```
"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=41288

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_CCG.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 543655 rows, 46641 columns and 1499735 nonzeros
Model fingerprint: 0x93443863
Variable types: 1 continuous, 46640 integer (46608 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 364125 rows and 24742 columns (presolve time = 5s) ...
Presolve removed 488817 rows and 33971 columns
Presolve time: 6.41s
Presolved: 54838 rows, 12670 columns, 188803 nonzeros
Variable types: 0 continuous, 12670 integer (12646 binary)

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

Root relaxation presolved: 54833 rows, 12675 columns, 188788 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    9.1900000e+02   8.650000e+01   1.965148e+08      7s
Concurrent spin time: 0.02s

Solved with dual simplex (primal model)

Root relaxation: objective 7.790000e+02, 2314 iterations, 0.24 seconds (0.22 work units)

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

     0     0  779.00000    0   40          -  779.00000      -     -    7s
H    0     0                5139.0000000  779.00000  84.8%     -    7s
H    0     0                4979.0000000  779.00000  84.4%     -    7s
H    0     0                2479.0000000  779.00000  68.6%     -    7s
     0     0  779.00000    0  195 2479.00000  779.00000  68.6%     -    8s
     0     0  779.00000    0   89 2479.00000  779.00000  68.6%     -    8s
H    0     0                2359.0000000  779.00000  67.0%     -    8s
H    0     0                2139.0000000  779.00000  63.6%     -    8s
H    0     0                1479.0000000  779.00000  47.3%     -    8s
     0     0  779.00000    0   90 1479.00000  779.00000  47.3%     -    8s
H    0     0                1439.0000000  779.00000  45.9%     -    9s
     0     0  779.00000    0   10 1439.00000  779.00000  45.9%     -    9s
     0     0  779.00000    0   18 1439.00000  779.00000  45.9%     -   10s
     0     0  779.00000    0   18 1439.00000  779.00000  45.9%     -   10s
     0     0  779.00000    0   36 1439.00000  779.00000  45.9%     -   11s
     0     0  779.00000    0   64 1439.00000  779.00000  45.9%     -   11s
     0     0  779.00000    0   53 1439.00000  779.00000  45.9%     -   11s
H    0     0                779.0000000  779.00000  0.00%     -   12s
     0     0  779.00000    0   22  779.00000  779.00000  0.00%     -   12s

Cutting planes:
  Gomory: 2
  Cover: 275
  Implied bound: 882
  Clique: 19
```

```
  MIR: 49
  StrongCG: 27
  GUB cover: 8
  Zero half: 2
  RLT: 17
  Relax-and-lift: 18
  BQP: 9
  PSD: 1

Explored 1 nodes (25963 simplex iterations) in 12.42 seconds (21.52 work units)
Thread count was 8 (of 8 available processors)

Solution count 8: 779 1439 1479 ... 5139

Optimal solution found (tolerance 1.00e-10)
Best objective 7.790000000000e+02, best bound 7.790000000000e+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 1983368 rows, 1559473 columns and 13693931 nonzeros
Model fingerprint: 0x1ad678e8
Variable types: 766961 continuous, 792512 integer (787112 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 1981092 rows and 1558646 columns
Presolve time: 3.97s
Presolved: 2276 rows, 827 columns, 6068 nonzeros
Variable types: 6 continuous, 821 integer (486 binary)
Found heuristic solution: objective 3611.0215813

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    7.6070000e+03   2.825420e+03   0.000000e+00      5s
     637    5.0405771e+03   0.000000e+00   0.000000e+00      5s

Root relaxation: objective 5.040577e+03, 637 iterations, 0.00 seconds (0.00 work units)

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

     0     0 5040.57714    0    8 3611.02158 5040.57714  39.6%     -    5s
H    0     0                    4980.5771368 5040.57714  1.20%     -    5s
H    0     0                    5010.5771368 5040.57714  0.60%     -    5s
H    0     0                    5028.5771368 5040.57714  0.24%     -    5s
*    0     0               0    5040.5771368 5040.57714  0.00%     -    5s

Cutting planes:
  Gomory: 1
  Cover: 4
  Implied bound: 1
  Clique: 9
  MIR: 1
  Zero half: 3
  RLT: 2
  Relax-and-lift: 2

Explored 1 nodes (982 simplex iterations) in 5.28 seconds (5.87 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 5040.58 5028.58 5010.58 ... 3611.02

Optimal solution found (tolerance 1.00e-08)
Best objective 5.040577136846e+03, best bound 5.040577136846e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5040

  Itr = 0
Collect_LB =   [779.0]
Collect_UB =   [10860.154273692304]
Collect_Hua =   [0.0]
Collect_SPObjVal =   [5040.577136846152]
Collect_MPObjValNHua =   [779.0]

```

```
Set parameter MIPGap to value 0.05
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 978249 rows, 246921 columns and 2874075 nonzeros
Model fingerprint: 0x6669dd3c
Variable types: 1 continuous, 246920 integer (236784 binary)
Coefficient statistics:
  Matrix range     [1e-01, 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 814101 rows and 226888 columns (presolve time = 5s) ...
Presolve removed 888229 rows and 235283 columns (presolve time = 10s) ...
Presolve removed 901510 rows and 235288 columns
Presolve time: 10.72s
Presolved: 76739 rows, 11633 columns, 238449 nonzeros
Variable types: 1 continuous, 11632 integer (9629 binary)

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

Root relaxation presolved: 11633 rows, 88372 columns, 250082 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    5.8395771e+03   0.000000e+00   1.706797e+04     11s
Concurrent spin time: 0.40s

Solved with dual simplex (primal model)

Root relaxation: objective 5.839577e+03, 5949 iterations, 1.30 seconds (1.91 work units)

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

     0     0 5839.57714    0  235          - 5839.57714      -     -   14s
     0     0 5839.57714    0  659          - 5839.57714      -     -   15s
     0     0 5839.57714    0  601          - 5839.57714      -     -   16s
     0     0 5839.57714    0  482          - 5839.57714      -     -   16s
     0     0 5839.57714    0  479          - 5839.57714      -     -   16s
     0     0 5839.57714    0  124          - 5839.57714      -     -   20s
     0     0 5839.57714    0  293          - 5839.57714      -     -   21s
     0     0 5839.57714    0  314          - 5839.57714      -     -   21s
     0     0 5839.57714    0  159          - 5839.57714      -     -   25s
     0     0 5839.57714    0  129          - 5839.57714      -     -   26s
     0     0 5839.57714    0  126          - 5839.57714      -     -   26s
     0     0 5839.57714    0  153          - 5839.57714      -     -   29s
     0     0 5839.57714    0  115          - 5839.57714      -     -   29s
     0     0 5839.57714    0  269          - 5839.57714      -     -   29s
     0     0 5839.57714    0  117          - 5839.57714      -     -   31s
     0     0 5839.57714    0  100          - 5839.57714      -     -   31s
     0     0 5839.57714    0  233          - 5839.57714      -     -   32s
     0     0 5839.57714    0  126          - 5839.57714      -     -   33s
     0     0 5839.57714    0  246          - 5839.57714      -     -   34s
     0     0 5839.57714    0  241          - 5839.57714      -     -   34s
     0     0 5839.57714    0   63         - 5839.57714      -     -   35s
     0     0 5839.57714    0   70         - 5839.57714      -     -   35s
     0     0 5839.57714    0  131          - 5839.57714      -     -   36s
     0     0 5839.57714    0   67         - 5839.57714      -     -   37s
     0     2 5839.57714    0   67         - 5839.57714      -     -   40s
    19    22 6008.46603    5  389          - 5839.57714      -  1744   45s
    41    41 6039.57714   11  146          - 5839.57714      -  1615   50s
    61    60 6039.57714   17  168          - 5839.57714      -  1471   55s
   112   117 6039.57714   26  310          - 5839.57714      -  1064   60s
   223   224 6039.57714   34  306          - 5839.57714      -   696   66s
   340   314 6039.57714   54  276          - 5839.57714      -   512   70s
   686   705 6039.57714   94  197          - 5839.57714      -   294   76s
   967   850 6039.57714  137  238          - 5839.57714      -   228   80s
  1163  1106 6039.57714  172  254          - 5839.57714      -   226   86s
* 1470   499             80    5839.5771368 5839.57714  0.00%   200   89s

Cutting planes:
  Learned: 15
  Gomory: 2
```

```
  Cover: 519
  Implied bound: 441
  Clique: 123
  MIR: 102
  StrongCG: 49
  Flow cover: 11
  GUB cover: 307
  Zero half: 22
  RLT: 78
  Relax-and-lift: 232
  BQP: 17

Explored 1694 nodes (432903 simplex iterations) in 89.69 seconds (218.45 work units)
Thread count was 8 (of 8 available processors)

Solution count 1: 5839.58

Optimal solution found (tolerance 5.00e-02)
Best objective 5.839577136846e+03, best bound 5.839577136846e+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 1983368 rows, 1559473 columns and 13693931 nonzeros
Model fingerprint: 0x4b2e84e9
Variable types: 766961 continuous, 792512 integer (787112 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 1978553 rows and 1557793 columns
Presolve time: 3.84s
Presolved: 4815 rows, 1680 columns, 12856 nonzeros
Variable types: 6 continuous, 1674 integer (967 binary)
Found heuristic solution: objective 3627.0215813

Root relaxation: objective 5.338777e+03, 1290 iterations, 0.01 seconds (0.01 work units)

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

     0     0 5338.77678    0   48 3627.02158 5338.77678  47.2%     -    4s
H    0     0                    5104.0843674 5338.77678  4.60%     -    4s
H    0     0                    5328.4064055 5338.77678  0.19%     -    4s
     0     0    cutoff    0      5328.40641 5328.40641  0.00%     -    4s

Cutting planes:
  Gomory: 2
  Cover: 1
  Clique: 9
  Zero half: 7
  RLT: 1

Explored 1 nodes (2068 simplex iterations) in 5.14 seconds (5.66 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 5328.41 5104.08 3627.02

Optimal solution found (tolerance 1.00e-08)
Best objective 5.328406405495e+03, best bound 5.328406405495e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5328

  Itr = 1
Collect_LB =   [779.0, 5839.577136846152]
Collect_UB =   [10860.154273692304, 6127.40640549518]
Collect_Hua =   [0.0, 5040.577136846152]
Collect_SPObjVal =   [5040.577136846152, 5328.40640549518]
Collect_MPObjValNHua =   [779.0, 799.0]


Set parameter MIPGap to value 0.05
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 1408285 rows, 264417 columns and 4243829 nonzeros
Model fingerprint: 0x3c12c4ec
Variable types: 1 continuous, 264416 integer (244176 binary)
Coefficient statistics:
  Matrix range     [1e-01, 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 1198810 rows and 238844 columns (presolve time = 5s) ...
Presolve removed 1230112 rows and 241557 columns (presolve time = 10s) ...
Presolve removed 1295650 rows and 248172 columns (presolve time = 15s) ...
Presolve removed 1295686 rows and 248177 columns
Presolve time: 15.88s
Presolved: 112599 rows, 16240 columns, 370426 nonzeros
Variable types: 1 continuous, 16239 integer (12268 binary)

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

Root relaxation presolved: 16240 rows, 128839 columns, 386666 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    6.1274064e+03   0.000000e+00   4.055143e+04     17s
   15632    6.1274064e+03   0.000000e+00   0.000000e+00     18s
   15632    6.1274064e+03   0.000000e+00   0.000000e+00     18s
Concurrent spin time: 0.26s

Solved with primal simplex

Root relaxation: objective 6.127406e+03, 15632 iterations, 2.14 seconds (2.98 work units)
Total elapsed time = 20.56s

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

     0     0 6127.40641    0  490          - 6127.40641      -     -   22s
     0     0 6127.40641    0  766          - 6127.40641      -     -   26s
     0     0 6127.40641    0  663          - 6127.40641      -     -   26s
     0     0 6127.40641    0  746          - 6127.40641      -     -   28s
     0     0 6127.40641    0  752          - 6127.40641      -     -   28s
     0     0 6127.40641    0  478          - 6127.40641      -     -   37s
     0     0 6127.40641    0  510          - 6127.40641      -     -   38s
     0     0 6127.40641    0  200          - 6127.40641      -     -   44s
     0     0 6127.40641    0  221          - 6127.40641      -     -   44s
     0     0 6127.40641    0  265          - 6127.40641      -     -   45s
     0     0 6127.40641    0  261          - 6127.40641      -     -   52s
     0     0 6127.40641    0  496          - 6127.40641      -     -   53s
     0     0 6127.40641    0  425          - 6127.40641      -     -   53s
     0     0 6127.40641    0  229          - 6127.40641      -     -   59s
     0     0 6127.40641    0  202          - 6127.40641      -     -   59s
     0     0 6127.40641    0  202          - 6127.40641      -     -   61s
     0     2 6127.40641    0  202          - 6127.40641      -     -   72s
     3     8 6127.40641    2  490          - 6127.40641      -  4980   76s
    11    15 6127.40641    3  628          - 6127.40641      -  4053   80s
    23    29 6127.40641    5  519          - 6127.40641      -  3005   85s
    36    43 6127.40641    8  500          - 6127.40641      -  2271   92s
    43    68 6127.40641   11  288          - 6127.40641      -  3141  100s
    71   125 6127.40641   23  319          - 6127.40641      -  2830  113s
   149   272 6127.40641   67  132          - 6127.40641      -  2090  132s
*  231   272             141    6127.4064055 6127.40641  0.00%  1412  132s

Cutting planes:
  Learned: 29
  Gomory: 3
  Lift-and-project: 1
  Cover: 587
  Implied bound: 1348
  Clique: 3610
  MIR: 266
  StrongCG: 100
  Flow cover: 48
  GUB cover: 82
  Zero half: 44
  RLT: 112
  Relax-and-lift: 483
  BQP: 24
  PSD: 6
```

```
416
417  Explored 370 nodes (609654 simplex iterations) in 132.52 seconds (380.88 work units)
418  Thread count was 8 (of 8 available processors)
419
420  Solution count 1: 6127.41
421
422  Optimal solution found (tolerance 5.00e-02)
423  Best objective 6.127406405495e+03, best bound 6.127406405495e+03, gap 0.0000%
424  Warning: linear constraint 548214 and linear constraint 978250 have the same name "ConSP25_1[0,0]"
425  Set parameter MIPGap to value 1e-08
426  Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
427
428  CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
429  Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
430
431  Optimize a model with 1983368 rows, 1559473 columns and 13693931 nonzeros
432  Model fingerprint: 0x464f5980
433  Variable types: 766961 continuous, 792512 integer (787112 binary)
434  Coefficient statistics:
435    Matrix range     [1e-01, 1e+10]
436    Objective range  [6e-05, 5e+01]
437    Bounds range     [1e+00, 8e+01]
438    RHS range        [8e-01, 1e+10]
439  Warning: Model contains large matrix coefficients
440  Warning: Model contains large rhs
441           Consider reformulating model or setting NumericFocus parameter
442           to avoid numerical issues.
443  Presolve removed 1978600 rows and 1557844 columns
444  Presolve time: 3.85s
445  Presolved: 4768 rows, 1629 columns, 12720 nonzeros
446  Variable types: 6 continuous, 1623 integer (941 binary)
447  Found heuristic solution: objective 3738.9989981
448
449  Root relaxation: objective 5.343111e+03, 1303 iterations, 0.02 seconds (0.01 work units)
450
451      Nodes    |    Current Node    |     Objective Bounds      |     Work
452   Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time
453
454       0     0 5343.11111    0    8 3738.99900 5343.11111  42.9%     -    4s
455  H    0     0                    5343.1111111 5343.11111  0.00%     -    4s
456       0     0 5343.11111    0    8 5343.11111 5343.11111  0.00%     -    4s
457
458  Explored 1 nodes (1836 simplex iterations) in 5.09 seconds (5.62 work units)
459  Thread count was 8 (of 8 available processors)
460
461  Solution count 2: 5343.11 3739
462
463  Optimal solution found (tolerance 1.00e-08)
464  Best objective 5.343111111111e+03, best bound 5.343111111111e+03, gap 0.0000%
465  SP is solved
466  SP's optimal solution is'□5343
467
468    Itr = 2
469  Collect_LB =   [779.0, 5839.577136846152, 6127.40640549518]
470  Collect_UB =   [10860.154273692304, 6127.40640549518, 6127.40640549518]
471  Collect_Hua =   [0.0, 5040.577136846152, 5328.40640549518]
472  Collect_SPObjVal =   [5040.577136846152, 5328.40640549518, 5343.111111111111]
473  Collect_MPObjValNHua =   [779.0, 799.0, 799.0]
474
475
476    Reach the termination conditions, stop iteration
477    Values adopted from the Itr' th iteration, and Itr = {2}, judgeCount = {2}
478
479    Values adopted from the judgeCount's th iteration, and Itr = {2}, judgeCount = {2}
480
481    Values adopted from the judgeCount's th iteration, and Itr = {2}, judgeCount = {1}
482
483  ~~~~~~~~~~judgeCount = 1, SPObj_SPF = 5328.40640549518
484  Vessel i: 0:     pi: 0-6,     ai-di: 1-20,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 1-20,     taoi-deltai: 1-19,     taoPi_SP-deltaPi_SP: 1-19,     betaNi: 18
     ,     bi: 18
485  Vessel i: 1:     pi: 6-11,     ai-di: 7-14,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 7-14,     taoi-deltai: 7-12,     taoPi_SP-deltaPi_SP: 7-12,     betaNi: 5
     ,     bi: 5
486  Vessel i: 2:     pi: 19-26,     ai-di: 4-30,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 4-30,     taoi-deltai: 4-28,     taoPi_SP-deltaPi_SP: 4-28,     betaNi: 24
     ,     bi: 24
487  Vessel i: 3:     pi: 11-17,     ai-di: 7-20,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 7-20,     taoi-deltai: 7-18,     taoPi_SP-deltaPi_SP: 7-18,     betaNi: 11
     ,     bi: 11
488  Vessel i: 4:     pi: 10-16,     ai-di: 31-44,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 31-44,     taoi-deltai: 31-42,     taoPi_SP-deltaPi_SP: 31-42,
     betaNi: 11,     bi: 11
489  Vessel i: 5:     pi: 10-15,     ai-di: 21-43,     gi_SP-gpi_SP: 0.000000-0.527349,     ai_SP-di: 21-43,     taoi-deltai: 21-27,     taoPi_SP-deltaPi_SP: 21-27,
     betaNi: 6,     bi: 6
490  Vessel i: 6:     pi: 10-17,     ai-di: 37-78,     gi_SP-gpi_SP: 1.000000-0.600000,     ai_SP-di: 45-78,     taoi-deltai: 45-79,     taoPi_SP-deltaPi_SP: 45-79,
     betaNi: 34,     bi: 34
491  Vessel i: 7:     pi: 21-27,     ai-di: 25-57,     gi_SP-gpi_SP: 0.800000-0.672651,     ai_SP-di: 33-57,     taoi-deltai: 33-46,     taoPi_SP-deltaPi_SP: 33-46,
     betaNi: 13,     bi: 13
```

```
492
493   round LB =   [779, 5840, 6127]
494   round UB =   [10860, 6127, 6127]
495   round Hua =   [0, 5041, 5328]
496   round SPObjVal =   [5041, 5328, 5343]
497   round MPObjValNHua =   [779, 799, 799]
498
499   Time: 608.000000
500
501
502
503
```