```
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=40829
   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 481534 rows, 46641 columns and 1344872 nonzeros
19
   Model fingerprint: 0x3e7421da
   Variable types: 1 continuous, 46640 integer (46608 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 262377 rows and 19927 columns (presolve time = 5s) ...
30
31
   Presolve removed 424133 rows and 30617 columns
   Presolve time: 8.83s
   Presolved: 57401 rows, 16024 columns, 231304 nonzeros
34
   Variable types: 0 continuous, 16024 integer (16000 binary)
35
   Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
   Showing first log only...
37
38
39
   Root relaxation presolved: 57396 rows, 16029 columns, 231289 nonzeros
40
41
42
   Root simplex log...
43
44
                       Primal Inf. Dual Inf.
   Iteration Objective
       0 8.4300000e+02 7.187500e+01 1.524365e+08
45
                                                   10s
46
   Concurrent spin time: 0.02s
48
   Solved with dual simplex (primal model)
49
50
   Root relaxation: objective 8.430000e+02, 2419 iterations, 0.39 seconds (0.31 work units)
51
   Total elapsed time = 10.24s
52
53
     Nodes | Current Node | Objective Bounds |
                                                  Work
54
    Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
55
56
     0 0 843,00000 0 22
                               - 843.00000
                     3883.0000000 843.00000 78.3%
57 H 0 0
58 H
                     2023.0000000 843.00000 58.3%
59
     0 0 843.00000 0 148 2023.00000 843.00000 58.3%
                                                       - 11s
60 H 0 0
                     1963.0000000 843.00000 57.1%
         0 843.00000 0 148 1963.00000 843.00000 57.1% - 12s
      0
         0 843.00000 0 86 1963.00000 843.00000 57.1%
62
                                                      - 14s
         0 843.00000 0 80 1963.00000 843.00000 57.1% - 14s
63
      0
64 H 0
          0
                     1323.0000000 843.00000 36.3% - 14s
         0 843.00000 0 14 1323.00000 843.00000 36.3% - 17s
65
        0 843.00000 0 19 1323.00000 843.00000 36.3%
66
                                                       - 17s
      0
67 H 0 0
                      883.0000000 843.00000 4.53% - 17s
         0 843.00000 0 87 883.00000 843.00000 4.53% - 17s
68
69
         0.843.00000
                     0 99 883.00000 843.00000 4.53%
70
         0 843 00000 0 25 883 00000 843 00000 4 53%
                                                      - 23s
71
     0
         0 843.00000 0 211 883.00000 843.00000 4.53%
                                                      - 23s
         0\ 843.00000\ 0\ 279\ 883.00000\ 843.00000\ 4.53\%
73
   H = 0
                      843.0000000 843.00000 0.00% - 24s
74
75
   Cutting planes:
76
    Gomory: 9
    Lift-and-project: 2
77
78
    Cover: 46
    Implied bound: 3
79
```

```
80
      Clique: 21
 81
      MIR: 28
      StrongCG: 18
 82
 83
      GUB cover: 10
      Zero half: 2
 85
      RLT: 17
      Relax-and-lift: 54
 86
 87
      BQP: 3
 88
 89 Explored 1 nodes (30905 simplex iterations) in 24.95 seconds (36.73 work units)
 90 Thread count was 8 (of 8 available processors)
    Solution count 6: 843 883 1323 ... 3883
 93
 94 Optimal solution found (tolerance 1.00e-10)
 95 Best objective 8.43000000000e+02, best bound 8.43000000000e+02, gap 0.0000%
     Set parameter MIPGap to value 1e-08
 97
    Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
 98
 99 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
100 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
101
     Optimize a model with 429995 rows, 12824 columns and 883057 nonzeros
102
103 Model fingerprint: 0xe0feb0e0
104 Variable types: 32 continuous, 12792 integer (7392 binary)
105 Coefficient statistics:
106 Matrix range [1e-01, 1e+10]
     Objective range [6e-05, 5e+01]
107
     Bounds range [1e+00, 1e+00]
108
     RHS range
109
                    [8e-01, 1e+10]
110 Warning: Model contains large matrix coefficients
111 Warning: Model contains large rhs
112
          Consider reformulating model or setting NumericFocus parameter
          to avoid numerical issues.
113
114 Presolve removed 425042 rows and 11162 columns
115 Presolve time: 0.36s
116 Presolved: 4953 rows, 1662 columns, 13084 nonzeros
117 Variable types: 6 continuous, 1656 integer (953 binary)
118 Found heuristic solution: objective 3879.1111111
119 Found heuristic solution: objective 3899.1111111
120
121 Root relaxation: objective 5.605111e+03, 1610 iterations, 0.02 seconds (0.03 work units)
122
123
       Nodes | Current Node | Objective Bounds
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
124
125
           0 5605.11111 0 68 3899.11111 5605.11111 43.8%
126
127 H 0
                         4275.11111111 5605.11111 31.1% - 0s
                         5125.1111111 5605.11111 9.37%
128 H 0 0
                                                          - 0s
129 H 0 0
                         5145.1111111 5605.11111 8.94%
                                                          - 0s
130 H 0 0
                         5533.1111111 5605.11111 1.30%
                                                          - 0s
                         5603.6111111 5605.11111 0.03%
131 H 0 0
132
       0 0
                     0 5605.1111111 5605.11111 0.00%
133
134 Cutting planes:
135
     Learned: 21
136
     Gomory: 4
137
      Cover: 26
138
      Implied bound: 51
139
      Clique: 11
140
      MIR: 5
141
      StrongCG: 1
142
     Flow cover: 6
143
      Network: 7
144
      RLT: 3
145
      Relax-and-lift: 17
146
147
148 Explored 1 nodes (2414 simplex iterations) in 0.56 seconds (0.83 work units)
149 Thread count was 8 (of 8 available processors)
150
151 Solution count 8: 5605.11 5603.61 5533.11 ... 3879.11
152
153 Optimal solution found (tolerance 1.00e-08)
154 Best objective 5.605111111111e+03, best bound 5.605111111111e+03, gap 0.0000%
155 SP is solved
156 SP's optimal solution is' □ 5605
157
158 Itr = 0
159 Collect LB = [843.0]
160 Collect_UB = [12053.222222222226]
161 Collect_Hua = [0.0]
162 Collect_SPObjVal = [5605.111111111113]
163 Collect_MPObjValNHua = [843.0]
```

```
164
165
166 Set parameter MIPGap to value 1e-10
167
    Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
169 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
170 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
171
172 Optimize a model with 488880 rows, 229425 columns and 1352246 nonzeros
173 Model fingerprint: 0x46855033
174 Variable types: 1 continuous, 229424 integer (229392 binary)
175 Coefficient statistics:
176 Matrix range [1e+00, 1e+10]
177
     Objective range [1e+00, 2e+01]
178 Bounds range [1e+00, 1e+00]
                   [1e+00, 2e+10]
     RHS range
    Warning: Model contains large matrix coefficients
180
    Warning: Model contains large rhs
181
182
         Consider reformulating model or setting NumericFocus parameter
183
         to avoid numerical issues.
184 Presolve removed 323491 rows and 211253 columns (presolve time = 5s) ...
185 Presolve removed 466034 rows and 221792 columns
    Presolve time: 8.66s
187 Presolved: 22846 rows, 7633 columns, 95345 nonzeros
188 Variable types: 0 continuous, 7633 integer (7609 binary)
189
190 Root simplex log...
191
192 Iteration Objective
                          Primal Inf. Dual Inf.
                                                 Time
193
        0 6.4481111e+03 9.100000e+02 0.000000e+00
194
       3168 6.4481111e+03 0.000000e+00 0.000000e+00
195
196 Root relaxation: objective 6.448111e+03, 3168 iterations, 0.08 seconds (0.08 work units)
197
      Nodes | Current Node | Objective Bounds
198
                                                         Work
199
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
200
201
           0 6448.11111 0 25
                                    - 6448.11111
202
       0
           0.6448.11111 0.130
                                    - 6448.11111
                                                   - - 11s
203
       0
           0 6448.11111
                         0 127
                                    - 6448.11111
                                                      - 11s
204
           0 6448.11111
                                    - 6448.11111
                         0 182
205
       0
           0 6448.11111 0 166
                                    - 6448.11111
                                                      - 11s
                                                  - - 13s
206
           0.6448 11111 0 37
                                    - 6448 11111
       0
207
       0
           0 6448.11111 0 72
                                    - 6448.11111
                                                  - - 13s
       0
           0.6448.11111 \quad 0 \quad 25
                                    - 6448.11111
                                                      - 15s
208
           0 6448.11111 0 48
                                    - 6448.11111
                                                  - - 15s
209
       0
           0 6448.11111 0 361
210
       0
                                    - 6448.11111
                                                      - 15s
211
       0
           0 6448.11111 0 360
                                    - 6448.11111
                                                      - 15s
                                                   - - 16s
212
           0 6448.11111 0 50
                                    - 6448.11111
       0
           0 6448.11111 0 50
                                                   - - 16s
213
       0
                                    - 6448.11111
214
       0
           2\ 6448.11111 \ 0\ 50
                                    - 6448.11111
                                                      - 18s
215
          11 6448.11111 3 571
                                    - 6448.11111 - 2848 20s
      41 51 6448.11111 9 299
                                     - 6448.11111
                                                    - 2269 26s
216
                                      - 6448.11111 - 1847 31s
      88 117 6448.11111 17 270
217
218
      169 203 6448.11111 36 217
                                       - 6448.11111
                                                     - 1350 35s
219 H 226 203
                          6448.1111111 6448.11111 0.00% 1101 35s
220
221 Cutting planes:
     Learned: 4
222
223
     Gomory: 3
224
     Cover: 509
225
     Implied bound: 991
226
     Clique: 958
227
     MIR: 186
228
     StrongCG: 157
229
     GUB cover: 32
230
     Zero half: 11
231
     RLT: 7
232
     Relax-and-lift: 15
233
234
235 Explored 281 nodes (346551 simplex iterations) in 35.62 seconds (61.74 work units)
236 Thread count was 8 (of 8 available processors)
237
238 Solution count 1: 6448 11
239
240 Optimal solution found (tolerance 1.00e-10)
241 Best objective 6.448111111111e+03, best bound 6.448111111111e+03, gap 0.0000%
242 Set parameter MIPGap to value 1e-08
243 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
244
245 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
246 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
247
```

```
248 Optimize a model with 429995 rows, 12824 columns and 883057 nonzeros
249 Model fingerprint: 0x3a694f55
250 Variable types: 32 continuous, 12792 integer (7392 binary)
251 Coefficient statistics:
252 Matrix range [1e-01, 1e+10]
253
     Objective range [6e-05, 5e+01]
     Bounds range [1e+00, 1e+00]
254
255 RHS range
                    [8e-01, 1e+10]
256 Warning: Model contains large matrix coefficients
257 Warning: Model contains large rhs
258
          Consider reformulating model or setting NumericFocus parameter
259
          to avoid numerical issues.
260 Presolve removed 424534 rows and 11016 columns
261 Presolve time: 0.33s
262 Presolved: 5461 rows, 1808 columns, 14589 nonzeros
263 Variable types: 6 continuous, 1802 integer (1046 binary)
264
265 Root relaxation: objective 5.783111e+03, 1429 iterations, 0.00 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 * 0 0
                     0 5783.1111111 5783.11111 0.00% - 0s
271
272 Explored 1 nodes (1957 simplex iterations) in 0.47 seconds (0.68 work units)
273 Thread count was 8 (of 8 available processors)
275 Solution count 1: 5783.11
276
277 Optimal solution found (tolerance 1.00e-08)
278 Best objective 5.783111111111e+03, best bound 5.783111111111e+03, gap 0.0000%
279 SP is solved
280 SP's optimal solution is' ☐ 5783
281
282 	ext{ Itr} = 1
283 Collect_LB = [843.0, 6448.111111111111]
284 Collect_UB = [12053.22222222226, 6626.111111111113]
285 Collect Hua = [0.0, 5605.11111111111]
286 Collect SPObjVal = [5605.111111111113, 5783.111111111113]
287 Collect_MPObjValNHua = [843.0, 843.0]
288
289
290 Set parameter MIPGap to value 1e-10
291 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
292
293 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
294 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
295
296 Optimize a model with 488880 rows, 229425 columns and 1352246 nonzeros
297 Model fingerprint: 0x215ab8a4
298 Variable types: 1 continuous, 229424 integer (229392 binary)
299 Coefficient statistics:
300 Matrix range [1e+00, 1e+10]
     Objective range [1e+00, 2e+01]
301
302
     Bounds range [1e+00, 1e+00]
                    [1e+00, 2e+10]
303
     RHS range
304 Warning: Model contains large matrix coefficients
305 Warning: Model contains large rhs
306
          Consider reformulating model or setting NumericFocus parameter
307
          to avoid numerical issues.
308 Presolve removed 323491 rows and 211253 columns (presolve time = 5s) ...
309 Presolve removed 466034 rows and 221792 columns
310 Presolve time: 7.97s
311 Presolved: 22846 rows, 7633 columns, 95345 nonzeros
312 Variable types: 0 continuous, 7633 integer (7609 binary)
313
314 Root simplex log...
315
316 Iteration Objective
                           Primal Inf. Dual Inf.
                                                  Time
         0 6.6261111e+03 9.100000e+02 0.000000e+00
317
       3168 6.6261111e+03 0.000000e+00 0.000000e+00
318
319
320 Root relaxation: objective 6.626111e+03, 3168 iterations, 0.08 seconds (0.08 work units)
321
       Nodes | Current Node | Objective Bounds
                                                      Work
322
323
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
324
325
       0
           0 6626.11111 0 25
                                     - 6626.11111
                                                        - 8s
326
           0 6626.11111 0 130
                                     - 6626.11111
       0
327
           0 6626.11111 0 127
                                     - 6626.11111
328
       0
           0 6626.11111
                          0 182
                                     - 6626.11111
                                                        - 10s
                                                    - - 10s
329
       0
           0 6626.11111 0 166
                                     - 6626.11111
330
           0.6626.111111 \quad 0 \quad 37
                                     - 6626.11111
       0
                                                    - - 12s
       0
           0.6626.111111 \quad 0 \quad 72
                                     - 6626.11111
331
                                                        - 12s
```

```
0 6626.11111 0 25
                                    - 6626.11111
332
                                                         13s
333
           0 6626.11111
                         0 48
                                    - 6626.11111
                                                      - 13s
           0.6626.11111 0.361
                                    - 6626.11111
334
                                                       - 14s
335
       0
           0 6626.11111
                         0 360
                                    - 6626.11111
                                                       - 14s
           0 6626.11111 0 50
                                    - 6626.11111
                                                       - 15s
336
337
       0
           0 6626.11111 0 50
                                    - 6626.11111
                                                       - 15s
338
       0
           2 6626.11111 0 50
                                    - 6626.11111
                                                      - 17s
339
       19
           22 6626.11111 5 479
                                      - 6626.11111
                                                    - 2642 21s
340
       50
           52 6626.11111 11 173
                                      - 6626.11111
                                                     - 2247 25s
341
      120 145 6635,58480 24 246
                                                      - 1634 31s
                                       - 6626.11111
      219\ \ 279\ 8466.111111\ \ 61\ \ 370
342
                                       - 6626.11111
                                                      - 1227 36s
                                                      - 556 42s
343
      679 595 6626.11111 8 550
                                       - 6626.11111
344
      871 651 6626.11111 17 379
                                       - 6626.11111
                                                      - 483 46s
345
      1068 1017 6626.11111 51 491
                                        - 6626.11111
                                                       - 523 54s
346
      1451 1400 7086.11111 169 3
                                        - 6626.11111
                                                       - 455 60s
     * 1470 793
                       186 7086.1111111 6626.11111 6.49% 449 60s
347
      1954 559 6626.11111 98 50 7086.11111 6626.11111 6.49% 399 69s
348
      1956 560 6626.11111 4 45 7086.11111 6626.11111 6.49% 398 70s
349
350
     1959 562 6766.11111 120 194 7086.11111 6626.11111 6.49% 398 76s
351
      1961 564 6626.11111 52 316 7086.11111 6626.11111 6.49% 397 81s
352 H 1962 535
                           7026.1111111 6626.11111 5.69% 397 85s
353 H 1963 509
                           6626.11111111 6626.11111 0.00% 397 87s
354
355 Cutting planes:
356
      Gomory: 11
357
      Cover: 345
     Implied bound: 58
358
359
      Projected implied bound: 15
360
      Clique: 54
      MIR: 20
361
362
      StrongCG: 8
363
      Flow cover: 16
364
      GUB cover: 67
365
      Zero half: 19
366
      RLT: 17
367
      Relax-and-lift: 39
368
      BQP: 3
369
370 Explored 1963 nodes (879924 simplex iterations) in 87.31 seconds (145.47 work units)
371
    Thread count was 8 (of 8 available processors)
372
373 Solution count 3: 6626.11 7026.11 7086.11
374
375 Optimal solution found (tolerance 1.00e-10)
376 Best objective 6.626111111111e+03, best bound 6.626111111111e+03, gap 0.0000%
377 Set parameter MIPGap to value 1e-08
378 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
379
380 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
381 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
382
383 Optimize a model with 429995 rows, 12824 columns and 883057 nonzeros
384 Model fingerprint: 0x77065b1f
385 Variable types: 32 continuous, 12792 integer (7392 binary)
386 Coefficient statistics:
387
      Matrix range [1e-01, 1e+10]
388
      Objective range [6e-05, 5e+01]
389
      Bounds range [1e+00, 1e+00]
390
      RHS range
                   [8e-01, 1e+10]
     Warning: Model contains large matrix coefficients
391
392
     Warning: Model contains large rhs
393
          Consider reformulating model or setting NumericFocus parameter
394
          to avoid numerical issues.
395 Presolve removed 424107 rows and 10937 columns
396 Presolve time: 0.33s
     Presolved: 5888 rows, 1887 columns, 15718 nonzeros
397
398
     Variable types: 6 continuous, 1881 integer (1082 binary)
399
400 Root relaxation: objective 5.783111e+03, 1510 iterations, 0.02 seconds (0.02 work units)
401
402
       Nodes | Current Node | Objective Bounds
                                                        Work
403
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
404
                         5783.1111111 16897.7778 192% - 0s
405 H 0 0
406
       0 0
                  - 0
                        5783.11111 5783.11111 0.00% - 0s
407
408 Explored 1 nodes (2001 simplex iterations) in 0.45 seconds (0.73 work units)
409 Thread count was 8 (of 8 available processors)
410
411
     Solution count 1: 5783.11
412
413 Optimal solution found (tolerance 1.00e-08)
414 Best objective 5.783111111111e+03, best bound 5.783111111111e+03, gap 0.0000%
415 SP is solved
```

```
unknown
416 SP's optimal solution is' □ 5783
417
418 Itr = 2
419 Collect_LB = [843.0, 6448.111111111113, 6626.111111111113]
420 Collect UB = [12053.22222222226, 6626.1111111111113]
421 Collect Hua = [0.0, 5605.111111111113, 5783.111111111113]
422 Collect_SPObjVal = [5605.111111111113, 5783.11111111113, 5783.111111111113]
423 Collect_MPObjValNHua = [843.0, 843.0, 843.0]
424
425
426
      Reach the termination conditions, stop iteration
427
      Values adopted from the Itr' th iteration, and Itr = \{2\}, judgeCount = \{2\}
428
               ~~judge = 2, SPObj_SPF = 5783.111111111111
429
430 Vessel i: 0:
                   pi: 0-7, ai-di: 3-34, gi_SP-gpi_SP: 0.000000-0.000000,
                                                                               ai_SP-di: 3-34, taoi-deltai: 3-32,
                                                                                                                   taoPi_SP-deltaPi_SP: 3-32, betaNi: 29
         bi: 29
     Vessel i: 1:
                   pi: 7-12, ai-di: 12-22,
                                             gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                 ai SP-di: 12-22,
                                                                                                    taoi-deltai: 12-20,
                                                                                                                        taoPi SP-deltaPi SP: 12-20,
                                                                                                                                                      betaNi
      : 8,
           bi: 8
432 Vessel i: 2:
                   pi: 14-19,
                               ai-di: 27-35,
                                              gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                   ai_SP-di: 27-35,
                                                                                                     taoi-deltai: 27-33,
                                                                                                                         taoPi_SP-deltaPi_SP: 27-33,
     betaNi: 6,
                 bi: 6
                                             gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                                                        taoPi_SP-deltaPi_SP: 24-58,
     Vessel i: 3:
                  pi: 7-14,
                              ai-di: 24-60,
                                                                                 ai_SP-di: 24-60,
                                                                                                    taoi-deltai: 24-58,
                                                                                                                                                      betaNi
      : 34,
            bi: 34
     Vessel i: 4:
                               ai-di: 35-41,
                                                                                                                         taoPi_SP-deltaPi_SP: 35-39,
                   pi: 15-20,
                                              gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                   ai_SP-di: 35-41,
                                                                                                     taoi-deltai: 35-39,
     betaNi: 4,
                  bi: 4
435
                   pi: 28-34,
     Vessel i: 5:
                                              gi_SP-gpi_SP: 0.000000-1.000000,
                                                                                   ai_SP-di: 31-60,
                                                                                                                         taoPi_SP-deltaPi_SP: 31-46,
                                ai-di: 31-60,
                                                                                                     taoi-deltai: 31-46,
     betaNi: 15,
                   bi: 15
     Vessel i: 6:
                   pi: 15-21,
                                ai-di: 40-80,
                                              gi_SP-gpi_SP: 1.000000-0.600000,
                                                                                   ai SP-di: 48-80,
                                                                                                     taoi-deltai: 48-72,
                                                                                                                         taoPi SP-deltaPi SP: 48-72,
     betaNi: 24.
                   bi: 24
437
     Vessel i: 7:
                   pi: 28-34,
                                ai-di: 43-72,
                                              gi_SP-gpi_SP: 0.800000-0.200000,
                                                                                   ai_SP-di: 51-72,
                                                                                                     taoi-deltai: 51-64,
                                                                                                                         taoPi_SP-deltaPi_SP: 51-64,
     betaNi: 13,
                   bi: 13
438
439 round LB = [843, 6448, 6626]
440 round UB = [12053, 6626, 6626]
441 round Hua = [0, 5605, 5783]
442 round SPObjVal = [5605, 5783, 5783]
443 round MPObjValNHua = [843, 843, 843]
444
445 OptimalObj = 6626.111111111111
446 Time: 208.000000
447
448
449
450
```