```
"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=46401

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 648826 rows, 58701 columns and 1805708 nonzeros
Model fingerprint: 0x71546b27
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 292891 rows and 15988 columns (presolve time = 5s) ...
Presolve removed 292891 rows and 15988 columns (presolve time = 10s) ...
Presolve removed 292891 rows and 15988 columns (presolve time = 15s) ...
Presolve removed 539391 rows and 36153 columns
Presolve time: 17.57s
Presolved: 109435 rows, 22548 columns, 339203 nonzeros
Variable types: 0 continuous, 22548 integer (22518 binary)

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

Root relaxation presolved: 22548 rows, 131983 columns, 361751 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    6.8400000e+02   0.000000e+00   1.054000e+03     19s
Concurrent spin time: 0.00s

Solved with dual simplex (primal model)

Root relaxation: objective 6.840000e+02, 4274 iterations, 0.88 seconds (1.23 work units)
Total elapsed time = 20.60s

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

     0     0  684.00000    0   38          -  684.00000      -     -   20s
H    0     0                5844.0000000  684.00000  88.3%     -   21s
     0     0  684.00000    0  104 5844.00000  684.00000  88.3%     -   22s
     0     0  684.00000    0   79 5844.00000  684.00000  88.3%     -   22s
H    0     0                4204.0000000  684.00000  83.7%     -   22s
     0     0  684.00000    0   77 4204.00000  684.00000  83.7%     -   22s
     0     0  684.00000    0   18 4204.00000  684.00000  83.7%     -   24s
H    0     0                1544.0000000  684.00000  55.7%     -   24s
     0     0  684.00000    0   27 1544.00000  684.00000  55.7%     -   25s
     0     0  684.00000    0   60 1544.00000  684.00000  55.7%     -   26s
     0     0  684.00000    0  112 1544.00000  684.00000  55.7%     -   26s
     0     0  684.00000    0   36 1544.00000  684.00000  55.7%     -   28s
H    0     0                1124.0000000  684.00000  39.1%     -   28s
     0     0  684.00000    0   75 1124.00000  684.00000  39.1%     -   28s
     0     0  684.00000    0  175 1124.00000  684.00000  39.1%     -   29s
     0     0  684.00000    0   37 1124.00000  684.00000  39.1%     -   34s
     0     0  684.00000    0  237 1124.00000  684.00000  39.1%     -   35s
     0     0  684.00000    0  197 1124.00000  684.00000  39.1%     -   35s
     0     0  684.00000    0  149 1124.00000  684.00000  39.1%     -   35s
     0     0  684.00000    0   59 1124.00000  684.00000  39.1%     -   39s
     0     0  684.00000    0   58 1124.00000  684.00000  39.1%     -   39s
H    0     0                1084.0000000  684.00000  36.9%     -   39s
```

```
     0     0  684.00000    0  150 1084.00000  684.00000  36.9%    -   39s
H    0     0                924.0000000  684.00000  26.0%    -   39s
     0     0  684.00000    0  206  924.00000  684.00000  26.0%    -   41s
     0     0  684.00000    0   43  924.00000  684.00000  26.0%    -   42s
     0     0  684.00000    0   43  924.00000  684.00000  26.0%    -   45s
     0     0  684.00000    0  229  924.00000  684.00000  26.0%    -   46s
     0     0  684.00000    0  226  924.00000  684.00000  26.0%    -   46s
     0     0  684.00000    0  347  924.00000  684.00000  26.0%    -   47s
H    0     0                684.0000000  684.00000  0.00%    -   48s
     0     0  684.00000    0   25  684.00000  684.00000  0.00%    -   48s

Cutting planes:
  Gomory: 2
  Cover: 103
  Implied bound: 977
  Clique: 56
  MIR: 25
  StrongCG: 17
  GUB cover: 21
  RLT: 6
  Relax-and-lift: 10
  PSD: 2

Explored 1 nodes (69720 simplex iterations) in 48.81 seconds (80.64 work units)
Thread count was 8 (of 8 available processors)

Solution count 7: 684 924 1084 ... 5844

Optimal solution found (tolerance 1.00e-10)
Best objective 6.840000000000e+02, best bound 6.840000000000e+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 3035833 rows, 2395885 columns and 21185866 nonzeros
Model fingerprint: 0x4fb8607a
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 3033045 rows and 2394852 columns (presolve time = 5s) ...
Presolve removed 3033329 rows and 2394938 columns
Presolve time: 6.36s
Presolved: 2504 rows, 947 columns, 6695 nonzeros
Variable types: 10 continuous, 937 integer (563 binary)
Found heuristic solution: objective 3279.6104410
Found heuristic solution: objective 3440.6104410

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    8.2792222e+03   2.755776e+03   0.000000e+00      8s
     783    4.8948590e+03   0.000000e+00   0.000000e+00      8s

Root relaxation: objective 4.894859e+03, 783 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 4894.85898    0   54 3440.61044 4894.85898  42.3%    -    8s
H    0     0                4891.7251799 4894.85898  0.06%    -    8s
     0     0 4893.27025    0   23 4891.72518 4893.27025  0.03%    -    8s
     0     0 4893.27025    0   12 4891.72518 4893.27025  0.03%    -    8s
     0     0 4893.27025    0    9 4891.72518 4893.27025  0.03%    -    8s
H    0     0                4892.3829521 4893.27025  0.02%    -    8s
     0     0    cutoff    0      4892.38295 4892.38295  0.00%    -    8s

Cutting planes:
  Gomory: 1
  MIR: 1
  RLT: 1
  Relax-and-lift: 1

Explored 1 nodes (1478 simplex iterations) in 8.43 seconds (9.28 work units)
Thread count was 8 (of 8 available processors)
```

```
Solution count 4: 4892.38 4891.73 3440.61 3279.61

Optimal solution found (tolerance 1.00e-08)
Best objective 4.892382952071e+03, best bound 4.892382952071e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□4892

  Itr = 0
Collect_LB =   [684.0]
Collect_UB =   [10468.7659041425]
Collect_Hua =   [0.0]
Collect_SPObjVal =   [4892.38295207125]
Collect_MPObjValNHua =   [684.0]


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 654152 rows, 344301 columns and 1811099 nonzeros
Model fingerprint: 0x0f17104a
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 342656 rows and 308396 columns (presolve time = 5s) ...
Presolve removed 342656 rows and 308396 columns (presolve time = 10s) ...
Presolve removed 342656 rows and 308396 columns (presolve time = 15s) ...
Presolve removed 342656 rows and 308396 columns (presolve time = 20s) ...
Presolve removed 577229 rows and 327628 columns
Presolve time: 24.14s
Presolved: 76923 rows, 16673 columns, 242083 nonzeros
Variable types: 0 continuous, 16673 integer (16643 binary)

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

Root relaxation presolved: 16673 rows, 93596 columns, 258756 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    5.5810258e+03   0.000000e+00   5.837000e+03     26s
Concurrent spin time: 0.00s

Solved with dual simplex (primal model)

Root relaxation: objective 5.581026e+03, 7662 iterations, 0.94 seconds (1.76 work units)

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

     0     0 5581.02581    0   29          - 5581.02581      -     -   27s
     0     0 5581.02581    0   99          - 5581.02581      -     -   28s
     0     0 5581.02581    0  211          - 5581.02581      -     -   28s
     0     0 5581.02581    0  103          - 5581.02581      -     -   31s
H    0     0                 8281.0258092 5581.02581  32.6%     -   32s
     0     0 5581.02581    0  128 8281.02581 5581.02581  32.6%     -   32s
     0     0 5581.02581    0  107 8281.02581 5581.02581  32.6%     -   33s
H    0     0                 8201.0258092 5581.02581  31.9%     -   33s
H    0     0                 7561.0258092 5581.02581  26.2%     -   34s
     0     0 5581.02581    0  241 7561.02581 5581.02581  26.2%     -   34s
     0     0 5581.02581    0  165 7561.02581 5581.02581  26.2%     -   36s
     0     0 5581.02581    0  207 7561.02581 5581.02581  26.2%     -   36s
     0     0 5581.02581    0  371 7561.02581 5581.02581  26.2%     -   38s
     0     0 5581.02581    0  221 7561.02581 5581.02581  26.2%     -   41s
     0     0 5581.02581    0  170 7561.02581 5581.02581  26.2%     -   41s
H    0     0                 7181.0258092 5581.02581  22.3%     -   43s
H    0     0                 5581.0258092 5581.02581  0.00%     -   46s
     0     0 5581.02581    0  170 5581.02581 5581.02581  0.00%     -   46s

Cutting planes:
  Learned: 1
  Gomory: 1
```

```
  Cover: 49
  Implied bound: 32
  Clique: 446
  MIR: 81
  StrongCG: 54
  GUB cover: 7
  Zero half: 3
  RLT: 9
  Relax-and-lift: 17
  BQP: 79
  PSD: 1

Explored 1 nodes (100005 simplex iterations) in 46.08 seconds (79.33 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 5581.03 7181.03 7561.03 ... 8281.03

Optimal solution found (tolerance 5.00e-04)
Best objective 5.581025809214e+03, best bound 5.581025809214e+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 3035833 rows, 2395885 columns and 21185866 nonzeros
Model fingerprint: 0x144eec69
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 3031118 rows and 2394350 columns (presolve time = 5s) ...
Presolve removed 3031170 rows and 2394365 columns
Presolve time: 5.99s
Presolved: 4663 rows, 1520 columns, 12447 nonzeros
Variable types: 10 continuous, 1510 integer (884 binary)
Found heuristic solution: objective 3772.3644878
Found heuristic solution: objective 3801.2533767

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    8.8640000e+03   4.513912e+03   0.000000e+00      8s
    1893    5.4099444e+03   0.000000e+00   0.000000e+00      8s

Root relaxation: objective 5.409944e+03, 1893 iterations, 0.03 seconds (0.04 work units)

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

     0     0 5409.94444    0    4 3801.25338 5409.94444  42.3%     -    7s
H    0     0                    5407.9005126 5409.94444  0.04%     -    7s
*    0     0               0    5409.9444444 5409.94444  0.00%     -    7s

Cutting planes:
  Gomory: 1
  GUB cover: 1
  RLT: 1

Explored 1 nodes (2544 simplex iterations) in 8.06 seconds (8.63 work units)
Thread count was 8 (of 8 available processors)

Solution count 4: 5409.94 5407.9 3801.25 3772.36

Optimal solution found (tolerance 1.00e-08)
Best objective 5.409944444444e+03, best bound 5.409944444444e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5409

 Itr = 1
Collect_LB =   [684.0, 5581.025809214107]
Collect_UB =   [10468.7659041425, 6098.587301587302]
Collect_Hua =   [0.0, 4892.38295207125]
Collect_SPObjVal =   [4892.38295207125, 5409.944444444445]
Collect_MPObjValNHua =   [684.0, 688.6428571428569]


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 654153 rows, 344301 columns and 1811120 nonzeros
Model fingerprint: 0x91b3b71d
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 343650 rows and 308501 columns (presolve time = 5s) ...
Presolve removed 343650 rows and 308501 columns (presolve time = 10s) ...
Presolve removed 343650 rows and 308501 columns (presolve time = 15s) ...
Presolve removed 343650 rows and 308501 columns (presolve time = 20s) ...
Presolve removed 583691 rows and 327685 columns
Presolve time: 23.90s
Presolved: 70462 rows, 16616 columns, 235024 nonzeros
Variable types: 0 continuous, 16616 integer (16586 binary)

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

Root relaxation presolved: 16616 rows, 87078 columns, 251640 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    6.1084444e+03   0.000000e+00   5.838000e+03     25s
Concurrent spin time: 0.20s

Solved with dual simplex (primal model)

Root relaxation: objective 6.108444e+03, 7058 iterations, 1.16 seconds (1.98 work units)

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

     0     0 6108.44444    0   44          - 6108.44444      -     -   26s
     0     0 6108.44444    0   47          - 6108.44444      -     -   26s
     0     0 6108.44444    0  114          - 6108.44444      -     -   28s
     0     0 6108.44444    0  112          - 6108.44444      -     -   28s
     0     0 6108.44444    0  142          - 6108.44444      -     -   29s
     0     0 6108.44444    0  200          - 6108.44444      -     -   32s
     0     0 6108.44444    0  249          - 6108.44444      -     -   33s
     0     0 6108.44444    0  166          - 6108.44444      -     -   36s
     0     0 6108.44444    0  333          - 6108.44444      -     -   38s
     0     0 6108.44444    0  178          - 6108.44444      -     -   40s
H    0     0                12528.444444 6108.44444  51.2%     -   41s
     0     0 6108.44444    0  178 12528.4444 6108.44444  51.2%     -   42s
H    0     0                8408.4444444 6108.44444  27.4%     -   42s
H    0     0                6108.4444444 6108.44444  0.00%     -   45s
     0     0 6108.44444    0  178 6108.44444 6108.44444  0.00%     -   45s

Cutting planes:
  Gomory: 2
  Cover: 72
  Implied bound: 24
  Clique: 1837
  MIR: 109
  StrongCG: 67
  GUB cover: 32
  Zero half: 3
  RLT: 8
  Relax-and-lift: 13
  BQP: 71
  PSD: 1

Explored 1 nodes (73307 simplex iterations) in 45.41 seconds (64.68 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 6108.44 8408.44 12528.4

Optimal solution found (tolerance 5.00e-04)
Best objective 6.108444444444e+03, best bound 6.108444444444e+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 3035833 rows, 2395885 columns and 21185866 nonzeros
Model fingerprint: 0x1582cf2e
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 3031525 rows and 2394433 columns (presolve time = 5s) ...
Presolve removed 3031569 rows and 2394448 columns
Presolve time: 5.81s
Presolved: 4264 rows, 1437 columns, 11446 nonzeros
Variable types: 10 continuous, 1427 integer (841 binary)
Found heuristic solution: objective 3740.9042488
Found heuristic solution: objective 3780.9042488

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    8.8770000e+03   3.924648e+03   0.000000e+00      7s
    1595    5.4249444e+03   0.000000e+00   0.000000e+00      7s

Root relaxation: objective 5.424944e+03, 1595 iterations, 0.03 seconds (0.03 work units)

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

*    0     0               0    5424.9444444 5424.94444  0.00%     -    7s

Explored 1 nodes (2055 simplex iterations) in 7.82 seconds (8.12 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 5424.94 3780.9 3740.9

Optimal solution found (tolerance 1.00e-08)
Best objective 5.424944444444e+03, best bound 5.424944444444e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5424

 Itr = 2
Collect_LB =   [684.0, 5581.025809214107, 6108.444444444445]
Collect_UB =   [10468.7659041425, 6098.587301587302, 6098.587301587302]
Collect_Hua =   [0.0, 4892.38295207125, 5409.944444444445]
Collect_SPObjVal =   [4892.38295207125, 5409.944444444445, 5424.944444444445]
Collect_MPObjValNHua =   [684.0, 688.6428571428569, 698.5]


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

~~~~~~~~~~judgeCount = 1, SPObj_SPF = 5409.944444444445
Vessel i: 0:     pi: 0-5,     ai-di: 28-81,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 28-81,     taoi-deltai: 28-35,     taoPi_SP-deltaPi_SP: 28-35,     betaNi: 7,     bi: 7
Vessel i: 1:     pi: 0-5,     ai-di: 15-45,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 15-45,     taoi-deltai: 15-21,     taoPi_SP-deltaPi_SP: 15-21,     betaNi: 6,     bi: 6
Vessel i: 2:     pi: 5-10,     ai-di: 19-50,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 19-50,     taoi-deltai: 19-28,     taoPi_SP-deltaPi_SP: 19-28,     betaNi: 9,     bi: 9
Vessel i: 3:     pi: 10-16,     ai-di: 9-55,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 9-55,     taoi-deltai: 9-35,     taoPi_SP-deltaPi_SP: 9-35,     betaNi: 26,     bi: 26
Vessel i: 4:     pi: 22-27,     ai-di: 20-42,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 20-42,     taoi-deltai: 20-25,     taoPi_SP-deltaPi_SP: 20-25,     betaNi: 5,     bi: 5
Vessel i: 5:     pi: 17-22,     ai-di: 3-61,     gi_SP-gpi_SP: 0.000000-1.000000,     ai_SP-di: 3-61,     taoi-deltai: 4-12,     taoPi_SP-deltaPi_SP: 4-12,     betaNi: 8,     bi: 8
Vessel i: 6:     pi: 16-22,     ai-di: 9-72,     gi_SP-gpi_SP: 0.875000-0.200000,     ai_SP-di: 16-72,     taoi-deltai: 16-33,     taoPi_SP-deltaPi_SP: 16-33,     betaNi: 17,     bi: 17
Vessel i: 7:     pi: 24-29,     ai-di: 2-77,     gi_SP-gpi_SP: 0.800000-0.800000,     ai_SP-di: 10-77,     taoi-deltai: 6-12,     taoPi_SP-deltaPi_SP: 10-12,     betaNi: 6,     bi: 6
Vessel i: 8:     pi: 28-34,     ai-di: 22-62,     gi_SP-gpi_SP: 0.325000-1.000000,     ai_SP-di: 24-62,     taoi-deltai: 26-36,     taoPi_SP-deltaPi_SP: 26-36,     betaNi: 10,     bi: 10
Vessel i: 9:     pi: 17-24,     ai-di: 28-79,     gi_SP-gpi_SP: 1.000000-0.000000,     ai_SP-di: 35-79,     taoi-deltai: 35-58,     taoPi_SP-deltaPi_SP: 35-58,     betaNi: 23,     bi: 23

round LB =   [684, 5581, 6108]
round UB =   [10469, 6099, 6099]
round Hua =   [0, 4892, 5410]
```

```
round SPObjVal =   [4892, 5410, 5425]
round MPObjValNHua =   [684, 689, 698]

OptimalObj = 6108.444444444445
Time: 679.000000
```