```
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=46634
 3
     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 00000/1 00000/1 00000/1 LW_000/4 000/3 python_code/9 Code for this paper/main_RO_BDC.py', wdir='E:/1 0000/3 0000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 000000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 000000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00000/1 00
     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 557467 rows, 58701 columns and 1576383 nonzeros
19
     Model fingerprint: 0xaf759b0a
     Variable types: 1 continuous, 58700 integer (58660 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 342574 rows and 28008 columns (presolve time = 5s) ...
30
31
     Presolve removed 444834 rows and 38927 columns
     Presolve time: 8.44s
     Presolved: 112633 rows, 19774 columns, 307906 nonzeros
34
      Variable types: 0 continuous, 19774 integer (19744 binary)
35
     Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
37
     Showing first log only...
38
39
     Root relaxation presolved: 19774 rows, 132407 columns, 327680 nonzeros
40
41
42
     Root simplex log...
43
44
     Iteration Objective
                                      Primal Inf. Dual Inf.
           0 6.4900000e+02 0.000000e+00 9.500000e+02
45
46
     Concurrent spin time: 0.00s
48
     Solved with dual simplex (primal model)
49
50
     Root relaxation: objective 6.490000e+02, 2260 iterations, 0.43 seconds (0.44 work units)
51
52
         Nodes | Current Node | Objective Bounds
                                                                             Work
53
      Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
54
55
               0 649.00000 0 28
                                                   - 649.00000
                                                                        - - 10s
56
         0
               0 649 00000 0 91
                                                   - 649 00000
57
         0
               0 649.00000 0 84
                                                  - 649.00000
58 H 0 0
                                   4029.0000000 649.00000 83.9% - 11s
59
                                   1789.0000000 649.00000 63.7% - 11s
     H 0
                0
60
    Η
                                   709.0000000 649.00000 8.46% - 11s
              0 649.00000 0 188 709.00000 649.00000 8.46% - 11s
62
              0 649.00000 0 15 709.00000 649.00000 8.46%
63 \ H \ 0 \ 0
                                   649.0000000 649.00000 0.00% - 15s
64
65
     Cutting planes:
      Gomory: 3
66
67
       Cover: 75
68
       Implied bound: 1
69
       MIR: 49
       StrongCG: 50
70
       GUB cover: 1
       Zero half: 4
73
       Relax-and-lift: 3
     Explored 1 nodes (10906 simplex iterations) in 15.71 seconds (29.16 work units)
76
     Thread count was 8 (of 8 available processors)
     Solution count 4: 649 709 1789 4029
78
79
```

```
80 Optimal solution found (tolerance 1.00e-10)
 81 Best objective 6.49000000000e+02, best bound 6.49000000000e+02, gap 0.0000%
    Set parameter MIPGap to value 1e-08
 83 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
 85 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
 86
 87
 88 Optimize a model with 3035724 rows, 2395885 columns and 21185430 nonzeros
 89 Model fingerprint: 0xddb9f384
 90 Variable types: 1181973 continuous, 1213912 integer (1207162 binary)
 91 Coefficient statistics:
     Matrix range [1e-01, 1e+10]
 93
     Objective range [6e-05, 5e+01]
 94
     Bounds range [1e+00, 8e+01]
                   [8e-01, 1e+10]
     RHS range
    Warning: Model contains large matrix coefficients
 96
 97
    Warning: Model contains large rhs
 98
         Consider reformulating model or setting NumericFocus parameter
 99
         to avoid numerical issues.
100 Presolve removed 3032277 rows and 2394662 columns (presolve time = 5s) ...
101 Presolve removed 3033403 rows and 2394999 columns
    Presolve time: 6.32s
103 Presolved: 2321 rows, 886 columns, 6181 nonzeros
104 Variable types: 10 continuous, 876 integer (524 binary)
105 Found heuristic solution: objective 3987.9062900
106
107 Root simplex log...
108
109 Iteration Objective
                          Primal Inf. Dual Inf.
110
        0 8.4772222e+03 2.469038e+03 0.000000e+00
                                                          8s
       734 5.0084444e+03 0.000000e+00 0.000000e+00
111
                                                          8s
112
Root relaxation: objective 5.008444e+03, 734 iterations, 0.02 seconds (0.01 work units)
114
      Nodes | Current Node | Objective Bounds
115
                                                     Work
116
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
117
       0 0 5008.44444 0 38 3987.90629 5008.44444 25.6%
118
119 H 0 0
                        4071.6766934 5008.44444 23.0%
120 H 0 0
                        4115.0100267 5008.44444 21.7%
121
      0 0 5008.44444 0 19 4115.01003 5008.44444 21.7%
                 5004.9115810 5008.44444 0.07% - 8s
122 H 0 0
123 H 0 0
                        5007.5041736 5008.44444 0.02%
       0 0 5008.30159 0 12 5007.50417 5008.30159 0.02% -
124
                                                                 8s
       0 0 5008.30159 0 10 5007.50417 5008.30159 0.02% -
125
126\ H\ 0\ 0
                       5008.3015873 5008.30159 0.00% - 8s
127
128 Cutting planes:
129
     Learned: 1
130
     Cover: 12
     Implied bound: 19
131
132
     Clique: 8
     MIR: 11
133
134
     Zero half: 2
135
     RLT: 2
     Relax-and-lift: 16
136
137
138 Explored 1 nodes (1461 simplex iterations) in 8.46 seconds (8.98 work units)
139 Thread count was 8 (of 8 available processors)
140
141 Solution count 6: 5008.3 5007.5 5004.91 ... 3987.91
142
143 Optimal solution found (tolerance 1.00e-08)
144 Best objective 5.008301587302e+03, best bound 5.008301587302e+03, gap 0.0000%
145 SP is solved
146 SP's optimal solution is' □ 5008
147
148 Itr = 0
149 Collect_LB = [649.0]
150 Collect_UB = [10665.603174603173]
151 Collect_Hua = [0.0]
152 Collect SPObjVal = [5008.301587301587]
153 Collect MPObjValNHua = [649.0]
154
155
156 Set parameter TimeLimit to value 12000
157 Set parameter MIPGap to value 0.0005
158 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
159
160 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
161 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
162
    Optimize a model with 566499 rows, 344301 columns and 1585480 nonzeros
163
```

```
164 Model fingerprint: 0x58f0b5ee
165 Variable types: 1 continuous, 344300 integer (344260 binary)
166 Coefficient statistics:
     Matrix range [1e+00, 1e+10]
167
     Objective range [1e+00, 2e+01]
     Bounds range [1e+00, 1e+00]
RHS range [1e+00, 2e+10]
169
     RHS range
170
171 Warning: Model contains large matrix coefficients
172 Warning: Model contains large rhs
173
         Consider reformulating model or setting NumericFocus parameter
174
         to avoid numerical issues.
175 Presolve removed 414857 rows and 324178 columns (presolve time = 5s) ...
176 Presolve removed 512797 rows and 334811 columns
177 Presolve time: 8.50s
178 Presolved: 53702 rows, 9490 columns, 140676 nonzeros
179 Variable types: 0 continuous, 9490 integer (9460 binary)
180 Root relaxation presolved: 9490 rows, 63192 columns, 150166 nonzeros
181
182
183 Root simplex log...
184
185 Iteration Objective
                          Primal Inf. Dual Inf.
186
            handle free variables
       6890 5.6657666e+03 1.544375e+01 0.000000e+00
187
             5.6644444e+03 0.000000e+00 0.000000e+00
188
       6928
                                                          10s
189
       6928 5.6644444e+03 0.000000e+00 0.000000e+00
                                                          10s
190
191 Root relaxation: objective 5.664444e+03, 6928 iterations, 1.24 seconds (2.54 work units)
192
193
       Nodes | Current Node | Objective Bounds
194
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
195
196
       0 0 5664.44444 0 11
                                   - 5664.44444
197 H 0
                       6324.4444444 5664.44444 10.4% - 11s
       0 0 5664.44444 0 120 6324.44444 5664.44444 10.4% - 11s
198
199 H 0 0
                       6044.4444444 5664.44444 6.29%
                                                        - 11s
200
       0 0 5664.44444 0 34 6044.44444 5664.44444 6.29% - 12s
       0 0 5664.44444 0 33 6044.44444 5664.44444 6.29% - 12s
201
       0 0 5664.44444 0 56 6044.44444 5664.44444 6.29% - 12s
202
203 H 0 0
                       5864.4444444 5664.44444 3.41% - 12s
204
       0 0 5664.44444 0 61 5864.44444 5664.44444 3.41% - 12s
205
          0 5664.44444 0 174 5864.44444 5664.44444 3.41%
       0
                                                            - 13s
          0 5664 44444 0 25 5864 44444 5664 44444 3 41% - 13s
206
       0
207
       0 0 5664.44444 0 164 5864.44444 5664.44444 3.41% - 14s
           208
          0 5664.44444 0 160 5864.44444 5664.44444 3.41% - 14s
209
       0
          0 5664.44444 0 75 5864.44444 5664.44444 3.41% - 14s
210
211
       0
           0 5664.44444 0 72 5864.44444 5664.44444 3.41% - 15s
212
         0 5664.44444 0 119 5864.44444 5664.44444 3.41% - 15s
       0 \quad 0 \; 5664.44444 \quad 0 \; 118 \; 5864.44444 \; 5664.44444 \; 3.41\% \quad - \; 15s
213
214 H 0 0
                    5664.4444444 5664.44444 0.00% - 15s
215
       0 0 5664.44444 0 69 5664.44444 5664.44444 0.00% - 15s
216
217 Cutting planes:
218 Learned: 2
219
     Gomory: 3
220
     Cover: 120
221
     Implied bound: 1200
      Clique: 285
222
223
     MIR: 71
224
     StrongCG: 45
225
     GUB cover: 8
226
     Zero half: 11
227
     RLT: 42
228
     Relax-and-lift: 8
229
     BQP: 6
230
231
232 Explored 1 nodes (40964 simplex iterations) in 15.65 seconds (24.12 work units)
233
    Thread count was 8 (of 8 available processors)
234
235 Solution count 4: 5664.44 5864.44 6044.44 6324.44
236
237 Optimal solution found (tolerance 5.00e-04)
238 Best objective 5.66444444444e+03, best bound 5.6644444444e+03, gap 0.0000%
239 Set parameter MIPGap to value 1e-08
240 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
241
242 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
243 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
244
245 Optimize a model with 3035724 rows, 2395885 columns and 21185430 nonzeros
246 Model fingerprint: 0x71f00d4f
    Variable types: 1181973 continuous, 1213912 integer (1207162 binary)
247
```

```
248 Coefficient statistics:
249
     Matrix range [1e-01, 1e+10]
     Objective range [6e-05, 5e+01]
250
251
     Bounds range [1e+00, 8e+01]
252 RHS range
                    [8e-01, 1e+10]
253 Warning: Model contains large matrix coefficients
254 Warning: Model contains large rhs
255
          Consider reformulating model or setting NumericFocus parameter
256
          to avoid numerical issues.
257 Presolve removed 3030763 rows and 2394247 columns (presolve time = 5s) ...
258 Presolve removed 3031130 rows and 2394373 columns
259 Presolve time: 6.18s
260 Presolved: 4594 rows, 1512 columns, 12213 nonzeros
261 Variable types: 10 continuous, 1502 integer (875 binary)
262 Found heuristic solution: objective 4059.8240692
263
264 Root simplex log...
265
266 Iteration Objective
                         Primal Inf. Dual Inf.
267
        0 9.7032222e+03 6.479138e+03 0.000000e+00
                                                          8s
268
       1388 5.6174444e+03 0.000000e+00 0.000000e+00
269
270 Root relaxation: objective 5.617444e+03, 1388 iterations, 0.02 seconds (0.02 work units)
271
272
       Nodes | Current Node | Objective Bounds
                                                         Work
273
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
274
       0 0 5617.44444 0 40 4059.82407 5617.44444 38.4%
275
                        4579.6044479 5617.44444 22.7% - 7s
276 H 0 0
277 H 0 0
                        5081.6470308 5617.44444 10.5% - 7s
278
       0 0 5617.44444 0 37 5081.64703 5617.44444 10.5%
279 H 0 0
                   5614.0544382 5617.44444 0.06% - 8s
       0 0 5617.17864 0 20 5614.05444 5617.17864 0.06% - 8s
280
282 Cutting planes:
283
      Cover: 3
284
     Clique: 12
285
      MIR: 3
286
      Flow cover: 1
287
      Zero half: 3
288
      RLT: 2
289
290 Explored 1 nodes (2401 simplex iterations) in 8.33 seconds (8.86 work units)
291 Thread count was 8 (of 8 available processors)
292
293 Solution count 4: 5614.05 5081.65 4579.6 4059.82
294
295 Optimal solution found (tolerance 1.00e-08)
296 Best objective 5.614054438168e+03, best bound 5.614054438168e+03, gap 0.0000%
297 SP is solved
298 SP's optimal solution is' □5614
299
300 	ext{ Itr} = 1
301 Collect_LB = [649.0, 5664.444444444443]
302 Collect_UB = [10665.603174603173, 6270.1972953106]
303 Collect Hua = [0.0, 5008.301587301587]
304 Collect SPObjVal = [5008.301587301587, 5614.054438167743]
305 Collect_MPObjValNHua = [649.0, 656.1428571428569]
306
307
308 Set parameter TimeLimit to value 12000
309 Set parameter MIPGap to value 0.0005
310 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
311
312 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
313 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
314
315 Optimize a model with 566500 rows, 344301 columns and 1585501 nonzeros
316 Model fingerprint: 0x92266547
317 Variable types: 1 continuous, 344300 integer (344260 binary)
318 Coefficient statistics:
     Matrix range [1e+00, 1e+10]
319
320
     Objective range [1e+00, 2e+01]
      Bounds range [1e+00, 1e+00]
321
     RHS range
                   [1e+00, 2e+10]
322
323
     Warning: Model contains large matrix coefficients
324 Warning: Model contains large rhs
325
          Consider reformulating model or setting NumericFocus parameter
          to avoid numerical issues.
326
327 Presolve removed 415073 rows and 324162 columns (presolve time = 5s) ...
328 Presolve removed 513001 rows and 334836 columns
329 Presolve time: 8.51s
330 Presolved: 53499 rows, 9465 columns, 140196 nonzeros
331 Variable types: 0 continuous, 9465 integer (9435 binary)
```

```
332 Root relaxation presolved: 9465 rows, 62964 columns, 149661 nonzeros
333
334
335 Root simplex log...
336
337 Iteration Objective
                          Primal Inf. Dual Inf.
                                                 Time
338
        0 handle free variables
                                              9s
       6991 6.2790544e+03 0.000000e+00 0.000000e+00
339
                                                           10s
340
       6991 6.2790544e+03 0.000000e+00 0.000000e+00
341
Root relaxation: objective 6.279054e+03, 6991 iterations, 1.16 seconds (2.34 work units)
343
    Total elapsed time = 10.08s
344
       Nodes | Current Node | Objective Bounds
                                                     Work
345
346
     Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
347
348
           0 6279.05444 0 29
                                    - 6279.05444
       0
                                                   - - 10s
349
           0.6279.05444 0.29
                                    - 6279.05444
       0
                                                  - - 10s
350
          0 6279.05444 0 96
                                    - 6279.05444
                                                  - - 10s
351
       0
           0.6279.05444 \quad 0.91
                                    - 6279.05444
                                                      - 10s
                                    - 6279.05444
352
           0.6279.05444 0 68
       0
                                                  - - 11s
                       4 0 102 - 6279.05444 - - 11s
6299.0544382 6279.05444 0.32% - 12s
353
       0 0 6279.05444 0 102
354 H 0 0
355
       0 0 6279.05444 0 26 6299.05444 6279.05444 0.32% - 13s
                  6279.0544382 6279.05444 0.00% - 13s
356 H 0 0
357
       0 0 6279.05444 0 26 6279.05444 6279.05444 0.00%
358
359 Cutting planes:
360
     Learned: 1
361
      Gomory: 5
362
      Cover: 68
      Implied bound: 1057
363
364
      Clique: 224
      MIR: 22
365
366
      StrongCG: 13
      GUB cover: 2
367
368
      Zero half: 8
369
      RLT: 2
      Relax-and-lift: 201
370
371
372 Explored 1 nodes (25706 simplex iterations) in 13.39 seconds (21.83 work units)
373 Thread count was 8 (of 8 available processors)
374
375 Solution count 2: 6279.05 6299.05
376
377 Optimal solution found (tolerance 5.00e-04)
378 Best objective 6.279054438168e+03, best bound 6.279054438168e+03, gap 0.0000%
379 Set parameter MIPGap to value 1e-08
380 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
381
382 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
383 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
384
385 Optimize a model with 3035724 rows, 2395885 columns and 21185430 nonzeros
386 Model fingerprint: 0xf1374b93
    Variable types: 1181973 continuous, 1213912 integer (1207162 binary)
387
388 Coefficient statistics:
      Matrix range [1e-01, 1e+10]
389
390
      Objective range [6e-05, 5e+01]
     Bounds range [1e+00, 8e+01]
391
                    [8e-01, 1e+10]
392
     RHS range
393 Warning: Model contains large matrix coefficients
394 Warning: Model contains large rhs
395
          Consider reformulating model or setting NumericFocus parameter
396
          to avoid numerical issues.
397 Presolve removed 3030897 rows and 2394264 columns (presolve time = 5s) ...
398 Presolve removed 3030979 rows and 2394287 columns
399 Presolve time: 6.17s
400 Presolved: 4745 rows, 1598 columns, 12583 nonzeros
     Variable types: 10 continuous, 1588 integer (927 binary)
401
402 Found heuristic solution: objective 4046.4907358
403
404 Root simplex log...
405
406 Iteration Objective
                          Primal Inf Dual Inf
                                                 Time
           1.0449000e+04 3.783137e+03 0.000000e+00
407
408
       1405 5.7134444e+03 0.000000e+00 0.000000e+00
409
410 Root relaxation: objective 5.713444e+03, 1405 iterations, 0.01 seconds (0.01 work units)
411
412
       Nodes | Current Node | Objective Bounds
413 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
414
       0 0 5713.44444 0 38 4046.49074 5713.44444 41.2% - 7s
415
```

```
unknown
416
           0
417 H 0 0
                         5073.3521103 5713.44444 12.6% -
            0
                         5388.0187770 5713.44444 6.04%
418 H 0
419 H 0 0
                         5708.3928106 5713.44444 0.09%
                                                               8s
420
        0 0 5713.17864 0 10 5708.39281 5713.17864 0.08%
                                                                   8s
421
        0 0 cutoff 0
                           5708.39281 5708.39281 0.00% - 8s
422
423 Cutting planes:
424
      Gomory: 7
425
      Cover: 4
426
      Implied bound: 2
      Clique: 40
427
428
      MIR: 2
429
      Zero half: 3
430
      RLT: 1
431
432
     Explored 1 nodes (2669 simplex iterations) in 8.36 seconds (8.77 work units)
433
    Thread count was 8 (of 8 available processors)
434
435
    Solution count 4: 5708.39 5388.02 5073.35 4046.49
436
437 Optimal solution found (tolerance 1.00e-08)
     Best objective 5.708392810563e+03, best bound 5.708392810563e+03, gap 0.0000%
438
439 SP is solved
440 SP's optimal solution is' ☐ 5708
441
442 	ext{ Itr} = 2
443 Collect LB = [649.0, 5664.44444444443, 6279.054438167743]
444 Collect_UB = [10665.603174603173, 6270.1972953106, 6270.1972953106]
445 Collect_Hua = [0.0, 5008.301587301587, 5614.054438167743]
446 Collect SPObjVal = [5008.301587301587, 5614.054438167743, 5708.392810563291]
447 Collect MPObjValNHua = [649.0, 656.1428571428569, 665.0]
448
449
450 Ops, stop iteration
      Values adopted from the Itr-1' th iteration, and Itr = \{2\}, judgeCount = \{1\}
451
452
                 ~judgeCount = 1, SPObj SPF = 5614.054438167743
453
                  pi: 0-5,
                            ai-di: 9-20, gi_SP-gpi_SP: 0.000000-0.000000,
                                                                              ai SP-di: 9-20, taoi-deltai: 9-18, taoPi SP-deltaPi SP: 9-18, betaNi: 9,
454
    Vessel i: 0:
     bi: 9
                  pi: 0-5,
455
                            ai-di: 33-51,
                                           gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                                                     taoPi_SP-deltaPi_SP: 33-49,
     Vessel i: 1:
                                                                               ai_SP-di: 33-51,
                                                                                                 taoi-deltai: 33-49,
                                                                                                                                                  betaNi:
          bi: 16
     16.
     Vessel i: 2:
456
                            ai-di: 57-67,
                                           gi_SP-gpi_SP: 0.000000-0.000000,
                                                                               ai_SP-di: 57-67,
                                                                                                                     taoPi_SP-deltaPi_SP: 57-65,
                  pi: 0-5,
                                                                                                 taoi-deltai: 57-65,
                                                                                                                                                  betaNi:
          bi: 8
                  pi: 5-10,
     Vessel i: 3:
                             ai-di: 15-27,
                                            gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                ai_SP-di: 15-27,
                                                                                                  taoi-deltai: 15-25,
                                                                                                                      taoPi_SP-deltaPi_SP: 15-25,
                                                                                                                                                    betaNi
     : 10, bi: 10
                  pi: 5-10,
458
     Vessel i: 4:
                              ai-di: 42-62,
                                            gi_SP-gpi_SP: 0.000000-0.000000,
                                                                                ai_SP-di: 42-62,
                                                                                                  taoi-deltai: 42-60,
                                                                                                                      taoPi_SP-deltaPi_SP: 42-56,
                                                                                                                                                    betaNi
      18.
           bi: 18
     Vessel i: 5:
                  pi: 12-18,
                               ai-di: 17-40,
                                             gi_SP-gpi_SP: 0.000000-0.891036,
                                                                                 ai SP-di: 17-40,
                                                                                                   taoi-deltai: 18-28,
                                                                                                                       taoPi_SP-deltaPi_SP: 18-28,
     betaNi: 10.
                  bi: 10
     Vessel i: 6:
                   pi: 10-15,
                               ai-di: 21-48,
                                              gi SP-gpi SP: 1.000000-0.339615,
                                                                                 ai SP-di: 29-48,
                                                                                                   taoi-deltai: 29-42,
                                                                                                                       taoPi SP-deltaPi SP: 29-42,
                  bi: 13
     betaNi: 13,
                  pi: 28-34,
                                                                                                                       taoPi SP-deltaPi SP: 41-44,
461
     Vessel i: 7:
                               ai-di: 37-57.
                                              gi_SP-gpi_SP: 0.400000-0.769350,
                                                                                 ai SP-di: 41-57,
                                                                                                   taoi-deltai: 40-44.
     betaNi: 4,
                 bi: 4
     Vessel i: 8:
                  pi: 21-26,
                               ai-di: 8-41,
                                            gi_SP-gpi_SP: 0.600000-1.000000,
                                                                                ai_SP-di: 12-41,
                                                                                                   taoi-deltai: 12-29,
                                                                                                                      taoPi_SP-deltaPi_SP: 13-29,
           bi: 17
      : 17.
                                             gi_SP-gpi_SP: 1.000000-0.000000,
463
     Vessel i: 9:
                   pi: 16-21,
                               ai-di: 25-58,
                                                                                 ai SP-di: 31-58,
                                                                                                   taoi-deltai: 32-54,
                                                                                                                       taoPi_SP-deltaPi_SP: 32-54,
     betaNi: 22,
                  bi: 22
464
465 round LB = [649, 5664, 6279]
466 round UB = [10666, 6270, 6270]
     round Hua = [0, 5008, 5614]
467
468 round SPObjVal = [5008, 5614, 5708]
469 round MPObjValNHua = [649, 656, 665]
470
471 OptimalObj = 6279.054438167743
472
    Time: 583.000000
473
474
475
476
```