

```

1 "E:\1 \ \ \ \ \3 \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \_LW\_ \ \ \ \ \ \4 \ \ \ \ \ \3 python\_code\1 exzample\2 \ \ \ \ \ \ \ \ \ \ \ \9 Code for
  this paper\Scripts\python.exe" "D:\Python\Pycharm\setroule\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=
  client --port=22621
2
3 import sys; print('Python %s on %s' % (sys.version, sys.platform))
4 sys.path.extend(['E:\1 \ \ \ \ \ \3 \ \ \ \ \ \ \ \ \ \ \ \1 \ \ \ \ \ \ \ \ \ \ \ \1 \_LW\_ \ \ \ \ \ \4 \ \ \ \ \ \3 python\_code\9 Code for this
  paper', 'E:/1 \ \ \ \ \ /3 \ \ \ \ \ /1 \ \ \ \ \ \ \ \ \ \ \ /1 \ \ \ \ \ \ \ \ \ \ \ /1 \_LW\_ \ \ \ \ \ /4 \ \ \ \ \ /3 python\_code/9 Code for this paper'])
5
6 PyDev console: starting.
7
8 Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
9 >>> runfile('E:/1 \ \ \ \ \ /3 \ \ \ \ \ \ /1 \ \ \ \ \ \ \ \ \ \ \ /1 \ \ \ \ \ \ \ \ \ \ \ /1 \_LW\_ \ \ \ \ \ /4 \ \ \ \ \ /3 python\_code/9 Code for this paper/
  main_RO_BDC.py', wdir='E:/1 \ \ \ \ \ /3 \ \ \ \ \ \ /1 \ \ \ \ \ \ \ \ \ \ \ /1 \ \ \ \ \ \ \ \ \ \ \ /1 \_LW\_ \ \ \ \ \ /4 \ \ \ \ \ /3 python\_code/9 Code for
  this paper')
10 Backend TkAgg is interactive backend. Turning interactive mode on.
11 Waiting 5s.....
12 Set parameter MIPGap to value 1e-10
13 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
14
15 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
16 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
17
18 Optimize a model with 602799 rows, 52642 columns and 1675285 nonzeros
19 Model fingerprint: 0xc5c8e864
20 Variable types: 1 continuous, 52641 integer (52605 binary)
21 Coefficient statistics:
22   Matrix range   [1e+00, 1e+10]
23   Objective range [1e+00, 2e+01]
24   Bounds range   [1e+00, 1e+00]
25   RHS range      [1e+00, 2e+10]
26 Warning: Model contains large matrix coefficients
27 Warning: Model contains large rhs
28   Consider reformulating model or setting NumericFocus parameter
29   to avoid numerical issues.
30 Presolve removed 381477 rows and 26559 columns (presolve time = 5s) ...
31 Presolve removed 526889 rows and 37081 columns (presolve time = 10s) ...
32 Presolve removed 526889 rows and 37081 columns
33 Presolve time: 10.28s
34 Presolved: 75910 rows, 15561 columns, 248987 nonzeros
35 Variable types: 0 continuous, 15561 integer (15534 binary)
36
37 Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
38 Showing first log only...
39
40 Root relaxation presolved: 15561 rows, 91471 columns, 264548 nonzeros
41
42
43 Root simplex log...
44
45 Iteration   Objective    Primal Inf.   Dual Inf.    Time
46    0  8.460000e+02  0.000000e+00  1.036000e+03  11s
47 Concurrent spin time: 0.00s
48
49 Solved with dual simplex (primal model)
50
51 Root relaxation: objective 8.460000e+02, 2529 iterations, 0.48 seconds (0.40 work units)
52
53   Nodes | Current Node | Objective Bounds | Work
54 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
55
56    0  0  846.00000  0  19      - 846.00000      - - 12s
57 H  0  0          3806.000000 846.00000 77.8% - 12s
58    0  0  846.00000  0 174 3806.00000 846.00000 77.8% - 13s
59    0  0  846.00000  0 168 3806.00000 846.00000 77.8% - 13s
60 H  0  0          1786.000000 846.00000 52.6% - 13s
61 H  0  0          1206.000000 846.00000 29.9% - 13s
62    0  0  846.00000  0 154 1206.00000 846.00000 29.9% - 13s
63    0  0  846.00000  0 153 1206.00000 846.00000 29.9% - 13s
64    0  0  846.00000  0 11 1206.00000 846.00000 29.9% - 15s
65    0  0  846.00000  0 20 1206.00000 846.00000 29.9% - 15s
66    0  0  846.00000  0 82 1206.00000 846.00000 29.9% - 15s
67    0  0  846.00000  0 16 1206.00000 846.00000 29.9% - 18s
68    0  0  846.00000  0 19 1206.00000 846.00000 29.9% - 18s
69    0  0  846.00000  0 20 1206.00000 846.00000 29.9% - 19s
70    0  0  846.00000  0 20 1206.00000 846.00000 29.9% - 19s
71    0  2  846.00000  0 20 1206.00000 846.00000 29.9% - 23s
72    5  8  846.00000  3 121 1206.00000 846.00000 29.9% 1698 25s
73 H 30 32          1106.000000 846.00000 23.5% 478 27s
74    56 67 846.00000 11 206 1106.00000 846.00000 23.5% 695 31s
75 H 66 67          846.000000 846.00000 0.00% 618 31s
76
77 Cutting planes:
78 Cover: 162
79 Implied bound: 1841

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80 Clique: 7
81 MIR: 41
82 StrongCG: 24
83 GUB cover: 5
84 Zero half: 1
85 RLT: 5
86 Relax-and-lift: 644
87
88 Explored 80 nodes (70377 simplex iterations) in 31.44 seconds (47.23 work units)
89 Thread count was 8 (of 8 available processors)
90
91 Solution count 5: 846 1106 1206 ... 3806
92
93 Optimal solution found (tolerance 1.00e-10)
94 Best objective 8.460000000000e+02, best bound 8.460000000000e+02, gap 0.0000%
95 Set parameter MIPGap to value 1e-08
96 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
97
98 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
99 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
100
101 Optimize a model with 2481763 rows, 1955335 columns and 17236456 nonzeros
102 Model fingerprint: 0x3c869cee
103 Variable types: 963295 continuous, 992040 integer (985965 binary)
104 Coefficient statistics:
105 Matrix range [1e-01, 1e+10]
106 Objective range [6e-05, 5e+01]
107 Bounds range [1e+00, 8e+01]
108 RHS range [8e-01, 1e+10]
109 Warning: Model contains large matrix coefficients
110 Warning: Model contains large rhs
111 Consider reformulating model or setting NumericFocus parameter
112 to avoid numerical issues.
113 Presolve removed 2478118 rows and 1954044 columns (presolve time = 5s) ...
114 Presolve removed 2478962 rows and 1954283 columns
115 Presolve time: 6.46s
116 Presolved: 2801 rows, 1052 columns, 7492 nonzeros
117 Variable types: 5 continuous, 1047 integer (623 binary)
118 Found heuristic solution: objective 3368.0500186
119 Found heuristic solution: objective 3454.0500186
120
121 Root simplex log...
122
123 Iteration Objective Primal Inf. Dual Inf. Time
124 0 7.9102796e+03 2.792431e+03 0.000000e+00 8s
125 802 4.6850500e+03 0.000000e+00 0.000000e+00 8s
126
127 Root relaxation: objective 4.685050e+03, 802 iterations, 0.01 seconds (0.01 work units)
128
129 Nodes | Current Node | Objective Bounds | Work
130 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
131
132 0 0 4685.05002 0 27 3454.05002 4685.05002 35.6% - 8s
133 H 0 0 4658.0500186 4685.05002 0.58% - 8s
134 H 0 0 4678.0500186 4685.05002 0.15% - 8s
135 * 0 0 0 4685.0500186 4685.05002 0.00% - 8s
136
137 Cutting planes:
138 Learned: 6
139 Mod-K: 1
140
141 Explored 1 nodes (1211 simplex iterations) in 8.57 seconds (7.80 work units)
142 Thread count was 8 (of 8 available processors)
143
144 Solution count 5: 4685.05 4678.05 4658.05 ... 3368.05
145
146 Optimal solution found (tolerance 1.00e-08)
147 Best objective 4.685050018628e+03, best bound 4.685050018628e+03, gap 0.0000%
148 SP is solved
149 SP's optimal solution is'□4685
150
151 Itr = 0
152 Collect_LB = [846.0]
153 Collect_UB = [10216.100037255637]
154 Collect_Hua = [0.0]
155 Collect_SPObjVal = [4685.050018627819]
156 Collect_MPObjValNHua = [846.0]
157
158
159 Set parameter TimeLimit to value 12000
160 Set parameter MIPGap to value 0.0005
161 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
162
163 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]

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164 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
165
166 Optimize a model with 609509 rows, 283978 columns and 1682049 nonzeros
167 Model fingerprint: 0xfd3b0761
168 Variable types: 1 continuous, 283977 integer (283941 binary)
169 Coefficient statistics:
170   Matrix range    [1e+00, 1e+10]
171   Objective range [1e+00, 2e+01]
172   Bounds range   [1e+00, 1e+00]
173   RHS range      [1e+00, 2e+10]
174 Warning: Model contains large matrix coefficients
175 Warning: Model contains large rhs
176   Consider reformulating model or setting NumericFocus parameter
177   to avoid numerical issues.
178 Presolve removed 442591 rows and 265694 columns (presolve time = 5s) ...
179 Presolve removed 559101 rows and 275982 columns (presolve time = 10s) ...
180 Presolve removed 559146 rows and 275982 columns
181 Presolve time: 10.18s
182 Presolved: 50363 rows, 7996 columns, 128306 nonzeros
183 Variable types: 0 continuous, 7996 integer (7969 binary)
184 Root relaxation presolved: 7996 rows, 58359 columns, 136302 nonzeros
185
186
187 Root simplex log...
188
189 Iteration   Objective    Primal Inf.   Dual Inf.    Time
190    0   handle free variables                11s
191   7699   5.5310500e+03  0.0000000e+00  0.0000000e+00  12s
192   7699   5.5310500e+03  0.0000000e+00  0.0000000e+00  12s
193
194 Root relaxation: objective 5.531050e+03, 7699 iterations, 1.62 seconds (2.53 work units)
195
196   Nodes | Current Node | Objective Bounds | Work
197 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
198
199   0   0 5531.05002   0 11      - 5531.05002   - - 12s
200   0   0 5531.05002   0 224     - 5531.05002   - - 14s
201   0   0 5531.05002   0 152     - 5531.05002   - - 14s
202   0   0 5531.05002   0 152     - 5531.05002   - - 14s
203   0   0 5531.05002   0 31      - 5531.05002   - - 16s
204   0   0 5531.05002   0 57      - 5531.05002   - - 16s
205   0   0 5531.05002   0 111     - 5531.05002   - - 18s
206   0   0 5531.05002   0 141     - 5531.05002   - - 19s
207   0   0 5531.05002   0 15      - 5531.05002   - - 21s
208 H  0   0          9531.0500186 5531.05002 42.0% - 21s
209   0   0 5531.05002   0 13 9531.05002 5531.05002 42.0% - 21s
210 H  0   0          5531.0500186 5531.05002 0.00% - 21s
211   0   0 5531.05002   0 13 5531.05002 5531.05002 0.00% - 21s
212
213 Cutting planes:
214   Learned: 1
215   Gomory: 2
216   Cover: 132
217   Implied bound: 36
218   Clique: 1630
219   MIR: 41
220   StrongCG: 10
221   GUB cover: 43
222   RLT: 6
223   Relax-and-lift: 8
224   BQP: 9
225
226 Explored 1 nodes (45069 simplex iterations) in 22.00 seconds (28.30 work units)
227 Thread count was 8 (of 8 available processors)
228
229 Solution count 2: 5531.05 9531.05
230
231 Optimal solution found (tolerance 5.00e-04)
232 Best objective 5.531050018628e+03, best bound 5.531050018628e+03, gap 0.0000%
233 Set parameter MIPGap to value 1e-08
234 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
235
236 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
237 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
238
239 Optimize a model with 2481763 rows, 1955335 columns and 17236456 nonzeros
240 Model fingerprint: 0xbe992c7b
241 Variable types: 963295 continuous, 992040 integer (985965 binary)
242 Coefficient statistics:
243   Matrix range    [1e-01, 1e+10]
244   Objective range [6e-05, 5e+01]
245   Bounds range   [1e+00, 8e+01]
246   RHS range      [8e-01, 1e+10]
247 Warning: Model contains large matrix coefficients

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248 Warning: Model contains large rhs
249     Consider reformulating model or setting NumericFocus parameter
250     to avoid numerical issues.
251 Presolve removed 2476632 rows and 1953632 columns (presolve time = 5s) ...
252 Presolve removed 2476635 rows and 1953636 columns
253 Presolve time: 5.51s
254 Presolved: 5128 rows, 1699 columns, 13671 nonzeros
255 Variable types: 8 continuous, 1691 integer (967 binary)
256 Found heuristic solution: objective 3516.0500186
257 Found heuristic solution: objective 3536.0500186
258
259 Root simplex log...
260
261 Iteration   Objective      Primal Inf.   Dual Inf.   Time
262      0    1.0879280e+04  4.858573e+03  0.000000e+00  7s
263    1387   5.1331929e+03  0.000000e+00  0.000000e+00  7s
264
265 Root relaxation: objective 5.133193e+03, 1387 iterations, 0.02 seconds (0.02 work units)
266
267 Nodes | Current Node | Objective Bounds | Work
268 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
269
270 H  0  0           5133.1928758 15078.7410 194% - 7s
271   0  0   -  0    5133.19288 5133.19288 0.00% - 7s
272
273 Explored 1 nodes (1762 simplex iterations) in 7.29 seconds (7.40 work units)
274 Thread count was 8 (of 8 available processors)
275
276 Solution count 3: 5133.19 3536.05 3516.05
277
278 Optimal solution found (tolerance 1.00e-08)
279 Best objective 5.133192875771e+03, best bound 5.133192875771e+03, gap 0.00000%
280 SP is solved
281 SP's optimal solution is'□5133
282
283 Itr = 1
284 Collect_LB = [846.0, 5531.050018627819]
285 Collect_UB = [10216.100037255637, 5979.192875770674]
286 Collect_Hua = [0.0, 4685.050018627819]
287 Collect_SPObjVal = [4685.050018627819, 5133.192875770674]
288 Collect_MPObjValNHua = [846.0, 846.0]
289
290
291 Set parameter TimeLimit to value 12000
292 Set parameter MIPGap to value 0.0005
293 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
294
295 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
296 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
297
298 Optimize a model with 609510 rows, 283978 columns and 1682068 nonzeros
299 Model fingerprint: 0xea7a6c05
300 Variable types: 1 continuous, 283977 integer (283941 binary)
301 Coefficient statistics:
302   Matrix range    [1e+00, 1e+10]
303   Objective range [1e+00, 2e+01]
304   Bounds range    [1e+00, 1e+00]
305   RHS range       [1e+00, 2e+10]
306 Warning: Model contains large matrix coefficients
307 Warning: Model contains large rhs
308     Consider reformulating model or setting NumericFocus parameter
309     to avoid numerical issues.
310 Presolve removed 446096 rows and 266092 columns (presolve time = 5s) ...
311 Presolve removed 560049 rows and 276105 columns (presolve time = 10s) ...
312 Presolve removed 560049 rows and 276105 columns
313 Presolve time: 10.07s
314 Presolved: 49461 rows, 7873 columns, 126056 nonzeros
315 Variable types: 0 continuous, 7873 integer (7846 binary)
316 Root relaxation presolved: 7873 rows, 57334 columns, 133929 nonzeros
317
318
319 Root simplex log...
320
321 Iteration   Objective      Primal Inf.   Dual Inf.   Time
322      0    handle free variables          10s
323    7498   5.9970500e+03  0.000000e+00  0.000000e+00  12s
324    7498   5.9970500e+03  0.000000e+00  0.000000e+00  12s
325
326 Root relaxation: objective 5.997050e+03, 7498 iterations, 1.62 seconds (2.26 work units)
327
328 Nodes | Current Node | Objective Bounds | Work
329 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
330
331   0  0 5997.05002  0  97      -5997.05002  -  - 12s

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unknown

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332 0 0 5997.05002 0 381 - 5997.05002 - - 15s
333 0 0 5997.05002 0 313 - 5997.05002 - - 15s
334 0 0 5997.05002 0 183 - 5997.05002 - - 16s
335 0 0 5997.05002 0 225 - 5997.05002 - - 16s
336 0 0 5997.05002 0 198 - 5997.05002 - - 21s
337 0 0 5997.05002 0 207 - 5997.05002 - - 23s
338 0 0 5997.05002 0 351 - 5997.05002 - - 27s
339 0 0 5997.05002 0 331 - 5997.05002 - - 27s
340 0 0 5997.05002 0 54 - 5997.05002 - - 30s
341 0 0 5997.05002 0 186 - 5997.05002 - - 30s
342 0 0 5997.05002 0 57 - 5997.05002 - - 32s
343 0 0 5997.05002 0 54 - 5997.05002 - - 32s
344 H 0 0 10117.050019 5997.05002 40.7% - 33s
345 0 0 5997.05002 0 50 10117.0500 5997.05002 40.7% - 33s
346 H 0 0 8157.0500186 5997.05002 26.5% - 34s
347 H 0 0 5997.0500186 5997.05002 0.00% - 36s
348 0 0 5997.05002 0 50 5997.05002 5997.05002 0.00% - 36s
349
350 Cutting planes:
351 Learned: 13
352 Gomory: 1
353 Cover: 170
354 Implied bound: 509
355 Clique: 1693
356 MIR: 108
357 StrongCG: 65
358 GUB cover: 61
359 RLT: 16
360 Relax-and-lift: 35
361 BQP: 6
362 PSD: 1
363
364 Explored 1 nodes (58296 simplex iterations) in 36.26 seconds (35.94 work units)
365 Thread count was 8 (of 8 available processors)
366
367 Solution count 3: 5997.05 8157.05 10117.1
368
369 Optimal solution found (tolerance 5.00e-04)
370 Best objective 5.997050018628e+03, best bound 5.997050018628e+03, gap 0.0000%
371 Set parameter MIPGap to value 1e-08
372 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
373
374 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
375 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
376
377 Optimize a model with 2481763 rows, 1955335 columns and 17236456 nonzeros
378 Model fingerprint: 0xd3b809af
379 Variable types: 963295 continuous, 992040 integer (985965 binary)
380 Coefficient statistics:
381 Matrix range [1e-01, 1e+10]
382 Objective range [6e-05, 5e+01]
383 Bounds range [1e+00, 8e+01]
384 RHS range [8e-01, 1e+10]
385 Warning: Model contains large matrix coefficients
386 Warning: Model contains large rhs
387 Consider reformulating model or setting NumericFocus parameter
388 to avoid numerical issues.
389 Presolve removed 2476721 rows and 1953711 columns (presolve time = 5s) ...
390 Presolve removed 2476745 rows and 1953714 columns
391 Presolve time: 5.59s
392 Presolved: 5018 rows, 1621 columns, 13278 nonzeros
393 Variable types: 8 continuous, 1613 integer (931 binary)
394
395 Root simplex log...
396
397 Iteration Objective Primal Inf. Dual Inf. Time
398 0 9.7234519e+03 4.617892e+03 0.000000e+00 7s
399 1336 5.0791929e+03 0.000000e+00 0.000000e+00 7s
400
401 Root relaxation: objective 5.079193e+03, 1336 iterations, 0.02 seconds (0.01 work units)
402
403 Nodes | Current Node | Objective Bounds | Work
404 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
405
406 H 0 0 5079.1928758 14424.7410 184% - 7s
407 0 0 - 0 5079.19288 5079.19288 0.00% - 7s
408
409 Explored 1 nodes (1784 simplex iterations) in 7.43 seconds (7.36 work units)
410 Thread count was 8 (of 8 available processors)
411
412 Solution count 1: 5079.19
413
414 Optimal solution found (tolerance 1.00e-08)
415 Best objective 5.079192875771e+03, best bound 5.079192875771e+03, gap 0.0000%
```

```
416 SP is solved
417 SP's optimal solution is'□5079
418
419 Itr = 2
420 Collect_LB = [846.0, 5531.050018627819, 5997.050018627817]
421 Collect_UB = [10216.100037255637, 5979.192875770674, 5943.050018627817]
422 Collect_Hua = [0.0, 4685.050018627819, 5133.192875770674]
423 Collect_SPObjVal = [4685.050018627819, 5133.192875770674, 5079.192875770674]
424 Collect_MPObjValNHua = [846.0, 846.0, 863.8571428571431]
425
426
427 Ops, stop iteration
428 Values adopted from the Itr-1' th iteration, and Itr = {2}, judgeCount = {1}
429
430 ~~~~~judgeCount = 1, SPObj_SPF = 5133.192875770674
431 Vessel i: 0: pi: 0-7, ai-di: 6-22, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 6-22, taoi-deltai: 6-21, taoPi_SP-deltaPi_SP: 6-21, betaNi: 15
, bi: 15
432 Vessel i: 1: pi: 0-7, ai-di: 48-75, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 48-75, taoi-deltai: 48-74, taoPi_SP-deltaPi_SP: 48-70, betaNi:
26, bi: 26
433 Vessel i: 2: pi: 7-14, ai-di: 25-52, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 25-52, taoi-deltai: 25-51, taoPi_SP-deltaPi_SP: 25-51, betaNi
: 26, bi: 26
434 Vessel i: 3: pi: 7-12, ai-di: 14-21, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 14-21, taoi-deltai: 14-20, taoPi_SP-deltaPi_SP: 14-20, betaNi
: 6, bi: 6
435 Vessel i: 4: pi: 14-21, ai-di: 6-30, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 6-30, taoi-deltai: 6-29, taoPi_SP-deltaPi_SP: 6-29, betaNi: 23
, bi: 23
436 Vessel i: 5: pi: 15-22, ai-di: 37-62, gi_SP-gpi_SP: 0.821429-0.400000, ai_SP-di: 41-62, taoi-deltai: 42-55, taoPi_SP-deltaPi_SP: 42-55,
betaNi: 13, bi: 13
437 Vessel i: 6: pi: 8-13, ai-di: 2-21, gi_SP-gpi_SP: 0.750000-0.000000, ai_SP-di: 8-21, taoi-deltai: 5-11, taoPi_SP-deltaPi_SP: 8-11, betaNi: 6
, bi: 6
438 Vessel i: 7: pi: 28-34, ai-di: 7-27, gi_SP-gpi_SP: 0.400000-1.000000, ai_SP-di: 11-27, taoi-deltai: 9-14, taoPi_SP-deltaPi_SP: 11-14, betaNi:
5, bi: 5
439 Vessel i: 8: pi: 27-34, ai-di: 51-71, gi_SP-gpi_SP: 0.428571-1.000000, ai_SP-di: 54-71, taoi-deltai: 54-59, taoPi_SP-deltaPi_SP: 54-59,
betaNi: 5, bi: 5
440
441 round LB = [846, 5531, 5997]
442 round UB = [10216, 5979, 5943]
443 round Hua = [0, 4685, 5133]
444 round SPObjVal = [4685, 5133, 5079]
445 round MPObjValNHua = [846, 846, 864]
446
447 OptimalObj = 5997.050018627817
448 Time: 638.000000
449
450
451
452
```