```
"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=55556

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 377728 rows, 34789 columns and 1041116 nonzeros
Model fingerprint: 0x46f72647
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 213113 rows and 13994 columns (presolve time = 5s) ...
Presolve removed 337449 rows and 22786 columns
Presolve time: 6.17s
Presolved: 40279 rows, 12003 columns, 163014 nonzeros
Variable types: 0 continuous, 12003 integer (11988 binary)

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

Root relaxation presolved: 40277 rows, 12003 columns, 163010 nonzeros

Concurrent spin time: 0.02s

Solved with dual simplex (primal model)

Root relaxation: objective 7.880000e+02, 1547 iterations, 0.20 seconds (0.18 work units)

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

     0     0  788.00000    0   17          -  788.00000      -     -    6s
H    0     0                1768.0000000  788.00000  55.4%     -    7s
H    0     0                 788.0000000  788.00000  0.00%     -    7s
     0     0  788.00000    0  112  788.00000  788.00000  0.00%    -    7s

Cutting planes:
  Gomory: 7
  Cover: 36
  Implied bound: 6
  Clique: 2
  MIR: 32
  StrongCG: 20
  GUB cover: 1
  Zero half: 1
  RLT: 12
  Relax-and-lift: 6

Explored 1 nodes (4325 simplex iterations) in 7.84 seconds (12.17 work units)
Thread count was 8 (of 8 available processors)

Solution count 2: 788 1768

Optimal solution found (tolerance 1.00e-10)
Best objective 7.880000000000e+02, best bound 7.880000000000e+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 252634 rows, 9618 columns and 522244 nonzeros
Model fingerprint: 0x879bae13
Variable types: 24 continuous, 9594 integer (5544 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 250362 rows and 8728 columns
Presolve time: 0.23s
Presolved: 2272 rows, 890 columns, 6112 nonzeros
Variable types: 4 continuous, 886 integer (498 binary)
Found heuristic solution: objective 3850.3983806

Root relaxation: objective 5.221000e+03, 582 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 5221.00000    0    8 3850.39838 5221.00000  35.6%     -    0s
H    0     0                    5221.0000000 5221.00000  0.00%     -    0s
     0     0 5221.00000    0    8 5221.00000 5221.00000  0.00%     -    0s

Explored 1 nodes (582 simplex iterations) in 0.31 seconds (0.46 work units)
Thread count was 8 (of 8 available processors)

Solution count 2: 5221 3850.4

Optimal solution found (tolerance 1.00e-08)
Best objective 5.221000000000e+03, best bound 5.221000000000e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5221

 Itr = 0
Collect_LB =   [788.0]
Collect_UB =   [11230.000000000004]
Collect_Hua =   [0.0]
Collect_SPObjVal =   [5221.000000000002]
Collect_MPObjValNHua =   [788.0]


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 382373 rows, 137605 columns and 1045776 nonzeros
Model fingerprint: 0xe7894bd1
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 247724 rows and 121850 columns (presolve time = 5s) ...
Presolve removed 364020 rows and 131279 columns
Presolve time: 5.87s
Presolved: 18353 rows, 6326 columns, 77807 nonzeros
Variable types: 0 continuous, 6326 integer (6312 binary)

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    6.0610000e+03   7.871250e+02   0.000000e+00      6s
    2660    6.0610000e+03   0.000000e+00   0.000000e+00      6s

Root relaxation: objective 6.061000e+03, 2660 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 6061.00000    0   19          - 6061.00000      -     -    6s
     0     0 6061.00000    0  268          - 6061.00000      -     -    7s
     0     0 6061.00000    0  269          - 6061.00000      -     -    7s
     0     0 6061.00000    0  245          - 6061.00000      -     -    7s
```

```
     0     0 6061.00000    0  243          - 6061.00000      -     -    7s
     0     0 6061.00000    0   54          - 6061.00000      -     -    8s
     0     0 6061.00000    0   52          - 6061.00000      -     -    8s
H    0     0                6061.0000000 6061.00000  0.00%     -    9s
     0     0 6061.00000    0  134 6061.00000 6061.00000  0.00%     -    9s

Cutting planes:
  Learned: 2
  Gomory: 1
  Cover: 267
  Implied bound: 14
  Clique: 58
  MIR: 28
  StrongCG: 7
  GUB cover: 38
  RLT: 1
  Relax-and-lift: 5
  BQP: 3

Explored 1 nodes (16800 simplex iterations) in 9.15 seconds (12.74 work units)
Thread count was 8 (of 8 available processors)

Solution count 1: 6061

Optimal solution found (tolerance 1.00e-10)
Best objective 6.061000000000e+03, best bound 6.061000000000e+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 252634 rows, 9618 columns and 522244 nonzeros
Model fingerprint: 0xca8aaa3d
Variable types: 24 continuous, 9594 integer (5544 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 247378 rows and 7875 columns
Presolve time: 0.22s
Presolved: 5256 rows, 1743 columns, 14014 nonzeros
Variable types: 4 continuous, 1739 integer (994 binary)
Found heuristic solution: objective 3874.6085125
Found heuristic solution: objective 3894.6085125

Root relaxation: objective 5.472000e+03, 1514 iterations, 0.03 seconds (0.02 work units)

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

     0     0 5472.00000    0   14 3894.60851 5472.00000  40.5%     -    0s
H    0     0                4539.9153674 5472.00000  20.5%     -    0s
H    0     0                4567.0000000 5472.00000  19.8%     -    0s
     0     0 5472.00000    0    4 4567.00000 5472.00000  19.8%     -    0s
H    0     0                5472.0000000 5472.00000  0.00%     -    0s
     0     0 5472.00000    0    4 5472.00000 5472.00000  0.00%     -    0s

Cutting planes:
  Gomory: 3
  Cover: 1
  Clique: 3
  Zero half: 1

Explored 1 nodes (2419 simplex iterations) in 0.38 seconds (0.57 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 5472 4567 4539.92 ... 3874.61

Optimal solution found (tolerance 1.00e-08)
Best objective 5.472000000000e+03, best bound 5.472000000000e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5472

 Itr = 1
Collect_LB =   [788.0, 6061.000000000002]
Collect_UB =   [11230.000000000004, 6312.000000000002]
Collect_Hua =   [0.0, 5221.000000000002]
Collect_SPObjVal =   [5221.000000000002, 5472.000000000002]
```

```
Collect_MPObjValNHua =   [788.0, 840.0]


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 382373 rows, 137605 columns and 1045776 nonzeros
Model fingerprint: 0x5b09e65d
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 247724 rows and 121850 columns (presolve time = 5s) ...
Presolve removed 364020 rows and 131279 columns
Presolve time: 5.81s
Presolved: 18353 rows, 6326 columns, 77807 nonzeros
Variable types: 0 continuous, 6326 integer (6312 binary)

Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    6.3120000e+03   7.871250e+02   0.000000e+00      6s
    2660    6.3120000e+03   0.000000e+00   0.000000e+00      6s

Root relaxation: objective 6.312000e+03, 2660 iterations, 0.05 seconds (0.07 work units)

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

     0     0 6312.00000    0   19          - 6312.00000      -     -    6s
     0     0 6312.00000    0  268          - 6312.00000      -     -    7s
     0     0 6312.00000    0  269          - 6312.00000      -     -    7s
     0     0 6312.00000    0  245          - 6312.00000      -     -    7s
     0     0 6312.00000    0  243          - 6312.00000      -     -    7s
     0     0 6312.00000    0   54          - 6312.00000      -     -    8s
     0     0 6312.00000    0   52          - 6312.00000      -     -    8s
H    0     0                6312.0000000 6312.00000  0.00%     -    9s
     0     0 6312.00000    0  134 6312.00000 6312.00000  0.00%     -    9s

Cutting planes:
  Learned: 2
  Gomory: 1
  Cover: 267
  Implied bound: 14
  Clique: 58
  MIR: 28
  StrongCG: 7
  GUB cover: 38
  RLT: 1
  Relax-and-lift: 5
  BQP: 3

Explored 1 nodes (16800 simplex iterations) in 9.16 seconds (12.74 work units)
Thread count was 8 (of 8 available processors)

Solution count 1: 6312

Optimal solution found (tolerance 1.00e-10)
Best objective 6.312000000000e+03, best bound 6.312000000000e+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 252634 rows, 9618 columns and 522244 nonzeros
Model fingerprint: 0xca8aaa3d
Variable types: 24 continuous, 9594 integer (5544 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 247378 rows and 7875 columns
Presolve time: 0.22s
Presolved: 5256 rows, 1743 columns, 14014 nonzeros
Variable types: 4 continuous, 1739 integer (994 binary)
Found heuristic solution: objective 3874.6085125
Found heuristic solution: objective 3894.6085125

Root relaxation: objective 5.472000e+03, 1514 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 5472.00000    0   14 3894.60851 5472.00000  40.5%     -    0s
H    0     0                4539.9153674 5472.00000  20.5%     -    0s
H    0     0                4567.0000000 5472.00000  19.8%     -    0s
     0     0 5472.00000    0    4 4567.00000 5472.00000  19.8%     -    0s
H    0     0                5472.0000000 5472.00000  0.00%     -    0s
     0     0 5472.00000    0    4 5472.00000 5472.00000  0.00%     -    0s

Cutting planes:
  Gomory: 3
  Cover: 1
  Clique: 3
  Zero half: 1

Explored 1 nodes (2419 simplex iterations) in 0.38 seconds (0.57 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 5472 4567 4539.92 ... 3874.61

Optimal solution found (tolerance 1.00e-08)
Best objective 5.472000000000e+03, best bound 5.472000000000e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5472

 Itr = 2
Collect_LB =   [788.0, 6061.000000000002, 6312.000000000002]
Collect_UB =   [11230.000000000004, 6312.000000000002, 6312.000000000002]
Collect_Hua =   [0.0, 5221.000000000002, 5472.000000000002]
Collect_SPObjVal =   [5221.000000000002, 5472.000000000002, 5472.000000000002]
Collect_MPObjValNHua =   [788.0, 840.0, 840.0]


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

~~~~~~~~~~judge = 2, SPObj_SPF = 5472.000000000002
Vessel i: 0:     pi: 0-7,     ai-di: 8-25,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 8-25,     taoi-deltai: 8-25,     taoPi_SP-deltaPi_SP: 8-25,     betaNi: 17
,     bi: 17
Vessel i: 1:     pi: 22-28,     ai-di: 14-24,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 14-24,     taoi-deltai: 14-25,     taoPi_SP-deltaPi_SP: 14-25,
betaNi: 11,     bi: 11
Vessel i: 2:     pi: 16-22,     ai-di: 14-49,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 14-49,     taoi-deltai: 14-47,     taoPi_SP-deltaPi_SP: 14-47,
betaNi: 33,     bi: 33
Vessel i: 3:     pi: 11-16,     ai-di: 22-48,     gi_SP-gpi_SP: 0.000000-0.000000,     ai_SP-di: 22-48,     taoi-deltai: 22-49,     taoPi_SP-deltaPi_SP: 22-49,
betaNi: 27,     bi: 27
Vessel i: 4:     pi: 16-22,     ai-di: 43-56,     gi_SP-gpi_SP: 1.000000-0.600000,     ai_SP-di: 48-56,     taoi-deltai: 48-58,     taoPi_SP-deltaPi_SP: 48-58,
betaNi: 10,     bi: 10
Vessel i: 5:     pi: 22-27,     ai-di: 35-75,     gi_SP-gpi_SP: 0.200000-0.600000,     ai_SP-di: 35-75,     taoi-deltai: 36-70,     taoPi_SP-deltaPi_SP: 36-70,
betaNi: 34,     bi: 34

round LB =   [788, 6061, 6312]
round UB =   [11230, 6312, 6312]
round Hua =   [0, 5221, 5472]
round SPObjVal =   [5221, 5472, 5472]
round MPObjValNHua =   [788, 840, 840]

OptimalObj = 6312.000000000002
Time: 70.000000
```