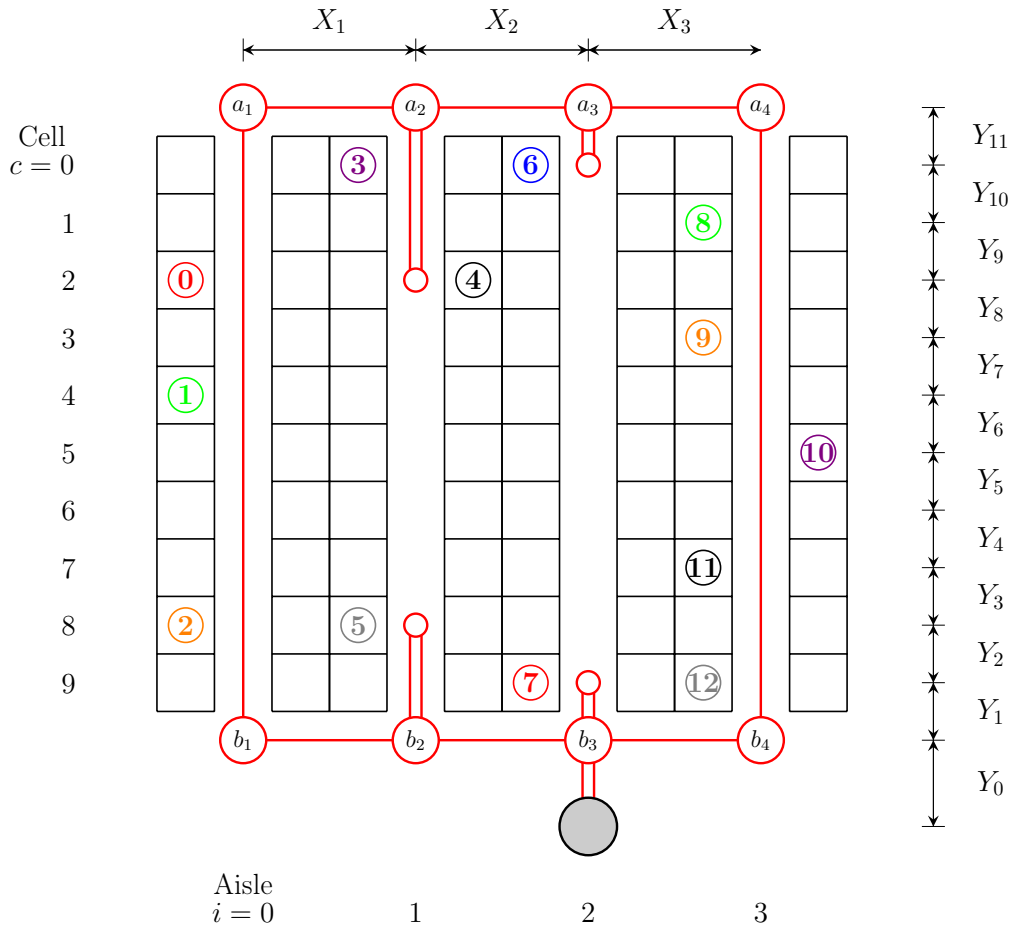


Figure 1: Warehouse layout and optimal solution of the instance `example_sprp.txt`.

Name	Description
NAME	instance name
TYPE	problem type
COMMENT	authors of the instance
LAYOUT	warehouse layout
NUM_AISLES	number of aisles
NUM_CELLS	number of cells
DEPOT_AISLE	depot aisle
DEPOT_LOCATION	depot location (top or bottom)
DISTANCE_AISLE_TO_AISLE	distance between neighboring aisles, the value corresponds to X_1, X_2, X_3 in Figure 1
DISTANCE_CELL_TO_CELL	distance between neighboring cells, the value corresponds to Y_2, Y_3, \dots, Y_{10} in Figure 1
DISTANCE_TOP_TO_CELL	distance between the top cross-aisle and the first cell, the value corresponds to Y_{11} in Figure 1
DISTANCE_BOTTOM_TO_CELL	distance between the bottom cross-aisle and the first cell, the value corresponds to Y_1 in Figure 1
DISTANCE_TOP_OR_BOTTOM_TO_DEPOT	distance between the depot and the top or bottom cross-aisle, the value corresponds to Y_0 in Figure 1
ARTICLE_SECTION	begin of the article section
NUM_ARTICLES	number of articles
ID	article id
SKU_SECTION	begin of the SKU section
NUM_SKUS	number of SKUs
AISLE	aisle number i (see Figure 1)
CELL	cell number c (see Figure 1)
QUANTITY	available or demanded quantity
LEFT_RIGHT_HAND_SIDE	left or right
ORDER_SECTION	begin of the order section
NUM_ARTICLES	number of articles
EOF	end of file

Table 1: Detailed description.

2 Joint Order Batching and Picker Routing Problem

As an example, we explain the instance file Pr_20_1_20_Store1_01.txt. A detailed instance description can be found in Table 2. The instance file Pr_20_1_20_Store1_01.txt is as follows:

```
1  NAME : Pr_20_1_20_Store1_01.txt
2  TYPE : Order_batching
3  COMMENT : Bahçeci and Öncan (2021)
4  PICKER_CAPACITY : 20
5  LAYOUT : single-block
6  NUM_AISLES : 10
7  NUM_CELLS : 10
8  DEPOT_AISLE : 0
9  DEPOT_LOCATION : bottom
10 DISTANCE_AISLE_TO_AISLE : 2.4
11 DISTANCE_CELL_TO_CELL : 1
12 DISTANCE_TOP_TO_CELL : 1
13 DISTANCE_BOTTOM_TO_CELL : 1
14 DISTANCE_TOP_OR_BOTTOM_TO_DEPOT : 0
15 ARTICLE_SECTION
16 NUM_ARTICLES : 18
17 ID 0 WEIGHT 1
18 ID 1 WEIGHT 1
19 ID 2 WEIGHT 1
20 ID 3 WEIGHT 1
21 ID 4 WEIGHT 1
22 ID 5 WEIGHT 1
23 ID 6 WEIGHT 1
24 ID 7 WEIGHT 1
25 ID 8 WEIGHT 1
26 ID 9 WEIGHT 1
27 ID 10 WEIGHT 1
28 ID 11 WEIGHT 1
29 ID 12 WEIGHT 1
30 ID 13 WEIGHT 1
31 ID 14 WEIGHT 1
32 ID 15 WEIGHT 1
33 ID 16 WEIGHT 1
34 ID 17 WEIGHT 1
35 SKU_SECTION
36 NUM_SKUS : 18
37 ID 6 AISLE 0 CELL 5 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
38 ID 15 AISLE 0 CELL 3 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
39 ID 7 AISLE 0 CELL 2 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
40 ID 0 AISLE 0 CELL 1 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
41 ID 14 AISLE 2 CELL 9 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
42 ID 1 AISLE 2 CELL 8 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
43 ID 13 AISLE 2 CELL 5 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
44 ID 10 AISLE 3 CELL 8 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
45 ID 3 AISLE 3 CELL 4 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
46 ID 16 AISLE 4 CELL 8 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
47 ID 4 AISLE 4 CELL 6 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
48 ID 12 AISLE 4 CELL 0 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
49 ID 17 AISLE 5 CELL 8 QUANTITY 2 LEFT_RIGHT_HAND_SIDE left
50 ID 8 AISLE 5 CELL 3 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
51 ID 2 AISLE 6 CELL 4 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
52 ID 5 AISLE 8 CELL 4 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
53 ID 11 AISLE 9 CELL 4 QUANTITY 2 LEFT_RIGHT_HAND_SIDE left
```

```
54 ID 9 AISLE 9 CELL 0 QUANTITY 1 LEFT_RIGHT_HAND_SIDE left
55 ORDER_SECTION
56 NUM_ORDERS : 8
57 NUM_ARTICLES_IN_ORDER : 2
58 ID 0 QUANTITY 1
59 ID 1 QUANTITY 1
60 NUM_ARTICLES_IN_ORDER : 3
61 ID 2 QUANTITY 1
62 ID 3 QUANTITY 1
63 ID 4 QUANTITY 1
64 NUM_ARTICLES_IN_ORDER : 2
65 ID 5 QUANTITY 1
66 ID 6 QUANTITY 1
67 NUM_ARTICLES_IN_ORDER : 3
68 ID 7 QUANTITY 1
69 ID 8 QUANTITY 1
70 ID 9 QUANTITY 1
71 NUM_ARTICLES_IN_ORDER : 2
72 ID 10 QUANTITY 1
73 ID 11 QUANTITY 1
74 NUM_ARTICLES_IN_ORDER : 3
75 ID 12 QUANTITY 1
76 ID 13 QUANTITY 1
77 ID 14 QUANTITY 1
78 NUM_ARTICLES_IN_ORDER : 2
79 ID 15 QUANTITY 1
80 ID 11 QUANTITY 1
81 NUM_ARTICLES_IN_ORDER : 2
82 ID 16 QUANTITY 1
83 ID 17 QUANTITY 2
84 EOF
```

Name	Description
NAME	instance name
TYPE	problem type
COMMENT	authors of the instance
PICKER_CAPACITY	picker capacity
LAYOUT	warehouse layout
NUM_AISLES	number of aisles
NUM_CELLS	number of cells
DEPOT_AISLE	depot aisle
DEPOT_LOCATION	depot location (top or bottom)
DISTANCE_AISLE_TO_AISLE	distance between neighboring aisles, the value corresponds to X_1, X_2, X_3 in Figure 1
DISTANCE_CELL_TO_CELL	distance between neighboring cells, the value corresponds to Y_2, Y_3, \dots, Y_{10} in Figure 1
DISTANCE_TOP_TO_CELL	distance between the top cross-aisle and the first cell, the value corresponds to Y_{11} in Figure 1
DISTANCE_BOTTOM_TO_CELL	distance between the bottom cross-aisle and the first cell, the value corresponds to Y_1 in Figure 1
DISTANCE_TOP_OR_BOTTOM_TO_DEPOT	distance between the depot and the top or bottom cross-aisle, the value corresponds to Y_0 in Figure 1
ARTICLE_SECTION	begin of the article section
NUM_ARTICLES	number of articles
ID	article id
WEIGHT	article weight
SKU_SECTION	begin of the SKU section
NUM_SKUS	number of SKUs
AISLE	aisle number i (see Figure 1)
CELL	cell number c (see Figure 1)
QUANTITY	available or demanded quantity
LEFT_RIGHT_HAND_SIDE	left or right
ORDER_SECTION	begin of the order section
NUM_ORDERS	number of orders
NUM_ARTICLES_IN_ORDER	number of articles in the order
EOF	end of file

Table 2: Detailed description.