```
"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=20986

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_TWS.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 486009 rows, 40692 columns and 1332989 nonzeros
Model fingerprint: 0x3bc9eb93
Variable types: 1 continuous, 40691 integer (40663 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 283849 rows and 17804 columns (presolve time = 5s) ...
Presolve removed 443004 rows and 28454 columns
Presolve time: 8.39s
Presolved: 43005 rows, 12238 columns, 171177 nonzeros
Variable types: 0 continuous, 12238 integer (12217 binary)

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

Root relaxation presolved: 43000 rows, 12243 columns, 171162 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    7.6100000e+02   9.125000e+01   1.761712e+08      9s
Concurrent spin time: 0.01s

Solved with dual simplex (primal model)

Root relaxation: objective 7.610000e+02, 2637 iterations, 0.25 seconds (0.27 work units)

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

     0     0  761.00000    0   21          -  761.00000      -     -    9s
H    0     0                    2461.0000000  761.00000  69.1%     -    9s
H    0     0                    2361.0000000  761.00000  67.8%     -    9s
H    0     0                    2321.0000000  761.00000  67.2%     -   10s
     0     0  761.00000    0   88 2321.00000  761.00000  67.2%     -   10s
H    0     0                    2041.0000000  761.00000  62.7%     -   11s
     0     0  761.00000    0  316 2041.00000  761.00000  62.7%     -   11s
     0     0  761.00000    0  306 2041.00000  761.00000  62.7%     -   11s
     0     0  761.00000    0   31 2041.00000  761.00000  62.7%     -   13s
     0     0  761.00000    0  324 2041.00000  761.00000  62.7%     -   14s
     0     0  761.00000    0  310 2041.00000  761.00000  62.7%     -   15s
     0     0  761.00000    0  104 2041.00000  761.00000  62.7%     -   17s
     0     0  761.00000    0  103 2041.00000  761.00000  62.7%     -   17s
     0     0  761.00000    0  154 2041.00000  761.00000  62.7%     -   17s
     0     0  761.00000    0  153 2041.00000  761.00000  62.7%     -   17s
     0     0  761.00000    0   30 2041.00000  761.00000  62.7%     -   20s
     0     0  761.00000    0   30 2041.00000  761.00000  62.7%     -   21s
     0     2  761.00000    0   30 2041.00000  761.00000  62.7%     -   22s
     5     8  761.00000    2   72 2041.00000  761.00000  62.7%  1357   25s
    37    44  761.00000    7  104 2041.00000  761.00000  62.7%   880   32s
H   45    44                    1261.0000000  761.00000  39.7%  1101   32s
H   63    77                    1221.0000000  761.00000  37.7%  1352   36s
   118   121  761.00000   31   48 1221.00000  761.00000  37.7%  1030   40s
H  210   183                     1021.0000000  761.00000  25.5%   771   43s
   317   211  941.00000   58  151 1021.00000  761.00000  25.5%   658   48s
```

```
 80  H  345   211                941.0000000  761.00000  19.1%   613   48s
 81     398   242  761.00000   21   62  941.00000  761.00000  19.1%   674   52s
 82     479   256  761.00000   43  218  941.00000  761.00000  19.1%   656   57s
 83  H  603   256                761.0000000  761.00000  0.00%   623   57s
 84
 85  Cutting planes:
 86    Gomory: 2
 87    Cover: 120
 88    Implied bound: 3989
 89    Clique: 2
 90    MIR: 71
 91    StrongCG: 42
 92    GUB cover: 11
 93    Zero half: 1
 94    RLT: 9
 95    Relax-and-lift: 3
 96    BQP: 7
 97
 98  Explored 639 nodes (419113 simplex iterations) in 57.99 seconds (100.96 work units)
 99  Thread count was 8 (of 8 available processors)
100
101  Solution count 9: 761 941 1021 ... 2461
102
103  Optimal solution found (tolerance 1.00e-10)
104  Best objective 7.610000000000e+02, best bound 7.610000000000e+02, gap 0.0000%
105  Set parameter MIPGap to value 1e-08
106  Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
107
108  CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
109  Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
110
111  Optimize a model with 335549 rows, 11221 columns and 691192 nonzeros
112  Model fingerprint: 0xaca662b3
113  Variable types: 28 continuous, 11193 integer (6468 binary)
114  Coefficient statistics:
115    Matrix range     [1e-01, 1e+10]
116    Objective range  [6e-05, 5e+01]
117    Bounds range     [1e+00, 1e+00]
118    RHS range        [8e-01, 1e+10]
119  Warning: Model contains large matrix coefficients
120  Warning: Model contains large rhs
121           Consider reformulating model or setting NumericFocus parameter
122           to avoid numerical issues.
123  Presolve removed 331672 rows and 9941 columns
124  Presolve time: 0.22s
125  Presolved: 3877 rows, 1280 columns, 10556 nonzeros
126  Variable types: 3 continuous, 1277 integer (755 binary)
127
128  Root relaxation: objective 5.038445e+03, 1654 iterations, 0.03 seconds (0.05 work units)
129
130      Nodes    |    Current Node    |     Objective Bounds      |     Work
131   Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time
132
133       0     0 5038.44514    0  346          - 5038.44514      -     -    0s
134  H    0     0                4608.0006962 5038.44514  9.34%     -    0s
135  H    0     0                4843.0006962 5038.44514  4.04%     -    0s
136       0     0 4996.23141    0  420 4843.00070 4996.23141  3.16%     -    0s
137       0     0 4996.21675    0  408 4843.00070 4996.21675  3.16%     -    0s
138  H    0     0                4884.0006962 4996.21675  2.30%     -    0s
139  H    0     0                4889.0006962 4996.21675  2.19%     -    0s
140  H    0     0                4891.0006962 4996.21675  2.15%     -    0s
141       0     0 4996.21675    0  404 4891.00070 4996.21675  2.15%     -    0s
142  H    0     0                4910.0006962 4996.21675  1.76%     -    0s
143  H    0     0                4938.0006962 4988.72585  1.03%     -    0s
144  H    0     0                4958.0006962 4988.72585  0.62%     -    0s
145       0     0 4986.73403    0  362 4958.00070 4986.73403  0.58%     -    0s
146       0     0 4986.73403    0  369 4958.00070 4986.73403  0.58%     -    0s
147       0     0 4986.73403    0  364 4958.00070 4986.73403  0.58%     -    0s
148  H    0     0                4972.0006962 4980.66746  0.17%     -    0s
149       0     0 4972.00070    0  152 4972.00070 4972.00070  0.00%     -    0s
150
151  Cutting planes:
152    Learned: 6
153    Gomory: 15
154    Cover: 64
155    Implied bound: 78
156    Clique: 29
157    MIR: 3
158    StrongCG: 1
159    Flow cover: 10
160    GUB cover: 5
161    Zero half: 11
162    Network: 1
163    RLT: 39
```

```
  Relax-and-lift: 2
  PSD: 23

Explored 1 nodes (3166 simplex iterations) in 0.61 seconds (0.77 work units)
Thread count was 8 (of 8 available processors)

Solution count 9: 4972 4958 4938 ... 4608

Optimal solution found (tolerance 1.00e-08)
Best objective 4.972000696225e+03, best bound 4.972000696225e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□4972

 Itr = 0
Collect_LB =   [761.0]
Collect_UB =   [10705.001392450096]
Collect_Hua =   [0.0]
Collect_SPObjVal =   [4972.000696225048]
Collect_MPObjValNHua =   [761.0]


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 489539 rows, 180636 columns and 1336540 nonzeros
Model fingerprint: 0x2843198e
Variable types: 1 continuous, 180635 integer (180607 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 331540 rows and 163404 columns (presolve time = 5s) ...
Presolve removed 463485 rows and 173505 columns
Presolve time: 7.29s
Presolved: 26054 rows, 7131 columns, 97661 nonzeros
Variable types: 0 continuous, 7131 integer (7111 binary)

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    5.7330007e+03   8.430000e+02   0.000000e+00      8s
    3541    5.7330007e+03   0.000000e+00   0.000000e+00      8s

Root relaxation: objective 5.733001e+03, 3541 iterations, 0.10 seconds (0.14 work units)

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

     0     0 5733.00070    0   25          - 5733.00070      -     -    7s
     0     0 5733.00070    0   90          - 5733.00070      -     -    8s
     0     0 5733.00070    0   77          - 5733.00070      -     -    9s
     0     0 5733.00070    0  296          - 5733.00070      -     -    9s
     0     0 5733.00070    0  233          - 5733.00070      -     -   10s
     0     0 5733.00070    0  204          - 5733.00070      -     -   10s
     0     0 5733.00070    0  101          - 5733.00070      -     -   14s
     0     0 5733.00070    0   99          - 5733.00070      -     -   14s
     0     0 5733.00070    0  147          - 5733.00070      -     -   14s
     0     0 5733.00070    0  206          - 5733.00070      -     -   19s
     0     0 5733.00070    0  201          - 5733.00070      -     -   19s
     0     0 5733.00070    0  187          - 5733.00070      -     -   20s
     0     2 5733.00070    0  149          - 5733.00070      -     -   23s
     3     8 5733.00070    2  316          - 5733.00070      -  6266   26s
    15    19 5733.00070    4  455          - 5733.00070      -  3927   30s
    60    66 5753.05230   15 2000          - 5733.00070      -  2716   36s
   120   133 5735.06836   18 1327          - 5733.00070      -  1765   40s
   444   397 5734.33591    5 1511          - 5733.00070      -   589   45s
  1224   891 6213.00070  192  187          - 5733.00070      -   265   61s
H 1225   847                 7833.0006962 5733.00070  26.8%   264   62s
  1227   848 6453.00070   29  149 7833.00070 5733.00070  26.8%   264   65s
  1229   849 5753.00070    4  661 7833.00070 5733.00070  26.8%   263   75s
  1231   851 6833.00070  288 1751 7833.00070 5733.99048  26.8%   263   88s
  1232   851 7233.00070  344 1904 7833.00070 5733.99778  26.8%   263   90s
  1234   853 6133.00070  231 2089 7833.00070 5733.99778  26.8%   262   95s
H 1234   810                 7473.0006962 5733.99778  23.3%   262  104s
  1235   810 6253.00070  252  571 7473.00070 5753.00068  23.0%   262  105s
H 1236   770                 6873.0006962 5753.00068  16.3%   262  115s
```

```
 H 1236   732                6713.0006962 5753.00068  14.3%   262  115s
 H 1236   695                6673.0006962 5753.00068  13.8%   262  115s
 H 1236   660                6633.0006962 5753.00068  13.3%   262  115s
 H 1236   627                6593.0006962 5753.00068  12.7%   262  115s
 H 1236   595                6553.0006962 5753.00068  12.2%   262  115s
 H 1236   565                6513.0006962 5753.00068  11.7%   262  115s
 H 1236   537                5993.0006962 5753.00068  4.00%   262  115s
 H 1236   510                5973.0006962 5753.00068  3.68%   262  122s
   1240   514 5973.00070  272  187 5973.00070 5753.00068  3.68%   352  128s
   1243   516 5973.00070  137  729 5973.00070 5753.00068  3.68%   351  132s
   1244   517 5973.00070  135 1031 5973.00070 5753.00068  3.68%   351  135s
   1246   518 5973.00070   25  968 5973.00070 5753.00068  3.68%   351  142s
   1248   519 5973.00070  190 1036 5973.00070 5753.00070  3.68%   350  146s
   1250   521 5973.00070  259 1110 5973.00070 5753.00070  3.68%   349  151s
   1253   523 5973.00070  152  775 5973.00070 5753.00070  3.68%   349  155s
   1256   530 5753.00070   30  890 5973.00070 5753.00070  3.68%   148  160s
   1282   544 5773.00070   33  639 5973.00070 5755.71501  3.64%   221  165s
 * 1340   503              46    5933.0006962 5761.71343  2.89%   258  169s
   1344   495     cutoff   36      5933.00070 5762.10330  2.88%   260  171s
 * 1349   469              38    5913.0006962 5770.26450  2.41%   263  171s

Cutting planes:
  Learned: 1
  Gomory: 126
  Cover: 566
  Implied bound: 262
  Projected implied bound: 152
  Clique: 111
  MIR: 144
  StrongCG: 62
  Flow cover: 329
  GUB cover: 75
  Zero half: 270
  RLT: 17
  Relax-and-lift: 791
  BQP: 7

Explored 1414 nodes (798842 simplex iterations) in 172.56 seconds (326.03 work units)
Thread count was 8 (of 8 available processors)

Solution count 10: 5913 5933 5973 ... 6713

Optimal solution found (tolerance 1.00e-10)
Best objective 5.913000696225e+03, best bound 5.913000696225e+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 335549 rows, 11221 columns and 691192 nonzeros
Model fingerprint: 0x968c3766
Variable types: 28 continuous, 11193 integer (6468 binary)
Coefficient statistics:
  Matrix range     [1e-01, 1e+10]
  Objective range  [6e-05, 5e+01]
  Bounds range     [1e+00, 1e+00]
  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 330561 rows and 9627 columns
Presolve time: 0.26s
Presolved: 4988 rows, 1594 columns, 13299 nonzeros
Variable types: 3 continuous, 1591 integer (918 binary)
Found heuristic solution: objective 3905.0006962

Root relaxation: objective 5.933334e+03, 1743 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 5933.33403    0  126 3905.00070 5933.33403  51.9%     -    0s
 H   0     0                5808.0006962 5933.33403  2.16%     -    0s
 H   0     0                5822.0006962 5929.00070  1.84%     -    0s
     0     0 5929.00070    0  125 5822.00070 5929.00070  1.84%     -    0s
     0     0 5929.00070    0   56 5822.00070 5929.00070  1.84%     -    0s
 H   0     0                5877.0006962 5929.00070  0.88%     -    0s
 H   0     0                5916.0006962 5929.00070  0.22%     -    0s
 *   0     0               0    5929.0006962 5929.00070  0.00%     -    0s

Cutting planes:
  Learned: 1
```

```
  Gomory: 6
  Cover: 5
  Implied bound: 24
  Clique: 14
  MIR: 1
  Flow cover: 1
  Zero half: 5
  Network: 1
  RLT: 25
  PSD: 3

Explored 1 nodes (2900 simplex iterations) in 0.47 seconds (0.74 work units)
Thread count was 8 (of 8 available processors)

Solution count 6: 5929 5916 5877 ... 3905

Optimal solution found (tolerance 1.00e-08)
Best objective 5.929000696225e+03, best bound 5.929000696225e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5929

 Itr = 1
Collect_LB =   [761.0, 5913.000696225048]
Collect_UB =   [10705.001392450096, 6870.0006962250445]
Collect_Hua =   [0.0, 4972.000696225048]
Collect_SPObjVal =   [4972.000696225048, 5929.0006962250445]
Collect_MPObjValNHua =   [761.0, 941.0]


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 489539 rows, 180636 columns and 1336540 nonzeros
Model fingerprint: 0x1b791173
Variable types: 1 continuous, 180635 integer (180607 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 437034 rows and 174747 columns (presolve time = 5s) ...
Presolve removed 455528 rows and 174765 columns
Presolve time: 5.29s
Presolved: 34011 rows, 5871 columns, 86318 nonzeros
Variable types: 0 continuous, 5871 integer (5851 binary)
Root relaxation presolved: 5871 rows, 39882 columns, 92189 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0     handle free variables                          6s
    4192    7.4100007e+03   0.000000e+00   0.000000e+00      6s
    4192    7.4100007e+03   0.000000e+00   0.000000e+00      6s
    4192    7.4100007e+03   0.000000e+00   0.000000e+00      6s

Root relaxation: objective 7.410001e+03, 4192 iterations, 0.29 seconds (0.54 work units)

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

     0     0 7410.00070    0    7          - 7410.00070      -     -    5s
     0     0 7410.00070    0   77          - 7410.00070      -     -    6s
     0     0 7410.00070    0   68          - 7410.00070      -     -    6s
     0     0 7410.00070    0  269          - 7410.00070      -     -    7s
     0     0 7410.00070    0  261          - 7410.00070      -     -    7s
     0     0 7410.00070    0   39          - 7410.00070      -     -    8s
     0     0 7410.00070    0   37          - 7410.00070      -     -    8s
     0     0 7410.00070    0   40          - 7410.00070      -     -    8s
     0     0 7410.00070    0   29          - 7410.00070      -     -    9s
     0     0 7410.00070    0   36          - 7410.00070      -     -    9s
     0     0 7410.00070    0   41          - 7410.00070      -     -    9s
     0     0 7410.00070    0   36          - 7410.00070      -     -   10s
     0     0 7410.00070    0   78          - 7410.00070      -     -   10s
     0     0 7410.00070    0   29          - 7410.00070      -     -   10s
H    0     0                    9310.0006962 7410.00070  20.4%     -   10s
     0     0 7410.00070    0   29 9310.00070 7410.00070  20.4%     -   10s
```

```
H    0     0                 8290.0006962 7410.00070  10.6%     -   11s
     0     2 7410.00070    0   28 8290.00070 7410.00070  10.6%     -   11s
*   24    20              7    8250.0006962 7410.00070  10.2%   443   12s
H   30    20                   7930.0006962 7410.00070  6.56%   385   13s
    37    21 7410.00070    9   89 7930.00070 7410.00070  6.56%   473   15s
*   88    53              22    7410.0006962 7410.00070  0.00%   876   18s

Cutting planes:
  Learned: 2
  Cover: 340
  Implied bound: 1293
  Clique: 25
  MIR: 37
  StrongCG: 19
  GUB cover: 16
  Zero half: 6
  RLT: 3
  Relax-and-lift: 27
  BQP: 3

Explored 108 nodes (114381 simplex iterations) in 18.70 seconds (31.36 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 7410 7930 8250 ... 9310

Optimal solution found (tolerance 1.00e-10)
Best objective 7.410000696225e+03, best bound 7.410000696225e+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 335549 rows, 11221 columns and 691192 nonzeros
Model fingerprint: 0x92ccdf29
Variable types: 28 continuous, 11193 integer (6468 binary)
Coefficient statistics:
  Matrix range     [1e-01, 1e+10]
  Objective range  [6e-05, 5e+01]
  Bounds range     [1e+00, 1e+00]
  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 330833 rows and 9649 columns
Presolve time: 0.26s
Presolved: 4716 rows, 1572 columns, 12564 nonzeros
Variable types: 3 continuous, 1569 integer (913 binary)
Found heuristic solution: objective 4678.0006962

Root relaxation: objective 6.786584e+03, 1975 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 6786.58403    0   28 4678.00070 6786.58403  45.1%     -    0s
H    0     0                 6779.0006962 6786.58403  0.11%     -    0s
     0     0     cutoff    0      6779.00070 6779.00070  0.00%     -    0s

Cutting planes:
  Learned: 10
  Gomory: 7
  Implied bound: 2
  MIR: 3
  StrongCG: 1
  Flow cover: 4
  GUB cover: 1
  Zero half: 2
  RLT: 3
  Relax-and-lift: 2
  PSD: 2

Explored 1 nodes (2633 simplex iterations) in 0.43 seconds (0.67 work units)
Thread count was 8 (of 8 available processors)

Solution count 2: 6779 4678

Optimal solution found (tolerance 1.00e-08)
Best objective 6.779000696225e+03, best bound 6.779000696225e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□6779

 Itr = 2
```

```
Collect_LB =   [761.0, 5913.000696225048, 7410.0006962250445]
Collect_UB =   [10705.001392450096, 6870.0006962250445, 6870.0006962250445]
Collect_Hua =   [0.0, 4972.000696225048, 5929.0006962250445]
Collect_SPObjVal =   [4972.000696225048, 5929.0006962250445, 6779.0006962250445]
Collect_MPObjValNHua =   [761.0, 941.0, 1481.0]


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

~~~~~~~~~~judgeCount = 1, SPObj_SPF = 5929.0006962250445
Vessel i: 0:    pi: 0-5,    ai-di: 8-17,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 8-17,    taoi-deltai: 8-15,    taoPi_SP-deltaPi_SP: 8-13,    betaNi: 7,    bi: 7
Vessel i: 1:    pi: 13-20,    ai-di: 10-35,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 10-35,    taoi-deltai: 10-33,    taoPi_SP-deltaPi_SP: 10-33,    betaNi: 23,    bi: 23
Vessel i: 2:    pi: 7-13,    ai-di: 16-38,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 16-38,    taoi-deltai: 16-36,    taoPi_SP-deltaPi_SP: 16-36,    betaNi: 20,    bi: 20
Vessel i: 3:    pi: 21-26,    ai-di: 17-26,    gi_SP-gpi_SP: 0.000000-0.000000,    ai_SP-di: 17-26,    taoi-deltai: 17-24,    taoPi_SP-deltaPi_SP: 17-24,    betaNi: 7,    bi: 7
Vessel i: 4:    pi: 20-27,    ai-di: 12-63,    gi_SP-gpi_SP: 0.000030-1.000000,    ai_SP-di: 52-63,    taoi-deltai: 31-63,    taoPi_SP-deltaPi_SP: 52-63,    betaNi: 32,    bi: 32
Vessel i: 5:    pi: 13-20,    ai-di: 15-59,    gi_SP-gpi_SP: 0.000017-0.800000,    ai_SP-di: 51-59,    taoi-deltai: 34-57,    taoPi_SP-deltaPi_SP: 51-57,    betaNi: 23,    bi: 23
Vessel i: 6:    pi: 29-34,    ai-di: 25-55,    gi_SP-gpi_SP: 0.000002-0.000000,    ai_SP-di: 30-55,    taoi-deltai: 27-32,    taoPi_SP-deltaPi_SP: 30-32,    betaNi: 5,    bi: 5

round LB =   [761, 5913, 7410]
round UB =   [10705, 6870, 6870]
round Hua =   [0, 4972, 5929]
round SPObjVal =   [4972, 5929, 6779]
round MPObjValNHua =   [761, 941, 1481]

OptimalObj = 7410.0006962250445
Time: 302.000000
```