```
"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=6958

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 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: 9.86s
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     10s
Concurrent spin time: 0.00s

Solved with dual simplex (primal model)

Root relaxation: objective 7.610000e+02, 2637 iterations, 0.26 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      -     -   10s
H    0     0                2461.0000000  761.00000  69.1%     -   11s
H    0     0                2361.0000000  761.00000  67.8%     -   11s
H    0     0                2321.0000000  761.00000  67.2%     -   12s
     0     0  761.00000    0   88 2321.00000  761.00000  67.2%     -   12s
H    0     0                2041.0000000  761.00000  62.7%     -   12s
     0     0  761.00000    0  316 2041.00000  761.00000  62.7%     -   13s
     0     0  761.00000    0  306 2041.00000  761.00000  62.7%     -   13s
     0     0  761.00000    0   31 2041.00000  761.00000  62.7%     -   15s
     0     0  761.00000    0  324 2041.00000  761.00000  62.7%     -   16s
     0     0  761.00000    0  310 2041.00000  761.00000  62.7%     -   16s
     0     0  761.00000    0  104 2041.00000  761.00000  62.7%     -   19s
     0     0  761.00000    0  103 2041.00000  761.00000  62.7%     -   19s
     0     0  761.00000    0  154 2041.00000  761.00000  62.7%     -   19s
     0     0  761.00000    0  153 2041.00000  761.00000  62.7%     -   19s
     0     0  761.00000    0   30 2041.00000  761.00000  62.7%     -   23s
     0     0  761.00000    0   30 2041.00000  761.00000  62.7%     -   23s
     0     2  761.00000    0   30 2041.00000  761.00000  62.7%     -   24s
     1     4  761.00000    1   46 2041.00000  761.00000  62.7%   148   25s
    15    20  761.00000    4  199 2041.00000  761.00000  62.7%  1233   31s
    37    44  761.00000    7  104 2041.00000  761.00000  62.7%   880   35s
H   45    44                1261.0000000  761.00000  39.7%  1101   35s
H   63    77                1221.0000000  761.00000  37.7%  1352   40s
H  210   183                 1021.0000000  761.00000  25.5%   771   48s
   317   211  941.00000   58  151 1021.00000  761.00000  25.5%   658   52s
```

```
 80  H  345   211                941.0000000  761.00000  19.1%   613   52s
 81     398   242  761.00000   21   62  941.00000  761.00000  19.1%   674   57s
 82     479   256  761.00000   43  218  941.00000  761.00000  19.1%   656   62s
 83  H  603   256                761.0000000  761.00000  0.00%   623   62s
 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 62.99 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 1540790 rows, 1208299 columns and 10558582 nonzeros
112  Model fingerprint: 0xf0ce5eec
113  Variable types: 592971 continuous, 615328 integer (610603 binary)
114  Coefficient statistics:
115    Matrix range     [1e-01, 1e+10]
116    Objective range  [6e-05, 5e+01]
117    Bounds range     [1e+00, 8e+01]
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 1536912 rows and 1207019 columns
124  Presolve time: 3.09s
125  Presolved: 3878 rows, 1280 columns, 10558 nonzeros
126  Variable types: 3 continuous, 1277 integer (755 binary)
127
128  Root relaxation: objective 5.038445e+03, 1650 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  280          - 5038.44514      -     -    3s
134  H    0     0                3057.0006962 5038.44514  64.8%     -    3s
135  H    0     0                4731.0006962 5038.44514  6.50%     -    4s
136  H    0     0                4863.0006962 5038.44514  3.61%     -    4s
137  H    0     0                4889.0006962 5038.44514  3.06%     -    4s
138       0     0 4996.23141    0  379 4889.00070 4996.23141  2.19%     -    4s
139       0     0 4996.21675    0  376 4889.00070 4996.21675  2.19%     -    4s
140       0     0 4996.21675    0  364 4889.00070 4996.21675  2.19%     -    4s
141  H    0     0                4918.0006962 4996.21675  1.59%     -    4s
142       0     0 4996.21675    0  362 4918.00070 4996.21675  1.59%     -    4s
143       0     0 4992.22064    0  292 4918.00070 4992.22064  1.51%     -    4s
144       0     0 4992.22064    0  288 4918.00070 4992.22064  1.51%     -    4s
145  H    0     0                4945.0006962 4988.00785  0.87%     -    4s
146       0     0 4988.00785    0  292 4945.00070 4988.00785  0.87%     -    4s
147  H    0     0                4953.0006962 4986.68903  0.68%     -    4s
148  H    0     0                4958.0006962 4986.68903  0.58%     -    4s
149       0     0 4983.80120    0  329 4958.00070 4983.80120  0.52%     -    4s
150       0     0 4980.66745    0  323 4958.00070 4980.66745  0.46%     -    4s
151       0     0 4980.66745    0  319 4958.00070 4980.66745  0.46%     -    4s
152       0     0 4980.66745    0  313 4958.00070 4980.66745  0.46%     -    4s
153       0     0 4980.66745    0  316 4958.00070 4980.66745  0.46%     -    4s
154  H    0     0                4967.0006962 4976.00070  0.18%     -    4s
155  H    0     0                4972.0006962 4976.00070  0.08%     -    4s
156
157  Cutting planes:
158    Learned: 4
159    Gomory: 5
160    Cover: 76
161    Implied bound: 97
162    Clique: 49
163    MIR: 19
```

```
  StrongCG: 2
  Flow cover: 23
  GUB cover: 4
  Zero half: 11
  RLT: 39
  Relax-and-lift: 4
  PSD: 15

Explored 1 nodes (3200 simplex iterations) in 4.58 seconds (4.76 work units)
Thread count was 8 (of 8 available processors)

Solution count 10: 4972 4967 4958 ... 3057

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 =  [10705.001392450093]
Collect_Hua =  [0.0]
Collect_SPObjVal =  [4972.000696225046]
Collect_MPObjValNHua =  [761.0]


Set parameter TimeLimit to value 10800
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 825052 rows, 195945 columns and 2412517 nonzeros
Model fingerprint: 0x7282e999
Variable types: 1 continuous, 195944 integer (187075 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 634634 rows and 174373 columns (presolve time = 5s) ...
Presolve removed 634634 rows and 174373 columns (presolve time = 10s) ...
Presolve removed 757662 rows and 183924 columns
Presolve time: 12.48s
Presolved: 67390 rows, 12021 columns, 251009 nonzeros
Variable types: 1 continuous, 12020 integer (9916 binary)

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

Root relaxation presolved: 12021 rows, 79411 columns, 263030 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    5.7330007e+03   0.000000e+00   3.201653e+04     13s
Concurrent spin time: 0.42s

Solved with dual simplex (primal model)

Root relaxation: objective 5.733001e+03, 6205 iterations, 1.58 seconds (1.86 work units)
Total elapsed time = 15.69s

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

     0     0 5733.00070    0  276          - 5733.00070      -     -   16s
     0     0 5733.00070    0  679          - 5733.00070      -     -   22s
     0     0 5733.00070    0  750          - 5733.00070      -     -   23s
     0     0 5733.00070    0  731          - 5733.00070      -     -   24s
     0     0 5733.00070    0  570          - 5733.00070      -     -   25s
     0     0 5733.00070    0  569          - 5733.00070      -     -   25s
     0     0 5733.00070    0  275          - 5733.00070      -     -   44s
     0     0 5733.00070    0  399          - 5733.00070      -     -   47s
     0     0 5733.00070    0  398          - 5733.00070      -     -   48s
     0     0 5733.00070    0  363          - 5733.00070      -     -   62s
     0     0 5733.00070    0  362          - 5733.00070      -     -   62s
     0     0 5733.00070    0  387          - 5733.00070      -     -   63s
```

```
248      0     0 5733.00070    0  342          - 5733.00070      -     -   80s
249      0     0 5733.00070    0  297          - 5733.00070      -     -   81s
250      0     0 5733.00070    0  645          - 5733.00070      -     -   84s
251      0     0 5733.00070    0  644          - 5733.00070      -     -   84s
252      0     0 5733.00070    0  252          - 5733.00070      -     -  104s
253  H   0     0                6413.0006962 5733.00070  10.6%     -  105s
254      0     0 5733.00070    0  252 6413.00070 5733.00070  10.6%     -  106s
255      0     2 5733.00070    0  252 6413.00070 5733.00070  10.6%     -  110s
256     11    16 5733.00070    3  561 6413.00070 5733.00070  10.6%  3261  117s
257     27    32 5733.00070    6  584 6413.00070 5733.00070  10.6%  2158  123s
258     44    52 5733.00070    9  592 6413.00070 5733.00070  10.6%  1469  126s
259     81   104 5733.00070   13  234 6413.00070 5733.00070  10.6%  1081  130s
260  H  169   178                6373.0006962 5733.00070  10.0%   565  135s
261    273   288 5733.00070   28  629 6373.00070 5733.00070  10.0%   375  141s
262    352   369 5733.00070   35  326 6373.00070 5733.00070  10.0%   330  145s
263    452   454 5733.00070   48  365 6373.00070 5733.00070  10.0%   276  152s
264    507   507 5733.00070   56  472 6373.00070 5733.00070  10.0%   264  155s
265    567   574 5733.00070   60  446 6373.00070 5733.00070  10.0%   265  160s
266  H  589   422                6093.0006962 5733.00070  5.91%   264  160s
267    651   462 5733.00070   69  485 6093.00070 5733.00070  5.91%   243  165s
268  H  664   335                6013.0006962 5733.00070  4.66%   241  165s
269
270  Cutting planes:
271    Learned: 30
272    Gomory: 1
273    Cover: 381
274    Implied bound: 134
275    Clique: 129
276    MIR: 117
277    StrongCG: 34
278    Flow cover: 1
279    GUB cover: 62
280    Zero half: 27
281    RLT: 67
282    Relax-and-lift: 232
283    BQP: 31
284
285  Explored 737 nodes (356468 simplex iterations) in 165.72 seconds (335.77 work units)
286  Thread count was 8 (of 8 available processors)
287
288  Solution count 4: 6013 6093 6373 6413
289
290  Optimal solution found (tolerance 5.00e-02)
291  Best objective 6.013000696225e+03, best bound 5.733000696225e+03, gap 4.6566%
292  Set parameter MIPGap to value 1e-08
293  Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
294
295  CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
296  Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
297
298  Optimize a model with 1540790 rows, 1208299 columns and 10558582 nonzeros
299  Model fingerprint: 0x5d8229c1
300  Variable types: 592971 continuous, 615328 integer (610603 binary)
301  Coefficient statistics:
302    Matrix range     [1e-01, 1e+10]
303    Objective range  [6e-05, 5e+01]
304    Bounds range     [1e+00, 8e+01]
305    RHS range        [8e-01, 1e+10]
306  Warning: Model contains large matrix coefficients
307  Warning: Model contains large rhs
308          Consider reformulating model or setting NumericFocus parameter
309          to avoid numerical issues.
310  Presolve removed 1536208 rows and 1206829 columns
311  Presolve time: 3.09s
312  Presolved: 4582 rows, 1470 columns, 12220 nonzeros
313  Variable types: 3 continuous, 1467 integer (858 binary)
314  Found heuristic solution: objective 3905.0006962
315
316  Root relaxation: objective 5.883334e+03, 1466 iterations, 0.02 seconds (0.04 work units)
317
318      Nodes    |    Current Node    |     Objective Bounds      |     Work
319   Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time
320
321      0     0 5883.33403    0   33 3905.00070 5883.33403  50.7%     -    3s
322  H   0     0                5852.0006962 5883.33403  0.54%     -    3s
323  *   0     0               0    5879.0006962 5879.00070  0.00%     -    4s
324
325  Cutting planes:
326    Learned: 2
327    Gomory: 1
328    Cover: 7
329    Implied bound: 8
330    Flow cover: 2
331    Mod-K: 1
```

```
  RLT: 16
  PSD: 6

Explored 1 nodes (2134 simplex iterations) in 4.18 seconds (4.39 work units)
Thread count was 8 (of 8 available processors)

Solution count 3: 5879 5852 3905

Optimal solution found (tolerance 1.00e-08)
Best objective 5.879000696225e+03, best bound 5.879000696225e+03, gap 0.0000%
SP is solved
SP's optimal solution is'□5879

  Itr = 1
Collect_LB =   [761.0, 6013.000696225046]
Collect_UB =   [10705.001392450093, 6920.0006962250445]
Collect_Hua =   [0.0, 4972.000696225046]
Collect_SPObjVal =   [4972.000696225046, 5879.0006962250445]
Collect_MPObjValNHua =   [761.0, 1041.0]
Time: 436.000000




Set parameter TimeLimit to value 10800
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 1160565 rows, 211254 columns and 3488494 nonzeros
Model fingerprint: 0x852d1688
Variable types: 1 continuous, 211253 integer (193543 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 982812 rows and 189107 columns (presolve time = 5s) ...
Presolve removed 1001249 rows and 190590 columns (presolve time = 10s) ...
Presolve removed 1067235 rows and 197108 columns
Presolve time: 13.56s
Presolved: 93330 rows, 14146 columns, 303474 nonzeros
Variable types: 1 continuous, 14145 integer (10645 binary)

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

Root relaxation presolved: 14146 rows, 107476 columns, 317620 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0    7.2200007e+03   0.000000e+00   6.064730e+04     14s
Concurrent spin time: 0.01s

Solved with dual simplex (primal model)

Root relaxation: infeasible, 0 iterations, 0.32 seconds (0.26 work units)

Explored 1 nodes (0 simplex iterations) in 14.50 seconds (26.60 work units)
Thread count was 8 (of 8 available processors)

Solution count 0

Model is infeasible
Best objective -, best bound -, gap -
Traceback (most recent call last):
  File "<input>", line 1, in <module>
  File "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\_pydev_bundle\pydev_umd.py", line 198, in runfile
    pydev_imports.execfile(filename, global_vars, local_vars)  # execute the script
  File "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\_pydev_imps\_pydev_execfile.py", line 18, in execfile
    exec(compile(contents+"\n", file, 'exec'), glob, loc)
  File "E:/1 □□□□/3 □□□□□/1 □□□□□□/1 □□□□□□□□/1_□□□□□□_□□□□/1_LW _□□□□/4 □□□□/3 python_code/9 Code for this paper/main_RO_CCG.py", line 1363, in <module>
    HuaValG = Hua.x
  File "src\gurobipy\var.pxi", line 125, in gurobipy.Var.__getattr__
```

```
  File "src\gurobipy\var.pxi", line 153, in gurobipy.Var.getAttr
  File "src\gurobipy\attrutil.pxi", line 100, in gurobipy.__getattr
AttributeError: Unable to retrieve attribute 'x'

```