```
"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=1268

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 361160 rows, 34789 columns and 995570 nonzeros
Model fingerprint: 0xd26ac180
Variable types: 1 continuous, 34788 integer (34764 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 320138 rows and 23992 columns
Presolve time: 5.00s
Presolved: 41022 rows, 10797 columns, 146176 nonzeros
Variable types: 0 continuous, 10797 integer (10782 binary)

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

Root relaxation presolved: 41022 rows, 10797 columns, 146176 nonzeros

Concurrent spin time: 0.00s

Solved with dual simplex (primal model)

Root relaxation: objective 6.820000e+02, 1686 iterations, 0.16 seconds (0.15 work units)

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

     0     0  682.00000    0    8          -  682.00000      -     -    5s
H    0     0                    1622.0000000  682.00000  58.0%     -    5s
     0     0  682.00000    0  133 1622.00000  682.00000  58.0%     -    6s
     0     0  682.00000    0  132 1622.00000  682.00000  58.0%     -    6s
H    0     0                    1202.0000000  682.00000  43.3%     -    6s
H    0     0                     682.0000000  682.00000  0.00%     -    6s

Cutting planes:
  Gomory: 1
  Cover: 23
  Implied bound: 474
  Clique: 1
  MIR: 7
  GUB cover: 4
  RLT: 1
  Relax-and-lift: 4
  BQP: 1

Explored 1 nodes (4505 simplex iterations) in 7.17 seconds (11.33 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 682 1202 1622

Optimal solution found (tolerance 1.00e-10)
Best objective 6.820000000000e+02, best bound 6.820000000000e+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 1153935 rows, 901813 columns and 7830116 nonzeros
Model fingerprint: 0x30e6b2a7
Variable types: 441325 continuous, 460488 integer (456438 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 1151486 rows and 900916 columns
Presolve time: 2.91s
Presolved: 2449 rows, 897 columns, 6631 nonzeros
Variable types: 0 continuous, 897 integer (507 binary)
Found heuristic solution: objective 3134.6666667
Found heuristic solution: objective 3194.6666667

Root relaxation: objective 4.522667e+03, 799 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

H    0     0                    4522.6666667 9482.66667   110%     -    3s
     0     0        -    0      4522.66667 4522.66667  0.00%     -    3s

Explored 1 nodes (1042 simplex iterations) in 3.78 seconds (3.47 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 4522.67 3194.67 3134.67

Optimal solution found (tolerance 1.00e-08)
Best objective 4.522666666667e+03, best bound 4.522666666667e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□4522

  Itr = 0
Collect_LB =   [682.0]
Collect_UB =   [9727.333333333332]
Collect_Hua =   [0.0]
Collect_SPObjVal =   [4522.666666666666]
Collect_MPObjValNHua =   [682.0]


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 365024 rows, 137605 columns and 999461 nonzeros
Model fingerprint: 0x57dda685
Variable types: 1 continuous, 137604 integer (137580 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 253026 rows and 123425 columns (presolve time = 5s) ...
Presolve removed 346407 rows and 131233 columns
Presolve time: 6.48s
Presolved: 18617 rows, 6372 columns, 76982 nonzeros
Variable types: 0 continuous, 6372 integer (6358 binary)

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    5.3396667e+03   6.250000e+02   0.000000e+00      7s
    2302    5.3396667e+03   0.000000e+00   0.000000e+00      7s

Root relaxation: objective 5.339667e+03, 2302 iterations, 0.06 seconds (0.07 work units)

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

     0     0 5339.66667    0   15          - 5339.66667      -     -    6s
     0     0 5339.66667    0  133          - 5339.66667      -     -    7s
     0     0 5339.66667    0  129          - 5339.66667      -     -    7s
```

```
     0     0 5339.66667    0   65          - 5339.66667      -     -    7s
H    0     0                    5339.6666667 5339.66667  0.00%     -    8s
     0     0 5339.66667    0    9 5339.66667 5339.66667  0.00%     -    8s

Cutting planes:
  Learned: 4
  Gomory: 7
  Cover: 47
  Implied bound: 367
  Clique: 572
  MIR: 133
  StrongCG: 94
  GUB cover: 2
  Zero half: 9
  RLT: 8
  Relax-and-lift: 18

Explored 1 nodes (8532 simplex iterations) in 8.88 seconds (11.02 work units)
Thread count was 8 (of 8 available processors)

Solution count 1: 5339.67

Optimal solution found (tolerance 5.00e-04)
Best objective 5.339666666667e+03, best bound 5.339666666667e+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 1153935 rows, 901813 columns and 7830116 nonzeros
Model fingerprint: 0xe360a0c9
Variable types: 441325 continuous, 460488 integer (456438 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 1151122 rows and 900850 columns
Presolve time: 2.49s
Presolved: 2813 rows, 963 columns, 7625 nonzeros
Variable types: 0 continuous, 963 integer (547 binary)

Root relaxation: objective 4.752667e+03, 918 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 4752.66667    0    4          - 4752.66667      -     -    3s
H    0     0                    4752.6666667 4752.66667  0.00%     -    3s

Explored 1 nodes (1447 simplex iterations) in 3.31 seconds (3.38 work units)
Thread count was 8 (of 8 available processors)

Solution count 1: 4752.67

Optimal solution found (tolerance 1.00e-08)
Best objective 4.752666666667e+03, best bound 4.752666666667e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□4752

 Itr = 1
Collect_LB =   [682.0, 5339.666666666666]
Collect_UB =   [9727.333333333332, 5569.666666666666]
Collect_Hua =   [0.0, 4522.666666666666]
Collect_SPObjVal =   [4522.666666666666, 4752.666666666666]
Collect_MPObjValNHua =   [682.0, 817.0]


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 365025 rows, 137605 columns and 999474 nonzeros
Model fingerprint: 0xb3039aa5
Variable types: 1 continuous, 137604 integer (137580 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 252853 rows and 123411 columns (presolve time = 5s) ...
Presolve removed 346401 rows and 131231 columns
Presolve time: 6.23s
Presolved: 18624 rows, 6374 columns, 77004 nonzeros
Variable types: 0 continuous, 6374 integer (6359 binary)

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    5.5946667e+03   6.260000e+02   0.000000e+00      6s
    2260    5.5946667e+03   0.000000e+00   0.000000e+00      7s

Root relaxation: objective 5.594667e+03, 2260 iterations, 0.06 seconds (0.06 work units)

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

     0     0 5594.66667    0    6          - 5594.66667      -     -    6s
H    0     0                 7294.6666667 5594.66667  23.3%     -    7s
     0     0 5594.66667    0  166 7294.66667 5594.66667  23.3%     -    7s
     0     0 5594.66667    0  124 7294.66667 5594.66667  23.3%     -    7s
H    0     0                 6814.6666667 5594.66667  17.9%     -    7s
     0     0 5594.66667    0  104 6814.66667 5594.66667  17.9%     -    7s
H    0     0                 5594.6666667 5594.66667  0.00%     -    8s
     0     0 5594.66667    0    3 5594.66667 5594.66667  0.00%     -    8s

Cutting planes:
  Learned: 1
  Gomory: 4
  Cover: 190
  Implied bound: 401
  Clique: 261
  MIR: 112
  StrongCG: 98
  GUB cover: 2
  Zero half: 14
  RLT: 3
  Relax-and-lift: 7

Explored 1 nodes (14662 simplex iterations) in 8.99 seconds (11.06 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 5594.67 6814.67 7294.67

Optimal solution found (tolerance 5.00e-04)
Best objective 5.594666666667e+03, best bound 5.594666666667e+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 1153935 rows, 901813 columns and 7830116 nonzeros
Model fingerprint: 0xbedf6f2f
Variable types: 441325 continuous, 460488 integer (456438 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 1151375 rows and 900926 columns
Presolve time: 2.68s
Presolved: 2560 rows, 887 columns, 6934 nonzeros
Variable types: 0 continuous, 887 integer (512 binary)

Root relaxation: objective 4.582667e+03, 831 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

H    0     0                 4582.6666667 9662.66667   111%     -    3s
     0     0        -    0     4582.66667 4582.66667  0.00%     -    3s
```

```
Explored 1 nodes (1127 simplex iterations) in 3.49 seconds (3.44 work units)
Thread count was 8 (of 8 available processors)

Solution count 1: 4582.67

Optimal solution found (tolerance 1.00e-08)
Best objective 4.582666666667e+03, best bound 4.582666666667e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□4582

 Itr = 2
Collect_LB =   [682.0, 5339.666666666666, 5594.666666666666]
Collect_UB =   [9727.333333333332, 5569.666666666666, 5424.666666666666]
Collect_Hua =   [0.0, 4522.666666666666, 4752.666666666666]
Collect_SPObjVal =   [4522.666666666666, 4752.666666666666, 4582.666666666666]
Collect_MPObjValNHua =   [682.0, 817.0, 842.0]


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

~~~~~~~~~~judgeCount = 1, SPObj_SPF = 4752.666666666666
Vessel i: 0:      pi: 0-5,      ai-di: 1-37,      gi_SP-gpi_SP: 0.000000-0.000000,      ai_SP-di: 1-37,      taoi-deltai: 1-34,      taoPi_SP-deltaPi_SP: 1-34,      betaNi: 33,      bi: 33
Vessel i: 1:      pi: 5-11,      ai-di: 10-30,      gi_SP-gpi_SP: 0.000000-0.000000,      ai_SP-di: 10-30,      taoi-deltai: 10-32,      taoPi_SP-deltaPi_SP: 10-32,      betaNi: 22,      bi: 22
Vessel i: 2:      pi: 16-21,      ai-di: 11-24,      gi_SP-gpi_SP: 0.000000-0.000000,      ai_SP-di: 11-24,      taoi-deltai: 11-27,      taoPi_SP-deltaPi_SP: 11-27,      betaNi: 16,      bi: 16
Vessel i: 3:      pi: 11-16,      ai-di: 13-26,      gi_SP-gpi_SP: 0.000000-0.000000,      ai_SP-di: 13-26,      taoi-deltai: 13-22,      taoPi_SP-deltaPi_SP: 13-22,      betaNi: 9,      bi: 9
Vessel i: 4:      pi: 14-19,      ai-di: 38-63,      gi_SP-gpi_SP: 0.200000-1.000000,      ai_SP-di: 39-63,      taoi-deltai: 41-63,      taoPi_SP-deltaPi_SP: 41-63,      betaNi: 22,      bi: 22
Vessel i: 5:      pi: 8-13,      ai-di: 40-50,      gi_SP-gpi_SP: 1.000000-0.200000,      ai_SP-di: 47-50,      taoi-deltai: 46-56,      taoPi_SP-deltaPi_SP: 48-56,      betaNi: 10,      bi: 10

round LB =   [682, 5340, 5595]
round UB =   [9727, 5570, 5425]
round Hua =   [0, 4523, 4753]
round SPObjVal =   [4523, 4753, 4583]
round MPObjValNHua =   [682, 817, 842]

OptimalObj = 5594.666666666666
Time: 272.000000
```