```
this paper\Scripts\python.exe" "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\pydevconsole.py" --mode=
   client --port=39158
   import sys; print('Python %s on %s' % (sys.version, sys.platform))
4
   6
   PyDev console: starting
   Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
8
   >>> runfile('E:/1 000/3 0000/1 00000/1 000000/1 000000/1 000000/1 LW 000/3 python_code/9 Code for this paper/main_RO_TWS.py', wdir='E:/1 0000/3 0000/1 000000/1 000000/1 000000/1 000000/1 LW 000/3 python_code/9 Code for
   this paper')
  Backend TkAgg is interactive backend. Turning interactive mode on.
   Waiting 5s....
   Set parameter MIPGap to value 1e-10
12
   Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
13
15
   CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
   Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
16
17
   Optimize a model with 554430 rows, 52642 columns and 1554628 nonzeros
19
   Model fingerprint: 0xf37ad2f3
   Variable types: 1 continuous, 52641 integer (52605 binary)
20
21
   Coefficient statistics:
   Matrix range [1e+00, 1e+10]
    Objective range [1e+00, 2e+01]
23
24
    Bounds range [1e+00, 1e+00]
                 [1e+00, 2e+10]
    RHS range
26
   Warning: Model contains large matrix coefficients
   Warning: Model contains large rhs
27
28
        Consider reformulating model or setting NumericFocus parameter
29
       to avoid numerical issues.
   Presolve removed 330690 rows and 25098 columns (presolve time = 5s) ...
30
31
   Presolve removed 462236 rows and 35319 columns
   Presolve time: 7.82s
   Presolved: 92194 rows, 17323 columns, 283394 nonzeros
34
   Variable types: 0 continuous, 17323 integer (17301 binary)
35
   Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
37
   Showing first log only...
38
39
   Root relaxation presolved: 17323 rows, 109517 columns, 300717 nonzeros
40
41
42
   Root simplex log...
43
44
                       Primal Inf. Dual Inf.
   Iteration Objective
       0 8.0300000e+02 0.000000e+00 1.021000e+03
45
46
   Concurrent spin time: 0.02s
48
   Solved with dual simplex (primal model)
49
50
   Root relaxation: objective 8.030000e+02, 2084 iterations, 0.33 seconds (0.36 work units)
51
52
     Nodes | Current Node | Objective Bounds
                                                  Work
53
   Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
54
        0 803.00000 0 16
55
                               - 803.00000
   H \quad 0 \quad 0
                     3583.0000000 803.00000 77.6% -
56
57
     0 0 803.00000 0 43 3583.00000 803.00000 77.6%
58
  H 0 0
                     2123.0000000 803.00000 62.2% - 10s
59
     0 0 803.00000 0 176 2123.00000 803.00000 62.2%
                                                       - 10s
60
     0
         0 803.00000 0 168 2123.00000 803.00000 62.2%
                                                       - 10s
         0 803.00000 0 14 2123.00000 803.00000 62.2%
                                                      - 12s
- 13s
     0
         0 803.00000 0 14 2123.00000 803.00000 62.2%
62
63
         0 803.00000 0 32 2123.00000 803.00000 62.2%
     0
64 H 0
          0
                     1003.0000000 803.00000 19.9%
         0 803.00000
                    0 28 1003.00000 803.00000 19.9%
65
         0 803.00000 0 27 1003.00000 803.00000 19.9%
66
         0 803.00000 0 14 1003.00000 803.00000 19.9%
67
     0
                                                       - 14s
68
     0
         0 803.00000
                    0 85 1003.00000 803.00000 19.9%
69
         0 803.00000 0 74 1003.00000 803.00000 19.9%
                                                       - 15s
70
         0.803.00000 0.16.1003.00000.803.00000.19.9%
     0
                                                       - 16s
71
     0
         0 803.00000
                     0 16 1003.00000 803.00000 19.9%
                                                        16s
         0 803.00000
                    0 7 1003.00000 803.00000 19.9%
        0 803.00000 0 63 1003.00000 803.00000 19.9%
73
     0
   H 0 0
                     803.0000000 803.00000 0.00% - 23s
74
75
        0 803.00000 0 88 803.00000 803.00000 0.00%
76
  Cutting planes:
77
78
    Gomory: 1
79
    Cover: 77
```

```
Implied bound: 1
 80
 81
      MIR: 7
     StrongCG: 4
 82
 83
     GUB cover: 26
     RLT: 2
 85
     Relax-and-lift: 24
 86
     BQP: 1
 87
 88 Explored 1 nodes (25603 simplex iterations) in 24.04 seconds (46.24 work units)
 89 Thread count was 8 (of 8 available processors)
 90
 91 Solution count 4: 803 1003 2123 3583
 92
 93 Optimal solution found (tolerance 1.00e-10)
 94 Best objective 8.030000000000e+02, best bound 8.03000000000e+02, gap 0.0000%
    Set parameter MIPGap to value 1e-08
 96 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
 98 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
    Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
100
101 Optimize a model with 536186 rows, 14427 columns and 1098485 nonzeros
102 Model fingerprint: 0xf8c80c4a
103 Variable types: 36 continuous, 14391 integer (8316 binary)
104 Coefficient statistics:
105 Matrix range [1e-01, 1e+10]
106 Objective range [6e-05, 5e+01]
     Bounds range [1e+00, 1e+00]
107
                    [8e-01, 1e+10]
108
     RHS range
109 Warning: Model contains large matrix coefficients
110 Warning: Model contains large rhs
          Consider reformulating model or setting NumericFocus parameter
111
112
          to avoid numerical issues.
113 Presolve removed 533874 rows and 13592 columns
114 Presolve time: 0.38s
115 Presolved: 2312 rows, 835 columns, 6149 nonzeros
116 Variable types: 5 continuous, 830 integer (502 binary)
117 Found heuristic solution: objective 3536.0500186
118
119 Root relaxation: objective 4.329050e+03, 655 iterations, 0.00 seconds (0.01 work units)
120
121
       Nodes | Current Node | Objective Bounds
                                                          Work
122
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
123
                         4329.0500186 8215.74099 89.8% - 0s
124 H 0 0
                        4329.05002 4329.05002 0.00% - 0s
125
       0 0
                  - 0
126
127 Explored 1 nodes (967 simplex iterations) in 0.52 seconds (0.77 work units)
128 Thread count was 8 (of 8 available processors)
129
130 Solution count 2: 4329.05 3536.05
131
132 Optimal solution found (tolerance 1.00e-08)
133 Best objective 4.329050018628e+03, best bound 4.329050018628e+03, gap 0.0000%
134 SP is solved
135 SP's optimal solution is' □ 4329
136
137 Itr = 0
138 Collect_LB = [803.0]
139 Collect UB = [9461.100037255623]
140 Collect_Hua = [0.0]
141 Collect SPObjVal = [4329.050018627811]
142 Collect MPObjValNHua = [803.0]
143
144
145 Set parameter MIPGap to value 1e-10
146 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
147
148 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
149 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
150
151 Optimize a model with 563247 rows, 283978 columns and 1563481 nonzeros
152 Model fingerprint: 0x92045efc
153 Variable types: 1 continuous, 283977 integer (283941 binary)
154 Coefficient statistics:
155 Matrix range [1e+00, 1e+10]
156 Objective range [1e+00, 2e+01]
157
     Bounds range [1e+00, 1e+00]
                    [1e+00, 2e+10]
158
     RHS range
159 Warning: Model contains large matrix coefficients
160 Warning: Model contains large rhs
          Consider reformulating model or setting NumericFocus parameter
161
          to avoid numerical issues.
162
163 Presolve removed 404285 rows and 266303 columns (presolve time = 5s) ...
```

```
164 Presolve removed 537986 rows and 276495 columns
165 Presolve time: 7.49s
166 Presolved: 25261 rows, 7483 columns, 100784 nonzeros
167
    Variable types: 0 continuous, 7483 integer (7461 binary)
168
169 Root simplex log...
170
171 Iteration Objective
                          Primal Inf. Dual Inf.
                                                 Time
        0 \quad 5.1320500e{+03} \quad 8.890000e{+02} \quad 0.000000e{+00}
172
       4703 5.1320500e+03 0.000000e+00 0.000000e+00
173
174
175
    Root relaxation: objective 5.132050e+03, 4703 iterations, 0.17 seconds (0.23 work units)
176
177
       Nodes | Current Node | Objective Bounds
                                                        Work
178
     Expl\ Unexpl\ |\ \ Obj\ \ Depth\ IntInf\ |\ Incumbent \qquad BestBd\quad Gap\ |\ It/Node\ Time
179
180
           0 5132.05002 0 36
                                    - 5132.05002
                                                         8s
           0 5132.05002
181
       0
                         0 134
                                    - 5132.05002
                                                         88
182
           0 5132.05002 0 132
                                    - 5132.05002
183
       0
           0 5132.05002
                         0 448
                                    - 5132.05002
                                                          9s
                         0 418
                                    - 5132.05002
184
           0.5132.05002
                                                         9s
       0
185
       0
           0 5132.05002 0 454
                                    - 5132.05002
                                                       - 10s
       0
           0 5132.05002
                         0 156
                                    - 5132.05002
186
187
           0 5132.05002
                         0 565
                                    - 5132.05002
                                                       - 13s
       0
           0 5132.05002
188
                         0 507
                                    - 5132.05002
       0
                                                       - 13s
189
       0
           0 5132.05002
                         0 303
                                    - 5132.05002
                                                       - 17s
           0 5132.05002 0 297
190
                                    - 5132.05002
                                                       - 17s
191
       0
           0.5132.05002 0.514
                                    - 5132.05002
                                                       - 19s
192
       0
           0 5132.05002 0 340
                                    - 5132.05002
193 H
        0
                        7652.0500186 5132.05002 32.9% - 25s
194
       0 0 5132.05002 0 303 7652.05002 5132.05002 32.9%
195 H 0
                        7052.0500186 5132.05002 27.2%
           0
196 H 0
           0
                        6972.0500186 5132.05002 26.4%
                                                         - 27s
197 H 0
                        6572.0500186 5132.05002 21.9%
198
           2 5132.05002 0 303 6572.05002 5132.05002 21.9% - 28s
199
           8 5132.05002 2 493 6572.05002 5132.05002 21.9% 7035 31s
200
       15
           20 5134.13314 4 1219 6572.05002 5132.05002 21.9% 5430 35s
201
       28
           34 5132.05002 6 663 6572.05002 5132.05002 21.9% 4266 40s
           52 5133.55107 9 1138 6572.05002 5132.05002 21.9% 2841 45s
202
       63
203
      130 129 5251.57943 16 874 6572.05002 5132.05002 21.9% 2108 50s
204 H 225 234
                          5932.0500186 5132.05002 13.5% 1272 52s
205 H 391 264
                          5852.0500186 5132.05002 12.3% 758 53s
      445 332 5612.05002 112 151 5852.05002 5132.05002 12.3% 679 55s
206
207 H 592 228
                          5412.0500186 5132.05002 5.17% 584 58s
      599 240 5141.30069 12 753 5412.05002 5132.05002 5.17% 609
208
                                                                     60s
      763 215 5152.05002 44 610 5412.05002 5132.05002 5.17% 563
209
                                                                     65s
                          5332.0500186 5132.05002 3.75% 591 67s
210 H 807 229
      821 238 5152.05002 52 608 5332.05002 5132.05002 3.75% 609
      888 154 5152.05002 55 303 5332.05002 5132.05002 3.75% 624 81s
212
      894 158 5302.05002 5 646 5332.05002 5175.18834 2.94% 620 85s
213
214
      900 162 5192.05002 6 471 5332.05002 5192.05002 2.63% 616
                                                                    90s
215 H 905 156
                          5232.0500186 5192.05002 0.76% 612 94s
216
217 Cutting planes:
218
     Learned: 1
219
     Gomory: 27
220
     Cover: 426
221
     Implied bound: 40
222
      Projected implied bound: 43
223
     Clique: 68
224
      MIR: 98
225
      StrongCG: 34
226
     Flow cover: 231
227
      GUB cover: 53
228
      Zero half: 92
229
      RLT: 13
230
     Relax-and-lift: 115
231
      BOP: 2
232
233 Explored 906 nodes (712058 simplex iterations) in 95.05 seconds (234.58 work units)
234 Thread count was 8 (of 8 available processors)
235
236
    Solution count 9: 5232.05 5332.05 5412.05 ... 7652.05
237
238 Optimal solution found (tolerance 1 00e-10)
239 Best objective 5.232050018628e+03, best bound 5.232050018628e+03, gap 0.0000%
240 Set parameter MIPGap to value 1e-08
241 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
242
243 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
244
    Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
245
246 Optimize a model with 536186 rows, 14427 columns and 1098485 nonzeros
    Model fingerprint: 0xc35efe82
247
```

```
248 Variable types: 36 continuous, 14391 integer (8316 binary)
249 Coefficient statistics:
     Matrix range [1e-01, 1e+10]
250
251
      Objective range [6e-05, 5e+01]
252
     Bounds range [1e+00, 1e+00]
253
     RHS range
                    [8e-01, 1e+10]
254 Warning: Model contains large matrix coefficients
255 Warning: Model contains large rhs
256
          Consider reformulating model or setting NumericFocus parameter
257
          to avoid numerical issues.
258 Presolve removed 531398 rows and 12899 columns
259 Presolve time: 0.38s
260 Presolved: 4788 rows, 1528 columns, 12871 nonzeros
261 Variable types: 8 continuous, 1520 integer (882 binary)
262 Found heuristic solution: objective 3697.0500186
263
264 Root relaxation: objective 5.285581e+03, 1398 iterations, 0.01 seconds (0.02 work units)
265
266
       Nodes | Current Node | Objective Bounds
                                                     Work
267
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
268
       0 0 5285.58074 0 11 3697.05002 5285.58074 43.0% - 0s
269
                        4376.5807430 5285.58074 20.8% - 0s
270 H 0 0
271 H 0 0
                        5285.5807430 5285.58074 0.00%
       0 0 5285.58074 0 11 5285.58074 5285.58074 0.00%
272
273
274 Explored 1 nodes (1896 simplex iterations) in 0.58 seconds (0.80 work units)
275 Thread count was 8 (of 8 available processors)
276
277 Solution count 3: 5285.58 4376.58 3697.05
278
279 Optimal solution found (tolerance 1.00e-08)
280 Best objective 5.285580742960e+03, best bound 5.285580742960e+03, gap 0.0000%
281 SP is solved
282 SP's optimal solution is' ☐ 5285
283
284 Itr = 1
285 Collect LB = [803.0, 5232.050018627811]
286 Collect_UB = [9461.100037255623, 6188.580742959544]
287 Collect_Hua = [0.0, 4329.050018627811]
288 Collect_SPObjVal = [4329.050018627811, 5285.580742959544]
289 Collect MPObjValNHua = [803.0, 903.0]
290
291
292 Set parameter MIPGap to value 1e-10
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 563247 rows, 283978 columns and 1563481 nonzeros
299 Model fingerprint: 0xfa7b8115
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]
      Bounds range [1e+00, 1e+00]
304
                   [1e+00, 2e+10]
305
     RHS range
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 413428 rows and 267080 columns (presolve time = 5s) ...
311 Presolve removed 539039 rows and 276661 columns
312 Presolve time: 7.74s
313 Presolved: 24208 rows, 7317 columns, 96550 nonzeros
314 Variable types: 0 continuous, 7317 integer (7295 binary)
315
316 Root simplex log...
317
                          Primal Inf. Dual Inf.
318 Iteration Objective
                                                 Time
        0 6.1071522e+03 8.840000e+02 0.000000e+00
319
320
       3521 6.1071522e+03 0.000000e+00 0.000000e+00
321
322 Root relaxation: objective 6.107152e+03, 3521 iterations, 0.08 seconds (0.10 work units)
323
324
       Nodes | Current Node | Objective Bounds
325
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
326
327
           0 6107.15217 0 34
                                    - 6107.15217
328
           0 6107.15217 0 136
                                     - 6107.15217
                                                   - - 9s
329
       0
           0 6107.15217 0 147
                                     - 6107.15217
330
       0
           0 6107.15217 0 127
                                     - 6107.15217
                                                          9s
       0
           0 6107.15217 0 264
                                     - 6107.15217
                                                          9s
331
```

```
0 6107.15217 0 258
                                    - 6107.15217
332
333
           0.6107.15217 \quad 0.226
                                    - 6107.15217
                                                      - 11s
                         0 224
                                    - 6107.15217
334
           0.6107.15217
                                                      - 11s
335
       0
           0 6107.15217
                         0.427
                                    -6107.15217
                                                      - 11s
           0 6107.15217 0 458
                                    - 6107.15217
336
337
       0
           0 6107.15217 0 198
                                    - 6107.15217
                                                      - 15s
338
           0 6107.15217 0 244
                                    - 6107.15217
                                                      - 15s
       0
339
           0.6107.15217 \quad 0.220
                                    - 6107.15217
       0
                                                      - 15s
340
       0
           0 6107.15217
                         0 284
                                    - 6107.15217
                                                      - 16s
           0 6107.15217 0 264
                                    - 6107.15217
341
       0
                                                      - 16s
342
       0
           0 6107.15217 0 113
                                    - 6107.15217
                                                      - 18s
343 H 0
                        8827.1521715 6107.15217 30.8% - 18s
344
       0
          0 6107.15217 0 67 8827.15217 6107.15217 30.8%
                        7087.1521715 6107.15217 13.8%
345 H 0 0
                                                        - 19s
346 H 0
           0
                        6707.1521715 6107.15217 8.95%
                                                        - 20s
           2\ 6107.15217 \quad 0 \quad 67\ 6707.15217\ 6107.15217\ 8.95\%
347
           34 6107.15217 9 234 6707.15217 6107.15217 8.95% 1604 25s
348
      36
349 H 69 65
                         6567.1521715 6107.15217 7.00% 1251 28s
350 H 117 100
                          6367.1521715 6107.15217 4.08% 930 29s
351
      131 105 6107.15217 27 309 6367.15217 6107.15217 4.08% 885
                         6307.1521715 6107.15217 3.17% 523 34s
352 H 368 214
      388 236 6107.15217 51 450 6307.15217 6107.15217 3.17% 543
353
                                                                    35s
                          6267.1521715 6107.15217 2.55% 439
354 H 529 255
                                                               36s
355 H 557 264
                          6247.1521715 6107.15217 2.24% 420 36s
                          6207.1521715 6107.15217 1.61% 417 36s
356 H 562 264
357 H 642 275
                          6167.1521715 6107.15217 0.97% 372
                                                              37s
     959 3 6107.15217 9 187 6167.15217 6107.15217 0.97% 278 40s
358
359 H 1016 75
                          6127.1521715 6107.15217 0.33% 285 41s
360
361 Explored 1120 nodes (365288 simplex iterations) in 43.22 seconds (85.45 work units)
362
    Thread count was 8 (of 8 available processors)
363
364 Solution count 10: 6127.15 6167.15 6207.15 ... 7087.15
365
366 Optimal solution found (tolerance 1.00e-10)
367 Best objective 6.127152171531e+03, best bound 6.127152171531e+03, gap 0.0000%
368
    Set parameter MIPGap to value 1e-08
369 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
370
371
    CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
372
    Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
373
374 Optimize a model with 536186 rows, 14427 columns and 1098485 nonzeros
375 Model fingerprint: 0xb8512909
    Variable types: 36 continuous, 14391 integer (8316 binary)
377 Coefficient statistics:
378
     Matrix range [1e-01, 1e+10]
379
      Objective range [6e-05, 5e+01]
     Bounds range [1e+00, 1e+00]
380
     RHS range
381
                   [8e-01, 1e+10]
382
    Warning: Model contains large matrix coefficients
383
    Warning: Model contains large rhs
         Consider reformulating model or setting NumericFocus parameter
384
385
         to avoid numerical issues.
386 Presolve removed 531386 rows and 12898 columns
387
    Presolve time: 0.38s
388 Presolved: 4800 rows, 1529 columns, 12833 nonzeros
389 Variable types: 8 continuous, 1521 integer (884 binary)
390 Found heuristic solution: objective 3487.2950287
391
392 Root relaxation: objective 5.058224e+03, 1535 iterations, 0.03 seconds (0.02 work units)
393
394
       Nodes | Current Node | Objective Bounds
395
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
396
397
          398 H 0 0
                        5057.8528892 5058.22411 0.01% - 0s
399
400 Cutting planes:
401
     MIR: 1
402
403 Explored 1 nodes (2120 simplex iterations) in 0.58 seconds (0.84 work units)
404
    Thread count was 8 (of 8 available processors)
405
406 Solution count 2: 5057.85 3487.3
407
408 Optimal solution found (tolerance 1.00e-08)
409 Best objective 5.057852889165e+03, best bound 5.057852889165e+03, gap 0.0000%
410 SP is solved
411 SP's optimal solution is' 5057
412
413 Itr = 2
414 Collect_LB = [803.0, 5232.050018627811, 6127.152171530973]
415 Collect_UB = [9461.100037255623, 6188.580742959544, 5899.424317736783]
```

```
unknown
416 Collect Hua = [0.0, 4329.050018627811, 5285.580742959544]
417 Collect SPObjVal = [4329.050018627811, 5285.580742959544, 5057.852889165355]
418 Collect_MPObjValNHua = [803.0, 903.0, 841.5714285714284]
419
420
421
       Ops. stop iteration
422
      Values adopted from the Itr' th iteration, and Itr = \{2\}, judgeCount = \{2\}
423
                  -judge = 2, SPObj SPF = 5057.852889165355
424
                   pi: 0-6, ai-di: 70-81, gi_SP-gpi_SP: 0.0000000-0.000000,
425 Vessel i: 0:
                                                                                  ai_SP-di: 70-81,
                                                                                                     taoi-deltai: 70-81,
                                                                                                                         taoPi_SP-deltaPi_SP: 70-75,
                                                                                                                                                        betaNi:
     11.
           bi: 11
426
     Vessel i: 1:
                   pi: 0-6,
                              ai-di: 13-31,
                                             gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                  ai_SP-di: 13-31,
                                                                                                     taoi-deltai: 13-31,
                                                                                                                         taoPi_SP-deltaPi_SP: 13-31,
                                                                                                                                                        betaNi:
      18, bi: 18
427
     Vessel i: 2:
                   pi: 6-13,
                               ai-di: 27-50,
                                              gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                   ai_SP-di: 27-50,
                                                                                                      taoi-deltai: 27-50,
                                                                                                                           taoPi_SP-deltaPi_SP: 27-50,
                                                                                                                                                         betaNi
      : 23,
            bi: 23
                                               gi_SP-gpi_SP: 0.000000-0.000000,
     Vessel i: 3:
                   pi: 13-20,
                                ai-di: 25-49,
                                                                                                       taoi-deltai: 25-49,
                                                                                                                            taoPi SP-deltaPi SP: 25-49,
                                                                                     ai SP-di: 25-49,
     betaNi: 24.
                   bi: 24
                   pi: 21-27,
                                               gi_SP-gpi_SP: 0.000000-0.000000,
     Vessel i: 4:
                                ai-di: 31-37,
                                                                                     ai_SP-di: 31-37,
                                                                                                       taoi-deltai: 31-37,
                                                                                                                            taoPi_SP-deltaPi_SP: 31-37,
     betaNi: 6,
                  bi: 6
     Vessel i: 5:
                   pi: 20-26,
                                ai-di: 16-38,
                                               gi_SP-gpi_SP: 0.000000-0.800000,
                                                                                    ai_SP-di: 16-38,
                                                                                                       taoi-deltai: 18-29,
                                                                                                                            taoPi_SP-deltaPi_SP: 18-29,
     betaNi: 11,
                   bi: 11
     Vessel i: 6:
                   pi: 14-19,
                                ai-di: 6-24,
                                              gi_SP-gpi_SP: 1.000000-0.000000,
                                                                                   ai_SP-di: 14-24,
                                                                                                      taoi-deltai: 14-20,
                                                                                                                           taoPi_SP-deltaPi_SP: 14-20,
                                                                                                                                                         betaNi
      : 6,
           bi: 6
                    pi: 27-34,
     Vessel i: 7:
                                ai-di: 30-49,
                                               gi_SP-gpi_SP: 1.000000-0.600000,
                                                                                    ai SP-di: 40-49,
                                                                                                       taoi-deltai: 39-44,
                                                                                                                            taoPi SP-deltaPi SP: 40-44,
     betaNi: 5,
                  bi: 5
433
     Vessel i: 8:
                   pi: 20-27,
                                ai-di: 40-73,
                                               gi_SP-gpi_SP: 0.400000-1.000000,
                                                                                     ai_SP-di: 42-73,
                                                                                                       taoi-deltai: 43-62,
                                                                                                                            taoPi_SP-deltaPi_SP: 43-62,
     betaNi: 19,
                   bi: 19
434
435 round LB = [803, 5232, 6127]
436 round UB = [9461, 6189, 5899]
437 round Hua = [0, 4329, 5286]
438 round SPObjVal = [4329, 5286, 5058]
439 round MPObjValNHua = [803, 903, 842]
440
441 OptimalObj = 6127.152171530973
442 Time: 230.000000
443
444
445
446
```