```
"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=10108

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 583306 rows, 52642 columns and 1624240 nonzeros
Model fingerprint: 0x09edb1e3
Variable types: 1 continuous, 52641 integer (52605 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 399361 rows and 28618 columns (presolve time = 5s) ...
Presolve removed 519996 rows and 37419 columns
Presolve time: 8.44s
Presolved: 63310 rows, 15223 columns, 224391 nonzeros
Variable types: 0 continuous, 15223 integer (15203 binary)

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

Root relaxation presolved: 15223 rows, 78533 columns, 239614 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    1.0170000e+03   0.000000e+00   1.056750e+03      9s
Concurrent spin time: 0.02s

Solved with dual simplex (primal model)

Root relaxation: objective 1.017000e+03, 2112 iterations, 0.31 seconds (0.28 work units)

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

     0     0 1017.00000    0   18          - 1017.00000      -     -    9s
     0     0 1017.00000    0  218          - 1017.00000      -     -   10s
     0     0 1017.00000    0  212          - 1017.00000      -     -   10s
     0     0 1017.00000    0  257          - 1017.00000      -     -   11s
     0     0 1017.00000    0  254          - 1017.00000      -     -   11s
     0     0 1017.00000    0   18          - 1017.00000      -     -   13s
     0     0 1017.00000    0  403          - 1017.00000      -     -   14s
     0     0 1017.00000    0  366          - 1017.00000      -     -   14s
H    0     0                3217.0000000 1017.00000  68.4%     -   14s
     0     0 1017.00000    0  400 3217.00000 1017.00000  68.4%     -   14s
     0     0 1017.00000    0  134 3217.00000 1017.00000  68.4%     -   28s
H    0     0                2637.0000000 1017.00000  61.4%     -   28s
H    0     0                2257.0000000 1017.00000  54.9%     -   29s
H    0     0                1017.0000000 1017.00000  0.00%     -   29s

Cutting planes:
  Gomory: 14
  Cover: 242
  Implied bound: 583
  Clique: 292
  MIR: 25
  StrongCG: 8
  GUB cover: 13
  Zero half: 6
  RLT: 8
```

```
  Relax-and-lift: 4
  BQP: 4

Explored 1 nodes (19221 simplex iterations) in 30.56 seconds (45.71 work units)
Thread count was 8 (of 8 available processors)

Solution count 4: 1017 2257 2637 3217

Optimal solution found (tolerance 1.00e-10)
Best objective 1.017000000000e+03, best bound 1.017000000000e+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 2481755 rows, 1955335 columns and 17236424 nonzeros
Model fingerprint: 0xf2c50956
Variable types: 963295 continuous, 992040 integer (985965 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 2478498 rows and 1954166 columns (presolve time = 5s) ...
Presolve removed 2478503 rows and 1954170 columns
Presolve time: 5.21s
Presolved: 3252 rows, 1165 columns, 8595 nonzeros
Variable types: 8 continuous, 1157 integer (659 binary)
Found heuristic solution: objective 4309.8302838

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    8.9802796e+03   8.166827e+03   0.000000e+00      7s
     925    5.5971303e+03   0.000000e+00   0.000000e+00      7s

Root relaxation: objective 5.597130e+03, 925 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 5597.13028    0   18 4309.83028 5597.13028  29.9%     -    6s
H    0     0                    5595.3302838 5597.13028  0.03%     -    6s
*    0     0               0    5596.8302838 5596.83028  0.00%     -    6s

Cutting planes:
  Learned: 1
  MIR: 1
  RLT: 1

Explored 1 nodes (1299 simplex iterations) in 6.87 seconds (7.57 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 5596.83 5595.33 4309.83

Optimal solution found (tolerance 1.00e-08)
Best objective 5.596830283766e+03, best bound 5.596830283766e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5596

  Itr = 0
Collect_LB =   [1017.0]
Collect_UB =   [12210.660567532992]
Collect_Hua =   [0.0]
Collect_SPObjVal =   [5596.830283766496]
Collect_MPObjValNHua =   [1017.0]


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 590288 rows, 283978 columns and 1631276 nonzeros
Model fingerprint: 0xe1e5281d
Variable types: 1 continuous, 283977 integer (283941 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 461689 rows and 268157 columns (presolve time = 5s) ...
Presolve removed 552239 rows and 276983 columns
Presolve time: 6.50s
Presolved: 38049 rows, 6995 columns, 100890 nonzeros
Variable types: 0 continuous, 6995 integer (6976 binary)
Root relaxation presolved: 6995 rows, 45044 columns, 107885 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0      handle free variables                      7s
    5945    7.0313303e+03   0.000000e+00   0.000000e+00      7s
    5945    7.0313303e+03   0.000000e+00   0.000000e+00      7s

Root relaxation: objective 7.031330e+03, 5945 iterations, 0.50 seconds (0.96 work units)

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

     0     0 7031.33028    0   24          - 7031.33028      -     -    7s
     0     0 7031.33028    0  232          - 7031.33028      -     -    8s
     0     0 7031.33028    0  220          - 7031.33028      -     -    8s
H    0     0                 8511.3302838 7031.33028  17.4%     -    8s
H    0     0                 8471.3302838 7031.33028  17.0%     -    8s
     0     0 7031.33028    0  165 8471.33028 7031.33028  17.0%     -    8s
     0     0 7031.33028    0   69 8471.33028 7031.33028  17.0%     -    9s
     0     0 7031.33028    0   57 8471.33028 7031.33028  17.0%     -    9s
     0     0 7031.33028    0  108 8471.33028 7031.33028  17.0%     -    9s
     0     0 7031.33028    0  180 8471.33028 7031.33028  17.0%     -   11s
     0     0 7031.33028    0  140 8471.33028 7031.33028  17.0%     -   11s
     0     0 7031.33028    0  291 8471.33028 7031.33028  17.0%     -   11s
     0     0 7031.33028    0  142 8471.33028 7031.33028  17.0%     -   11s
     0     0 7031.33028    0   66 8471.33028 7031.33028  17.0%     -   11s
     0     0 7031.33028    0   35 8471.33028 7031.33028  17.0%     -   12s
     0     0 7031.33028    0  240 8471.33028 7031.33028  17.0%     -   13s
     0     0 7031.33028    0  231 8471.33028 7031.33028  17.0%     -   13s
     0     0 7031.33028    0  249 8471.33028 7031.33028  17.0%     -   13s
     0     0 7031.33028    0  222 8471.33028 7031.33028  17.0%     -   13s
     0     0 7031.33028    0   22 8471.33028 7031.33028  17.0%     -   15s
     0     0 7031.33028    0  118 8471.33028 7031.33028  17.0%     -   15s
     0     0 7031.33028    0   35 8471.33028 7031.33028  17.0%     -   15s
     0     0 7031.33028    0  118 8471.33028 7031.33028  17.0%     -   16s
     0     0 7031.33028    0  353 8471.33028 7031.33028  17.0%     -   16s
     0     0 7031.33028    0  322 8471.33028 7031.33028  17.0%     -   16s
     0     0 7031.33028    0   81 8471.33028 7031.33028  17.0%     -   17s
     0     0 7031.33028    0   81 8471.33028 7031.33028  17.0%     -   17s
     0     2 7031.33028    0   77 8471.33028 7031.33028  17.0%     -   18s
    35    36 7031.33028    8  213 8471.33028 7031.33028  17.0%   890   20s
   238   237 7031.33028   41  152 8471.33028 7031.33028  17.0%   674   26s
H  248   237                 7511.3302838 7031.33028  6.39%   680   26s
   484   614 7031.33028   65  193 7511.33028 7031.33028  6.39%   478   30s
H  732   614                 7071.3302838 7031.33028  0.57%   336   30s
* 1510   323              74    7031.3302838 7031.33028  0.00%   212   32s

Cutting planes:
  Learned: 14
  Gomory: 7
  Lift-and-project: 1
  Cover: 502
  Implied bound: 2063
  Clique: 101
  MIR: 151
  StrongCG: 98
  GUB cover: 57
  Zero half: 16
  RLT: 13
  Relax-and-lift: 34
  BQP: 8

Explored 1592 nodes (402587 simplex iterations) in 32.99 seconds (65.75 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 7031.33 7071.33 7511.33 ... 8511.33

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

```
Best objective 7.031330283766e+03, best bound 7.031330283766e+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 2481755 rows, 1955335 columns and 17236424 nonzeros
Model fingerprint: 0xdc66fb85
Variable types: 963295 continuous, 992040 integer (985965 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 2476484 rows and 1953532 columns
Presolve time: 4.99s
Presolved: 5271 rows, 1803 columns, 14076 nonzeros
Variable types: 8 continuous, 1795 integer (1042 binary)
Found heuristic solution: objective 4233.8302838
Found heuristic solution: objective 4253.8302838

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    1.1487280e+04   8.733382e+03   0.000000e+00      6s
    1576    6.0871303e+03   0.000000e+00   0.000000e+00      6s

Root relaxation: objective 6.087130e+03, 1576 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 6087.13028    0   17 4253.83028 6087.13028  43.1%     -    6s
H    0     0                    6086.8302838 6087.13028  0.00%     -    6s

Cutting planes:
  Learned: 2
  Gomory: 1
  Cover: 10
  Implied bound: 15
  MIR: 2

Explored 1 nodes (2136 simplex iterations) in 6.62 seconds (7.38 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 6086.83 4253.83 4233.83

Optimal solution found (tolerance 1.00e-08)
Best objective 6.086830283766e+03, best bound 6.086830283766e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□6086

 Itr = 1
Collect_LB =   [1017.0, 7031.330283766496]
Collect_UB =   [12210.660567532992, 7521.330283766496]
Collect_Hua =   [0.0, 5596.830283766496]
Collect_SPObjVal =   [5596.830283766496, 6086.830283766496]
Collect_MPObjValNHua =   [1017.0, 1434.5]


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 590289 rows, 283978 columns and 1631295 nonzeros
Model fingerprint: 0x9da4c12a
Variable types: 1 continuous, 283977 integer (283941 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 461690 rows and 268157 columns (presolve time = 5s) ...
Presolve removed 552240 rows and 276983 columns
Presolve time: 6.47s
Presolved: 38049 rows, 6995 columns, 100890 nonzeros
Variable types: 0 continuous, 6995 integer (6976 binary)
Root relaxation presolved: 6995 rows, 45044 columns, 107885 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0      handle free variables                      7s
    5945    7.5213303e+03   0.000000e+00   0.000000e+00      7s
    5945    7.5213303e+03   0.000000e+00   0.000000e+00      7s

Root relaxation: objective 7.521330e+03, 5945 iterations, 0.50 seconds (0.96 work units)

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

     0     0 7521.33028    0   24          - 7521.33028      -     -    7s
     0     0 7521.33028    0  232          - 7521.33028      -     -    8s
     0     0 7521.33028    0  220          - 7521.33028      -     -    8s
H    0     0                9001.3302838 7521.33028  16.4%     -    8s
H    0     0                8961.3302838 7521.33028  16.1%     -    8s
     0     0 7521.33028    0  165 8961.33028 7521.33028  16.1%     -    8s
     0     0 7521.33028    0   69 8961.33028 7521.33028  16.1%     -    9s
     0     0 7521.33028    0   57 8961.33028 7521.33028  16.1%     -    9s
     0     0 7521.33028    0  108 8961.33028 7521.33028  16.1%     -    9s
     0     0 7521.33028    0  180 8961.33028 7521.33028  16.1%     -   11s
     0     0 7521.33028    0  140 8961.33028 7521.33028  16.1%     -   11s
     0     0 7521.33028    0  291 8961.33028 7521.33028  16.1%     -   11s
     0     0 7521.33028    0  142 8961.33028 7521.33028  16.1%     -   11s
     0     0 7521.33028    0   66 8961.33028 7521.33028  16.1%     -   11s
     0     0 7521.33028    0   35 8961.33028 7521.33028  16.1%     -   13s
     0     0 7521.33028    0  240 8961.33028 7521.33028  16.1%     -   13s
     0     0 7521.33028    0  231 8961.33028 7521.33028  16.1%     -   13s
     0     0 7521.33028    0  249 8961.33028 7521.33028  16.1%     -   13s
     0     0 7521.33028    0  222 8961.33028 7521.33028  16.1%     -   13s
     0     0 7521.33028    0   22 8961.33028 7521.33028  16.1%     -   15s
     0     0 7521.33028    0  118 8961.33028 7521.33028  16.1%     -   15s
     0     0 7521.33028    0   35 8961.33028 7521.33028  16.1%     -   15s
     0     0 7521.33028    0  118 8961.33028 7521.33028  16.1%     -   16s
     0     0 7521.33028    0  353 8961.33028 7521.33028  16.1%     -   16s
     0     0 7521.33028    0  322 8961.33028 7521.33028  16.1%     -   16s
     0     0 7521.33028    0   81 8961.33028 7521.33028  16.1%     -   17s
     0     0 7521.33028    0   81 8961.33028 7521.33028  16.1%     -   17s
     0     2 7521.33028    0   77 8961.33028 7521.33028  16.1%     -   18s
    19    21 7521.33028    4  321 8961.33028 7521.33028  16.1%  1492   20s
    56    58 7521.33028   13  148 8961.33028 7521.33028  16.1%   859   25s
   238   237 7521.33028   41  152 8961.33028 7521.33028  16.1%   674   30s
H  248   237                8001.3302838 7521.33028  6.00%   680   30s
*  713   557             115    7561.3302838 7521.33028  0.53%   336   34s
   987   284     cutoff  127      7561.33028 7521.33028  0.53%   250   35s
* 1210   284              53    7521.3302838 7521.33028  0.00%   214   35s

Cutting planes:
  Learned: 8
  Gomory: 6
  Lift-and-project: 1
  Cover: 276
  Implied bound: 2017
  Clique: 66
  MIR: 125
  StrongCG: 75
  GUB cover: 47
  Zero half: 9
  RLT: 10
  Relax-and-lift: 20
  BQP: 7

Explored 1444 nodes (345605 simplex iterations) in 35.75 seconds (61.60 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 7521.33 7561.33 8001.33 ... 9001.33

Optimal solution found (tolerance 5.00e-04)
Best objective 7.521330283766e+03, best bound 7.521330283766e+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 2481755 rows, 1955335 columns and 17236424 nonzeros
Model fingerprint: 0x9c1c0565
Variable types: 963295 continuous, 992040 integer (985965 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 2476578 rows and 1953561 columns
Presolve time: 4.91s
Presolved: 5177 rows, 1774 columns, 13825 nonzeros
Variable types: 8 continuous, 1766 integer (1027 binary)
Found heuristic solution: objective 4233.8302838

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    1.1287280e+04   8.580382e+03   0.000000e+00      6s
    1458    6.0871303e+03   0.000000e+00   0.000000e+00      6s

Root relaxation: objective 6.087130e+03, 1458 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 6087.13028    0   17 4233.83028 6087.13028  43.8%     -    6s
H    0     0                    6086.8302838 6087.13028  0.00%     -    6s

Cutting planes:
  Learned: 2
  Cover: 10
  Implied bound: 15
  MIR: 2

Explored 1 nodes (1976 simplex iterations) in 6.52 seconds (7.30 work units)
Thread count was 8 (of 8 available processors)

Solution count 2: 6086.83 4233.83

Optimal solution found (tolerance 1.00e-08)
Best objective 6.086830283766e+03, best bound 6.086830283766e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□6086

 Itr = 2
Collect_LB =   [1017.0, 7031.330283766496, 7521.330283766496]
Collect_UB =   [12210.660567532992, 7521.330283766496, 7521.330283766496]
Collect_Hua =   [0.0, 5596.830283766496, 6086.830283766496]
Collect_SPObjVal =   [5596.830283766496, 6086.830283766496, 6086.830283766496]
Collect_MPObjValNHua =   [1017.0, 1434.5, 1434.5]


 Reach the termination conditions, stop iteration
 Values adopted from the Itr' th iteration, and Itr = {2}, judgeCount = {2}

~~~~~~~~~~judge = 2, SPObj_SPF = 6086.830283766496
Vessel i: 0:     pi: 0-6,     ai-di: 7-27,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 7-27,     taoi-deltai: 7-29,     taoPi_SP-deltaPi_SP: 7-29,     betaNi: 22
,     bi: 22
Vessel i: 1:     pi: 12-18,     ai-di: 9-18,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 9-18,     taoi-deltai: 9-18,     taoPi_SP-deltaPi_SP: 9-18,     betaNi: 9
,     bi: 9
Vessel i: 2:     pi: 6-12,     ai-di: 11-40,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 11-40,     taoi-deltai: 11-42,     taoPi_SP-deltaPi_SP: 11-42,     betaNi
: 31,     bi: 31
Vessel i: 3:     pi: 18-24,     ai-di: 17-31,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 17-31,     taoi-deltai: 17-27,     taoPi_SP-deltaPi_SP: 17-27,
betaNi: 10,     bi: 10
Vessel i: 4:     pi: 28-34,     ai-di: 18-23,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 18-23,     taoi-deltai: 18-23,     taoPi_SP-deltaPi_SP: 18-23,
betaNi: 5,     bi: 5
Vessel i: 5:     pi: 27-34,     ai-di: 26-30,     gi_SP-gpi_SP: 0.025000-1.000000,     ai_SP-di: 26-30,     taoi-deltai: 27-32,     taoPi_SP-deltaPi_SP: 27-32,
betaNi: 5,     bi: 5
Vessel i: 6:     pi: 16-22,     ai-di: 33-42,     gi_SP-gpi_SP: 0.375000-0.200000,     ai_SP-di: 36-42,     taoi-deltai: 36-45,     taoPi_SP-deltaPi_SP: 36-45,
betaNi: 9,     bi: 9
Vessel i: 7:     pi: 14-20,     ai-di: 37-68,     gi_SP-gpi_SP: 1.000000-0.600000,     ai_SP-di: 47-68,     taoi-deltai: 47-77,     taoPi_SP-deltaPi_SP: 47-77,
betaNi: 30,     bi: 30
Vessel i: 8:     pi: 22-28,     ai-di: 46-64,     gi_SP-gpi_SP: 1.000000-0.600000,     ai_SP-di: 53-64,     taoi-deltai: 53-74,     taoPi_SP-deltaPi_SP: 53-74,
betaNi: 21,     bi: 21

round LB =   [1017, 7031, 7521]
round UB =   [12211, 7521, 7521]
round Hua =   [0, 5597, 6087]
round SPObjVal =   [5597, 6087, 6087]
round MPObjValNHua =   [1017, 1434, 1434]
```

```
491
492   OptimalObj = 7521.330283766496
493   Time: 556.000000
494
495
496
497
```