General 2D Bin Packing Problem - Group 9 - Topic 3

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The PDF file of the report and everything else in the project is available here:

https://github.com/htnminh/optimization-project

Introduction to important files and directories in the project

- files\data_generator.py: The data generator.
- files\generated_data: The folder contains all generated files.
- files\CP_model.py: The implementation of CP.
- files\mip_model.py: The implementation of MIP.
- files\heuristic_bestfit_area_numpy.py: The implementation of heuristic.

Analysis

The data are analyzed in the files directory.

Warning: Some last columns might be hidden in the right side if this file is viewed as a page on Notion. PDF file is highly recommended.

The result table

File path: files_ana_data_loaded_df.txt

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10 15 6 200.0 1.0 300 3.44 11 16 6 1050.0 2.0 300 300.17 12 17 6 1300.0 2.0 300 300.16 13 18 8 150.0 1.0 300 9.31 14 19 9 900.0 3.0 300 300.19 15 20 9 400.0 1.0 300 300.18								
11 16 6 1050.0 2.0 300 300.17 12 17 6 1300.0 2.0 300 300.16 13 18 8 150.0 1.0 300 9.31 14 19 9 900.0 3.0 300 300.19 15 20 9 400.0 1.0 300 300.18			5					
12 17 6 1300.0 2.0 300 300.16 13 18 8 150.0 1.0 300 9.31 14 19 9 900.0 3.0 300 300.19 15 20 9 400.0 1.0 300 300.18								
13 18 8 150.0 1.0 300 9.31 14 19 9 900.0 3.0 300 300.19 15 20 9 400.0 1.0 300 300.18								
14 19 9 900.0 3.0 300 300.19 15 20 9 400.0 1.0 300 300.18								
15 20 9 400.0 1.0 300 300.18								

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19
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                              2.0
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21
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            10
                 950.0
                             3.0
                                        300
                                                  300.28
22
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                 3350.0
                                        300
                                                  300.31
                              5.0
                                        300
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             9
                 3350.0
                             5.0
                                                  300.31
                                        300
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      29
            11
                 150.0
                             1.0
                                                  262.91
25
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26
      31
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                             5.0
                                        300
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            12
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                             8.0
                                        300
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28
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           14
                 7550.0
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                                        300
                                                  300.42
29
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             12
                 5100.0
                             11.0
                                        300
                                                  300.41
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                 4500.0
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            12
                 5650.0
                             11.0
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                              NaN
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                                        300
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      150
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      180
                    NaN
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      210
             72
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      270
             93
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62
     450
            158
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63
            167
                    NaN
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64
      550
            196
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                              NaN
                                        300
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65
      600
            200
                    NaN
                              NaN
                                        300
                                                     NaN
66
      650
            231
                    NaN
                              NaN
                                        300
                                                     NaN
67
     700
            239
                    NaN
                              NaN
                                        300
                                                     NaN
68
      750
            250
                    NaN
                              NaN
                                        300
                                                     NaN
69
      800
            270
                              NaN
                                        300
                    NaN
70
      850
            299
                              NaN
                                        300
                    NaN
                                                     NaN
71
      900
            318
                    NaN
                              NaN
                                        300
72
      950
            335
                    NaN
                              NaN
                                        300
                                                     NaN
73 1000
          346
                   NaN
                              NaN
                                        300
                                                     NaN
ANALYTICAL DATA OF heuristic_bestfit_area_numpy.py WITH GLOBAL_TIME_LIMIT_PER_ITER = 1
  rect_count car_count total cost cars used count running time GLOBAL_TIME_LIMIT_PER_ITER time_exceeded_count
0
      5 3 950 1 0.000997
1
           6
                    3
                             350
                                             1
                                                    0.002014
                                                                                  1
                                                                                                     0
                  3 300
4 450
4 100
4 1550
3 1000
74
                                                    0.000972
2
                                                    0.002973
3
                                                   0.008007
          9
                                                    0.002997
          10
                                            1
5
                                                    0.006947
6
          11
                    5
                             750
                                             1
                                                    0.012967
          12
                   5
                            700
7
                                             2
                                                    0.010993
          13
14
8
                    4
                            450
                                             1
                                                    0.020943
                                                                                  1
                                                                                                     0
                   5
                          1550
9
                                             2
                                                    0.016961
                   6
          15
                            250
10
                                             1
                                                    0.036895
                                                                                  1
                          1050
11
          16
                   6
                                             2
                                                    0.013963
                                                                                                     0
                   6
                          1300
12
          17
                                             2
                                                    0.031914
                                                                                  1
                                                                                                     0
13
          18
                    8
                            150
                                             1
                                                    0.076802
                                                                                  1
                                                                                                     0
                   9
14
          19
                            1650
                                             3
                                                    0.008952
                                                                                                     0
```

0.099759

0.033909 0.160574

18	23	8	750	1	0.150594	1	. 0
19	24	9	100	1	0.223403	1	. 0
20	25	10	400	1	0.259306	1	. 0
21	26	10	800	2	0.047872	1	. 0
22	27	10	350	1	0.292190	1	. 0
23	28	9	700	1	0.347101	1	. 0
24	29	11	150	1	0.316155	1	. 0
25	30	11	900	3	0.026928	1	. 0
26	31	10	550	1	0.444810	1	. 0
27	32	12	1200	2	0.186501	1	. 0
28	33	14	350	2	0.087766	1	. 0
29	34	12	750	2	0.265292	1	. 0
30	35	11	1600	3	0.059838	1	. 0
31	36	12	1200	4	0.032917	1	. 0
32	37	12	900	3	0.081748	1	
33	38	12	1050	3	0.134670	1	
34	39	16	3200	5	0.038895	1	
35	40	14	1250	3	0.123669	1	
36	41	15	600	1	0.872666	1	
37	42	14	700	4	0.085772	1	
38	43	17	1100	3	0.099733	1	
39	44	18	1000	2	0.864688	1	
40	45	17	950	3	0.104718	1	
						1	
41	46	17	1150	4	0.147573		
42	47	16	700	3	0.150597	1	
43	48	18	1250	3	0.411929	1	
44	49	15	600	3	0.190490	1	
45	50	18	1750	5	0.060837	1	
46	51	18	2000	5	0.152592	1	
47	52	17	1750	4	0.181485	1	
48	53	20	950	2	1.098094	1	
49	54	18	2600	5	0.098738	1	
50	60	23	2550	6	0.188493	1	
51	90	29	1150	5	0.560502	1	
52	120	44	2300	7	0.688131	1	
53	150	53	3700	12	0.442843	1	
54	180	64	1700	7	2.248959	1	
55	210	72	4200	15	2.006664	1	
56	240	81	3450	8	9.161504	1	
57	270	93	6050	17	1.640614	1	
58	300	110	4450	13	3.803832	1	
59	330	110	4000	16	3.068793	1	
60	350	122	3150	12	6.357003	1	
61	400	135	5950	22	2.096394	1	
62	450	158	6150	21	5.346707	1	
63	500	167	8400	35	1.706438	1	. 0
64	550	196	6850	27	3.502637	1	. 0
65	600	200	8250	29	7.192769	1	. 0
66	650	231	7150	28	20.260799	1	. 0
67	700	239	8800	34	7.254632	1	. 0
68	750	250	13350	42	5.701724	1	. 0
69	800	270	9650	42	6.406899	1	. 0
70	850	299	9200	38	9.951397	1	. 0
71	900	318	13250	41	12.916435	1	. 0
72	950	335	16550	59	4.232715	1	
73	1000	346	11800	48	10.196733	1	

Data analysis

A part of the file files_ana_data_loaded_describe.txt

count								
	62.000000	62.000000	62.000000	62.000000	62.0	62.000000		
mean	61.000000	21.693548	2990.322581	6.306452	120.0	86.498871		
std	81.005161	27.929413	7474.228063	13.413461	0.0	58.735972		
min	5.000000	3.000000	100.000000	1.000000	120.0	0.070000		
25%	19.250000	8.000000	462.500000	1.000000	120.0	0.997500		
50%	34.500000	12.000000	900.000000	2.000000	120.0	120.630000		
75%	49.750000	18.000000	1550.000000	4.000000	120.0	121.210000		
max	350.000000	122.000000	36450.000000	65.000000	120.0	167.710000		
			ANALYTICA	AL DATA OF mi	o_model.py WI	TH time_limit	= 300	
	n_rect	n_ca	r cost	n car used	time limit	time_running		
count	75.000000				75.0	50.000000		
mean	171.760000				300.0	221.164000		
std	266.188352				0.0	128.792955		
min	5.000000				300.0	0.070000		
25%	22.500000				300.0	91.107500		
50%	41.000000				300.0	300.310000		
75%	195.000000				300.0	300.632500		
max	1000.000000				300.0	303.150000		
IIIUX	1000.000000	340.00000	0 12300.000000	20.000000	300.0	303.130000		
count	n_rect	n_car				me_running		
		41.000000	41.000000	41.000000	41.0	41.000000		
mean	24.487805 12.625613	9.195122	2629.268293	4.926829	300.0 0.0	203.535854		
std		4.462172	2980.456668	5.091121		136.198725		
min	5.000000	3.000000	100.000000	1.000000	300.0	0.070000		
25%	14.000000	5.000000	450.000000	1.000000 2.000000	300.0	9.310000		
50%	24.000000	9.000000	1050.000000	2.000000		000 400000		
750/		40 000000	4500 000000		300.0	300.190000		
75%		12.000000	4500.000000	8.000000	300.0	300.420000		
75% max			4500.000000 12300.000000					
		20.000000	12300.000000	8.000000 20.000000	300.0 300.0	300.420000 301.110000	 TIME_LIMIT_PER_ITER =	1
	53.000000	20.000000 ANALYTICAL	12300.000000 DATA OF heuris	8.000000 20.000000 stic_bestfit_a	300.0 300.0 area_numpy.py	300.420000 301.110000 		
max 	53.000000 rect_count	20.000000 ANALYTICAL car_coun	12300.000000 DATA OF heuris t t total cost	8.000000 20.000000 stic_bestfit_a	300.0 300.0 area_numpy.py	300.420000 301.110000 / WITH GLOBAL_T	L_TIME_LIMIT_PER_ITER	time_exceeded_count
max count	53.000000 	20.000000 ANALYTICAL car_coun 75.00000	DATA OF heuris t total cost 0 75.000000	8.000000 20.000000 stic_bestfit_a cars used (300.0 300.0 area_numpy.py 	300.420000 301.110000 / WITH GLOBAL_T	TIME_LIMIT_PER_ITER 75.0	time_exceeded_count
max count mean	53.000000 rect_count 75.000000 171.760000	20.000000 ANALYTICAL car_coun 75.00000 59.85333	12300.000000 DATA OF heuris t total cost 0 75.000000 3 2794.66666	8.000000 20.000000 stic_bestfit_a c cars used (300.0 300.0 area_numpy.py count runnir 90000 75.	300.420000 301.110000 / WITH GLOBAL_ ing time GLOBAL 000000 801636	L_TIME_LIMIT_PER_ITER 75.0 1.0	time_exceeded_count 75.0
max count mean std	75.000000 rect_count 75.000000 171.760000 266.188352	20.000000 ANALYTICAL car_coun 75.00000 59.85333 91.96954	12300.000000 DATA OF heuris t total cost 0 75.000000 3 2794.666667 5 3585.712768	8.000000 20.000000 stic_bestfit_a c cars used (7.5.00 9.30 13.44	300.0 300.0 area_numpy.py 	300.420000 301.110000 WITH GLOBAL_ og time GLOBAL 000000 801636 575140	TIME_LIMIT_PER_ITER 75.0 1.0 0.0	time_exceeded_count 75.0 0.0
max count mean std min	75.000000 171.760000 266.188352 5.000000	20.000000 ANALYTICAL car_coun 75.00000 59.85333 91.96954 0 3.00000	DATA OF heuris t total cost 0 75.000000 3 2794.66666 5 3585.712768 0 100.000000	8.000000 20.000000 stic_bestfit_a c cars used (75.00 9.30 5.13.44 0.1.00	300.0 300.0 area_numpy.py 	300.420000 301.110000 WITH GLOBAL_1 og time GLOBAL 000000 801636 575140 000972	TIME_LIMIT_PER_ITER 75.0 1.0 0.0 1.0	time_exceeded_count 75.0 0.0 0.0
max count mean std min 25%	53.000000 rect_count 75.000000 171.760000 266.188352 5.000000 22.500000	20.000000 	DATA OF heuris t total cost 75.00000 2794.66666 5 3585.71276 0 100.000000 0 700.000000	8.000000 20.000000 stic_bestfit_a c cars used () 75.00 7 9.30 6 13.44 0 1.00 0 1.50	300.0 300.0 area_numpy.py count runnir 20000 75. 206667 1. 49579 3. 20000 0.	300.420000 301.110000 WITH GLOBAL_T og time GLOBAL 000000 801636 575140 000972 043383	TIME_LIMIT_PER_ITER 75.0 1.0 0.0 1.0 1.0	time_exceeded_count 75.0 0.0 0.0
max count mean std min 25% 50%	75.000000 171.760000 266.188352 5.00000 22.500000 41.000000	20.000000 ANALYTICAL Car_coun 75.00000 59.85333 91.96954 3.00000 9.00000 15.00000	DATA OF heuris t total cost 0 75.00000 3 2794.66666 5 3585.71276 0 100.00000 0 700.00000 0 1150.00000	8.000000 20.000000 stic_bestfit_a c cars used 7.000000 7.0000000000 7.00000000000000	300.0 300.0 area_numpy.py count runnir 200000 75. 206667 1. 49579 3. 200000 0.	300.420000 301.110000 WITH GLOBAL_T og time GLOBAL 000000 801636 575140 000972 043383 181485	L_TIME_LIMIT_PER_ITER 75.0 1.0 0.0 1.0 1.0 1.0	time_exceeded_count 75.0 0.0 0.0 0.0 0.0
max count mean std min 25%	53.000000 rect_count 75.000000 171.760000 266.188352 5.000000 22.500000	20.000000 ANALYTICAL car_coun 75.00000 59.85333 91.96954 3.00000 9.00000 15.00000 68.00000	DATA OF heuris t total cost 75.00000 3 2794.66666 5 3585.71276 0 100.00000 0 700.00000 0 1150.00000 0 3325.000000	8.000000 20.000000 stic_bestfit_a c cars used (75.00 79.30 13.44 1.00 1.55 1.00 1.50 1.00 1.00 1.00 1.00	300.0 300.0 area_numpy.py count runnir 20000 75. 206667 1. 49579 3. 200000 0. 200000 0.	300.420000 301.110000 WITH GLOBAL_T og time GLOBAL 000000 801636 575140 000972 043383	TIME_LIMIT_PER_ITER 75.0 1.0 0.0 1.0 1.0	time_exceeded_count 75.0 0.0 0.0 0.0 0.0 0.0

List of tasks

Hoàng Trần Nhật Minh

- Leader (100%)
- Data analysis (5%)
- Heuristic (100%)
- Report (100%)
- Slide (70%)

Nguyễn Hoàng Phúc

• Data analysis (95%)

Nguyễn Hải Long

- MIP model (100%)
- Slide (15%)

Nguyễn Ngọc Dũng

- CP model (100%)
- Slide (15%)