```
"E:\1 □□□□\3 □□□□□\1 □□□□□□\1 □□□□□□□□\1_□□□□□□_□□□□\1_LW _□□□□\4 □□□□\3 python_code\1 exzample\2 □□□□□□\9 Code for 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=46057

import sys; print('Python %s on %s' % (sys.version, sys.platform))
sys.path.extend(['E:\\1 □□□□\\3 □□□□□\\1 □□□□□□\\1 □□□□□□□□\\1_□□□□□□_□□□□\\1_LW _□□□□\\4 □□□□\\3 python_code\\9 Code for this paper', 'E:/1 □□□□/3 □□□□□/1 □□□□□□/1 □□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper'])

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
>>> runfile('E:/1 □□□□/3 □□□□□/1 □□□□□□/1 □□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper/main_RO_BDC.py', wdir='E:/1 □□□□/3 □□□□□/1 □□□□□□/1 □□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/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
Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)

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

Optimize a model with 619028 rows, 58701 columns and 1738778 nonzeros
Model fingerprint: 0x6d0d7cf6
Variable types: 1 continuous, 58700 integer (58660 binary)
Coefficient statistics:
  Matrix range     [1e+00, 1e+10]
  Objective range  [1e+00, 2e+01]
  Bounds range     [1e+00, 1e+00]
  RHS range        [1e+00, 2e+10]
Warning: Model contains large matrix coefficients
Warning: Model contains large rhs
         Consider reformulating model or setting NumericFocus parameter
         to avoid numerical issues.
Presolve removed 387375 rows and 28383 columns (presolve time = 5s) ...
Presolve removed 536416 rows and 39539 columns
Presolve time: 8.45s
Presolved: 82612 rows, 19162 columns, 288490 nonzeros
Variable types: 0 continuous, 19162 integer (19136 binary)

Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
Showing first log only...

Root relaxation presolved: 19162 rows, 101774 columns, 307652 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    9.9100000e+02   0.000000e+00   1.206000e+03      9s
Concurrent spin time: 0.00s

Solved with dual simplex (primal model)

Root relaxation: objective 9.910000e+02, 2421 iterations, 0.36 seconds (0.39 work units)

    Nodes    |    Current Node    |     Objective Bounds      |     Work
 Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time

     0     0  991.00000    0   20          -  991.00000      -     -   10s
     0     0  991.00000    0   93          -  991.00000      -     -   11s
     0     0  991.00000    0  104          -  991.00000      -     -   11s
H    0     0                6691.0000000  991.00000  85.2%     -   11s
H    0     0                4611.0000000  991.00000  78.5%     -   11s
     0     0  991.00000    0  104 4611.00000  991.00000  78.5%     -   11s
     0     0  991.00000    0   19 4611.00000  991.00000  78.5%     -   13s
     0     0  991.00000    0   27 4611.00000  991.00000  78.5%     -   14s
     0     0  991.00000    0   92 4611.00000  991.00000  78.5%     -   15s
     0     0  991.00000    0   88 4611.00000  991.00000  78.5%     -   16s
H    0     0                2611.0000000  991.00000  62.0%     -   17s
     0     0  991.00000    0   85 2611.00000  991.00000  62.0%     -   17s
     0     0  991.00000    0   68 2611.00000  991.00000  62.0%     -   18s
     0     0  991.00000    0   68 2611.00000  991.00000  62.0%     -   18s
H    0     0                1311.0000000  991.00000  24.4%     -   18s
     0     2  991.00000    0   29 1311.00000  991.00000  24.4%     -   21s
    42    46  991.00000    6  146 1311.00000  991.00000  24.4%   848   26s
H   66    79                 991.0000000  991.00000  0.00%  1075   28s

Cutting planes:
  Gomory: 1
  Cover: 117
  Implied bound: 649
  Clique: 4
  MIR: 102
```

```
  StrongCG: 56
  GUB cover: 11
  Zero half: 5
  RLT: 10
  Relax-and-lift: 612
  BQP: 8

Explored 117 nodes (126391 simplex iterations) in 28.67 seconds (65.83 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 991 1311 2611 ... 6691

Optimal solution found (tolerance 1.00e-10)
Best objective 9.910000000000e+02, best bound 9.910000000000e+02, gap 0.0000%
Set parameter MIPGap to value 1e-08
Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)

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

Optimize a model with 3035720 rows, 2395885 columns and 21185414 nonzeros
Model fingerprint: 0xf2f7ca95
Variable types: 1181973 continuous, 1213912 integer (1207162 binary)
Coefficient statistics:
  Matrix range     [1e-01, 1e+10]
  Objective range  [6e-05, 5e+01]
  Bounds range     [1e+00, 8e+01]
  RHS range        [8e-01, 1e+10]
Warning: Model contains large matrix coefficients
Warning: Model contains large rhs
         Consider reformulating model or setting NumericFocus parameter
         to avoid numerical issues.
Presolve removed 3030782 rows and 2394157 columns (presolve time = 5s) ...
Presolve removed 3031923 rows and 2394476 columns
Presolve time: 6.71s
Presolved: 3797 rows, 1409 columns, 10130 nonzeros
Variable types: 10 continuous, 1399 integer (819 binary)
Found heuristic solution: objective 4594.6120144
Found heuristic solution: objective 4599.2524802

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    1.1568222e+04   6.702269e+03   0.000000e+00      8s
    1350    6.5692444e+03   0.000000e+00   0.000000e+00      8s

Root relaxation: objective 6.569244e+03, 1350 iterations, 0.02 seconds (0.01 work units)

    Nodes    |    Current Node    |     Objective Bounds      |     Work
 Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time

     0     0 6569.24444    0   46 4599.25248 6569.24444  42.8%     -    8s
H    0     0                6539.4691941 6569.24444  0.46%     -    8s
     0     0 6566.44444    0    6 6539.46919 6566.44444  0.41%     -    8s
H    0     0                6566.4444444 6566.44444  0.00%     -    8s
     0     0 6566.44444    0    6 6566.44444 6566.44444  0.00%     -    8s

Cutting planes:
  Learned: 2
  Gomory: 6
  Cover: 4
  Implied bound: 12
  Clique: 1
  MIR: 1
  Flow cover: 1
  RLT: 1
  PSD: 2

Explored 1 nodes (1855 simplex iterations) in 8.74 seconds (9.79 work units)
Thread count was 8 (of 8 available processors)

Solution count 4: 6566.44 6539.47 4599.25 4594.61

Optimal solution found (tolerance 1.00e-08)
Best objective 6.566444444444e+03, best bound 6.566444444444e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□6566

  Itr = 0
Collect_LB =   [991.0]
Collect_UB =   [14123.888888888869]
Collect_Hua =   [0.0]
Collect_SPObjVal =   [6566.444444444434]
Collect_MPObjValNHua =   [991.0]
```

```
164
165
166  Set parameter TimeLimit to value 12000
167  Set parameter MIPGap to value 0.0005
168  Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
169
170  CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
171  Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
172
173  Optimize a model with 628196 rows, 344301 columns and 1748011 nonzeros
174  Model fingerprint: 0x9b065119
175  Variable types: 1 continuous, 344300 integer (344260 binary)
176  Coefficient statistics:
177    Matrix range     [1e+00, 1e+10]
178    Objective range  [1e+00, 2e+01]
179    Bounds range     [1e+00, 1e+00]
180    RHS range        [1e+00, 2e+10]
181  Warning: Model contains large matrix coefficients
182  Warning: Model contains large rhs
183           Consider reformulating model or setting NumericFocus parameter
184           to avoid numerical issues.
185  Presolve removed 471431 rows and 325200 columns (presolve time = 5s) ...
186  Presolve removed 578970 rows and 335642 columns
187  Presolve time: 8.31s
188  Presolved: 49226 rows, 8659 columns, 127720 nonzeros
189  Variable types: 0 continuous, 8659 integer (8636 binary)
190  Root relaxation presolved: 8659 rows, 57885 columns, 136379 nonzeros
191
192
193  Root simplex log...
194
195  Iteration    Objective       Primal Inf.    Dual Inf.      Time
196         0      handle free variables                         9s
197      7610    7.9174444e+03   0.000000e+00   0.000000e+00     10s
198      7610    7.9174444e+03   0.000000e+00   0.000000e+00     10s
199
200  Root relaxation: objective 7.917444e+03, 7610 iterations, 0.83 seconds (1.55 work units)
201
202      Nodes    |    Current Node    |     Objective Bounds      |     Work
203   Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time
204
205      0     0 7917.44444    0   45          - 7917.44444      -     -    9s
206      0     0 7917.44444    0  198          - 7917.44444      -     -   11s
207      0     0 7917.44444    0  162          - 7917.44444      -     -   11s
208      0     0 7917.44444    0  377          - 7917.44444      -     -   11s
209      0     0 7917.44444    0   27          - 7917.44444      -     -   13s
210      0     0 7917.44444    0  238          - 7917.44444      -     -   14s
211      0     0 7917.44444    0  131          - 7917.44444      -     -   14s
212      0     0 7917.44444    0  130          - 7917.44444      -     -   14s
213      0     0 7917.44444    0  250          - 7917.44444      -     -   14s
214      0     0 7917.44444    0  154          - 7917.44444      -     -   15s
215      0     0 7917.44444    0  248          - 7917.44444      -     -   16s
216      0     0 7917.44444    0  245          - 7917.44444      -     -   16s
217  H    0     0                    7917.4444444 7917.44444  0.00%     -   17s
218      0     0 7917.44444    0  211 7917.44444 7917.44444  0.00%     -   17s
219
220  Cutting planes:
221    Learned: 4
222    Gomory: 3
223    Cover: 186
224    Implied bound: 1306
225    Clique: 443
226    MIR: 193
227    StrongCG: 125
228    GUB cover: 43
229    Zero half: 13
230    RLT: 35
231    Relax-and-lift: 104
232    BQP: 25
233
234  Explored 1 nodes (40537 simplex iterations) in 17.62 seconds (27.92 work units)
235  Thread count was 8 (of 8 available processors)
236
237  Solution count 1: 7917.44
238
239  Optimal solution found (tolerance 5.00e-04)
240  Best objective 7.917444444444e+03, best bound 7.917444444444e+03, gap 0.0000%
241  Set parameter MIPGap to value 1e-08
242  Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
243
244  CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
245  Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
246
247  Optimize a model with 3035720 rows, 2395885 columns and 21185414 nonzeros
```

```
Model fingerprint: 0x7213566c
Variable types: 1181973 continuous, 1213912 integer (1207162 binary)
Coefficient statistics:
  Matrix range     [1e-01, 1e+10]
  Objective range  [6e-05, 5e+01]
  Bounds range     [1e+00, 8e+01]
  RHS range        [8e-01, 1e+10]
Warning: Model contains large matrix coefficients
Warning: Model contains large rhs
         Consider reformulating model or setting NumericFocus parameter
         to avoid numerical issues.
Presolve removed 3028876 rows and 2393635 columns (presolve time = 5s) ...
Presolve removed 3029027 rows and 2393680 columns
Presolve time: 6.12s
Presolved: 6693 rows, 2205 columns, 17882 nonzeros
Variable types: 10 continuous, 2195 integer (1261 binary)
Found heuristic solution: objective 4878.5754258

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    1.3784000e+04   7.285388e+03   0.000000e+00      8s
    1770    7.1231111e+03   0.000000e+00   0.000000e+00      8s

Root relaxation: objective 7.123111e+03, 1770 iterations, 0.02 seconds (0.02 work units)

    Nodes    |    Current Node    |     Objective Bounds      |     Work
 Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time

     0     0 7123.11111    0   17 4878.57543 7123.11111  46.0%     -    7s
H    0     0                    7104.4444444 7123.11111  0.26%     -    7s
*    0     0               0    7120.4444444 7120.44444  0.00%     -    7s

Cutting planes:
  Learned: 2
  Gomory: 5
  Cover: 1
  Implied bound: 2
  MIR: 2
  Flow cover: 4
  RLT: 4
  Relax-and-lift: 5
  PSD: 1

Explored 1 nodes (2452 simplex iterations) in 8.17 seconds (9.15 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 7120.44 7104.44 4878.58

Optimal solution found (tolerance 1.00e-08)
Best objective 7.120444444444e+03, best bound 7.120444444444e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□7120

 Itr = 1
Collect_LB =   [991.0, 7917.444444444444]
Collect_UB =   [14123.888888888869, 8471.444444444456]
Collect_Hua =   [0.0, 6566.444444444434]
Collect_SPObjVal =   [6566.444444444434, 7120.444444444445]
Collect_MPObjValNHua =   [991.0, 1351.000000000001]


Set parameter TimeLimit to value 12000
Set parameter MIPGap to value 0.0005
Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)

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

Optimize a model with 628197 rows, 344301 columns and 1748032 nonzeros
Model fingerprint: 0x8a7cb295
Variable types: 1 continuous, 344300 integer (344260 binary)
Coefficient statistics:
  Matrix range     [1e+00, 1e+10]
  Objective range  [1e+00, 2e+01]
  Bounds range     [1e+00, 1e+00]
  RHS range        [1e+00, 2e+10]
Warning: Model contains large matrix coefficients
Warning: Model contains large rhs
         Consider reformulating model or setting NumericFocus parameter
         to avoid numerical issues.
Presolve removed 472888 rows and 325364 columns (presolve time = 5s) ...
Presolve removed 579368 rows and 335687 columns
Presolve time: 8.37s
```

```
Presolved: 48829 rows, 8614 columns, 126604 nonzeros
Variable types: 0 continuous, 8614 integer (8591 binary)
Root relaxation presolved: 8614 rows, 57443 columns, 135218 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0     handle free variables                         9s
    7450    8.5114444e+03   0.000000e+00   0.000000e+00      9s
    7450    8.5114444e+03   0.000000e+00   0.000000e+00      9s

Root relaxation: objective 8.511444e+03, 7450 iterations, 0.83 seconds (1.56 work units)

    Nodes    |    Current Node    |     Objective Bounds      |     Work
 Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time

     0     0 8511.44444    0   48          - 8511.44444      -     -    9s
     0     0 8511.44444    0  359          - 8511.44444      -     -   10s
     0     0 8511.44444    0  371          - 8511.44444      -     -   11s
     0     0 8511.44444    0  168          - 8511.44444      -     -   11s
     0     0 8511.44444    0  198          - 8511.44444      -     -   11s
     0     0 8511.44444    0  170          - 8511.44444      -     -   13s
     0     0 8511.44444    0  211          - 8511.44444      -     -   13s
     0     0 8511.44444    0  221          - 8511.44444      -     -   13s
     0     0 8511.44444    0  404          - 8511.44444      -     -   14s
     0     0 8511.44444    0  379          - 8511.44444      -     -   14s
     0     0 8511.44444    0  250          - 8511.44444      -     -   18s
     0     0 8511.44444    0  248          - 8511.44444      -     -   18s
     0     0 8511.44444    0  562          - 8511.44444      -     -   19s
     0     0 8511.44444    0  424          - 8511.44444      -     -   19s
     0     0 8511.44444    0  421          - 8511.44444      -     -   19s
     0     0 8511.44444    0  279          - 8511.44444      -     -   21s
     0     0 8511.44444    0  109          - 8511.44444      -     -   22s
     0     2 8511.44444    0  109          - 8511.44444      -     -   24s
     1     4 8511.44444    1  254          - 8511.44444      -  1005   25s
    31    28 8511.44444    8  456          - 8511.44444      -  1733   30s
    61    62 8551.44444   13  852          - 8511.44444      -  2035   36s
   126   157 8831.44444   40  259          - 8511.44444      -  1540   43s
   217   241 8831.44444   77  190          - 8511.44444      -  1115   46s
   451   441 8871.44444  188  267          - 8511.44444      -   643   51s
   723   611 8831.44444    4  438          - 8511.44444      -   473   55s
   978   836 8865.78404   56  484          - 8511.44444      -   415   61s
  1213  1065 8911.44444  121  296          - 8511.44444      -   380   65s
  1604  1415 8911.44444  252  260          - 8511.44444      -   325   70s
  1786  1416 8547.50078   56  109          - 8511.44444      -   312   84s
  1788  1417 8631.44444  424   56          - 8511.44444      -   312   86s
  1790  1419 8511.44444    7  439          - 8511.44444      -   311   91s
  1791  1419 9111.44444  480  375          - 8511.44444      -   311   95s
  1793  1421 8751.44444  162  597          - 8511.44444      -   311  102s
  1794  1421 8951.44444  246  783          - 8511.44444      -   311  105s
  1796  1423 8951.44444  572  716          - 8511.44444      -   310  111s
  1797  1423 8511.44444   22  507          - 8511.44444      -   310  116s
  1799  1425 9791.44444  181  665          - 8511.44444      -   310  124s
  1800  1425 8911.44444  295  904          - 8511.44444      -   310  126s
H 1800  1353                    8631.4444444 8511.44444  1.39%   310  132s
  1802  1355 8591.44444  211  645 8631.44444 8511.44444  1.39%   309  135s
  1810  1363 8631.44444  231  109 8631.44444 8511.44444  1.39%   389  142s
  1813  1365 8631.44444  511  427 8631.44444 8511.44444  1.39%   388  145s
  1817  1368 8631.44444  201  317 8631.44444 8511.44444  1.39%   387  151s
H 1818  1299                    8591.4444444 8511.44444  0.93%   387  153s

Cutting planes:
  Learned: 1
  Gomory: 53
  Cover: 175
  Implied bound: 45
  Projected implied bound: 9
  Clique: 74
  MIR: 54
  StrongCG: 15
  Flow cover: 117
  GUB cover: 86
  Zero half: 15
  RLT: 60
  Relax-and-lift: 98
  BQP: 2

Explored 1818 nodes (810195 simplex iterations) in 153.71 seconds (299.91 work units)
Thread count was 8 (of 8 available processors)

Solution count 2: 8591.44 8631.44

Optimal solution found (tolerance 5.00e-04)
```

```
Best objective 8.591444444444e+03, best bound 8.591444444444e+03, gap 0.0000%
Set parameter MIPGap to value 1e-08
Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)

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

Optimize a model with 3035720 rows, 2395885 columns and 21185414 nonzeros
Model fingerprint: 0xa3e69282
Variable types: 1181973 continuous, 1213912 integer (1207162 binary)
Coefficient statistics:
  Matrix range     [1e-01, 1e+10]
  Objective range  [6e-05, 5e+01]
  Bounds range     [1e+00, 8e+01]
  RHS range        [8e-01, 1e+10]
Warning: Model contains large matrix coefficients
Warning: Model contains large rhs
         Consider reformulating model or setting NumericFocus parameter
         to avoid numerical issues.
Presolve removed 3029068 rows and 2393693 columns (presolve time = 5s) ...
Presolve removed 3029341 rows and 2393776 columns
Presolve time: 6.22s
Presolved: 6379 rows, 2109 columns, 17146 nonzeros
Variable types: 10 continuous, 2099 integer (1212 binary)
Found heuristic solution: objective 4929.7421607
Found heuristic solution: objective 4933.6310496

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    1.3020000e+04   5.535106e+03   0.000000e+00      8s
    1898    7.1284444e+03   0.000000e+00   0.000000e+00      8s

Root relaxation: objective 7.128444e+03, 1898 iterations, 0.02 seconds (0.02 work units)

    Nodes    |    Current Node    |     Objective Bounds      |     Work
 Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time

     0     0 7128.44444    0   15 4933.63105 7128.44444  44.5%     -    7s
H    0     0                    7102.4444444 7128.44444  0.37%     -    7s
H    0     0                    7124.4444444 7128.44444  0.06%     -    8s
*    0     0               0    7128.4444444 7128.44444  0.00%     -    8s

Cutting planes:
  Learned: 1
  Implied bound: 6
  MIR: 2
  Flow cover: 2
  Zero half: 3
  RLT: 2
  Relax-and-lift: 1

Explored 1 nodes (2719 simplex iterations) in 8.35 seconds (9.14 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 7128.44 7124.44 7102.44 ... 4929.74

Optimal solution found (tolerance 1.00e-08)
Best objective 7.128444444444e+03, best bound 7.128444444444e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□7128

 Itr = 2
Collect_LB =   [991.0, 7917.444444444444, 8591.444444444445]
Collect_UB =   [14123.888888888869, 8471.444444444456, 8471.444444444456]
Collect_Hua =   [0.0, 6566.444444444434, 7120.444444444445]
Collect_SPObjVal =   [6566.444444444434, 7120.444444444445, 7128.444444444445]
Collect_MPObjValNHua =   [991.0, 1351.00000000001, 1471.0]


 Ops, stop iteration
 Values adopted from the Itr-1' th iteration, and Itr = {2}, judgeCount = {1}

~~~~~~~~~~judgeCount = 1, SPObj_SPF = 7120.444444444445
Vessel i: 0:    pi: 12-18,    ai-di: 2-15,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 2-15,    taoi-deltai: 2-15,    taoPi_SP-deltaPi_SP: 2-15,    betaNi: 13,    bi: 13
Vessel i: 1:    pi: 6-12,    ai-di: 14-36,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 14-36,    taoi-deltai: 14-37,    taoPi_SP-deltaPi_SP: 14-37,    betaNi: 23,    bi: 23
Vessel i: 2:    pi: 18-25,    ai-di: 14-25,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 14-25,    taoi-deltai: 14-21,    taoPi_SP-deltaPi_SP: 14-21,    betaNi: 7,    bi: 7
Vessel i: 3:    pi: 12-17,    ai-di: 20-44,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 20-44,    taoi-deltai: 20-41,    taoPi_SP-deltaPi_SP: 20-41,    betaNi: 21,    bi: 21
Vessel i: 4:    pi: 17-24,    ai-di: 24-30,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 24-30,    taoi-deltai: 24-29,    taoPi_SP-deltaPi_SP: 24-29,    betaNi: 5,    bi: 5
```

```
Vessel i: 5:  pi: 17-23,  ai-di: 29-48,  gi_SP-gpi_SP: 0.200000-1.000000,  ai_SP-di: 30-48,  taoi-deltai: 32-50,  taoPi_SP-deltaPi_SP: 32-50,  betaNi: 18,  bi: 18
Vessel i: 6:  pi: 9-15,  ai-di: 34-63,  gi_SP-gpi_SP: 1.000000-0.600000,  ai_SP-di: 42-63,  taoi-deltai: 42-71,  taoPi_SP-deltaPi_SP: 42-71,  betaNi: 29,  bi: 29
Vessel i: 7:  pi: 28-34,  ai-di: 34-43,  gi_SP-gpi_SP: 0.800000-0.400000,  ai_SP-di: 42-43,  taoi-deltai: 38-45,  taoPi_SP-deltaPi_SP: 42-45,  betaNi: 7,  bi: 7
Vessel i: 8:  pi: 28-34,  ai-di: 47-66,  gi_SP-gpi_SP: 0.000000-1.000000,  ai_SP-di: 47-66,  taoi-deltai: 47-67,  taoPi_SP-deltaPi_SP: 47-67,  betaNi: 20,  bi: 20
Vessel i: 9:  pi: 17-23,  ai-di: 50-68,  gi_SP-gpi_SP: 1.000000-0.000000,  ai_SP-di: 57-68,  taoi-deltai: 57-74,  taoPi_SP-deltaPi_SP: 57-74,  betaNi: 17,  bi: 17

round LB =  [991, 7917, 8591]
round UB =  [14124, 8471, 8471]
round Hua =  [0, 6566, 7120]
round SPObjVal =  [6566, 7120, 7128]
round MPObjValNHua =  [991, 1351, 1471]

OptimalObj = 8591.444444444445
Time: 739.000000
```