```
"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=18215

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_DM.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.....

-----------------------------------------------
Warning: your license will expire in 14 days
-----------------------------------------------

Set parameter TimeLimit to value 10800
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 1113780 rows, 72324 columns and 3299667 nonzeros
Model fingerprint: 0xb989e45e
Variable types: 0 continuous, 72324 integer (60921 binary)
Coefficient statistics:
  Matrix range     [1e-01, 1e+15]
  Objective range  [1e+00, 5e+01]
  Bounds range     [1e+00, 1e+00]
  RHS range        [1e+00, 2e+15]
Warning: Model contains large matrix coefficient range
Warning: Model contains large rhs
         Consider reformulating model or setting NumericFocus parameter
         to avoid numerical issues.
Presolve removed 873494 rows and 43964 columns (presolve time = 5s) ...
Presolve removed 908496 rows and 46064 columns (presolve time = 10s) ...
Presolve removed 987062 rows and 53940 columns
Presolve time: 14.78s
Presolved: 126718 rows, 18384 columns, 388901 nonzeros
Variable types: 0 continuous, 18384 integer (18073 binary)

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

Root relaxation presolved: 18372 rows, 145066 columns, 406500 nonzeros


Root simplex log...

Iteration    Objective       Primal Inf.    Dual Inf.      Time
       0   -1.1467000e+04   0.000000e+00   1.477496e+05     16s
Concurrent spin time: 0.47s

Solved with dual simplex (primal model)

Root relaxation: objective 1.041863e+03, 4320 iterations, 3.08 seconds (3.38 work units)
Total elapsed time = 20.03s

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

     0     0 1041.86281    0  764          - 1041.86281      -     -   21s
     0     0 1042.75133    0  795          - 1042.75133      -     -   21s
     0     0 1048.01163    0 1509           - 1048.01163      -     -   26s
     0     0 1048.01163    0 1464           - 1048.01163      -     -   26s
     0     0 1065.63438    0 1464           - 1065.63438      -     -   31s
     0     0 1065.63438    0 1462           - 1065.63438      -     -   31s
     0     0 1068.28427    0 1767           - 1068.28427      -     -   33s
     0     0 1068.28427    0 1765           - 1068.28427      -     -   33s
     0     0 1068.55939    0 1739           - 1068.55939      -     -   34s
     0     0 1068.55939    0 1746           - 1068.55939      -     -   34s
     0     0 1068.76568    0 1734           - 1068.76568      -     -   35s
     0     0 1068.89263    0 1731           - 1068.89263      -     -   35s
     0     0 1068.89263    0 1733           - 1068.89263      -     -   35s
     0     0 1068.99442    0 1728           - 1068.99442      -     -   36s
     0     0 1069.03678    0 1689           - 1069.03678      -     -   36s
     0     0 1069.06909    0 1705           - 1069.06909      -     -   36s
     0     0 1069.06909    0 1704           - 1069.06909      -     -   37s
     0     0 1070.08990    0 1892           - 1070.08990      -     -   40s
```

```
  80      0    0 1073.45394    0 1843         - 1073.45394     -     -   41s
  81      0    0 1073.51917    0 1825         - 1073.51917     -     -   42s
  82      0    0 1074.79118    0 1871         - 1074.79118     -     -   43s
  83      0    0 1074.83892    0 1646         - 1074.83892     -     -   44s
  84      0    0 1074.84093    0 1665         - 1074.84093     -     -   44s
  85      0    0 1076.30312    0 1587         - 1076.30312     -     -   48s
  86      0    0 1076.30312    0 1516         - 1076.30312     -     -   48s
  87      0    0 1076.98977    0 1624         - 1076.98977     -     -   49s
  88      0    0 1077.01916    0 2057         - 1077.01916     -     -   50s
  89      0    0 1077.03251    0 2000         - 1077.03251     -     -   51s
  90      0    0 1077.03251    0 2013         - 1077.03251     -     -   51s
  91      0    0 1077.05103    0 1903         - 1077.05103     -     -   51s
  92      0    0 1077.05103    0 1936         - 1077.05103     -     -   51s
  93      0    0 1079.05266    0 1439         - 1079.05266     -     -   55s
  94      0    0 1079.24470    0 1545         - 1079.24470     -     -   57s
  95      0    0 1079.24470    0 1556         - 1079.24470     -     -   57s
  96      0    0 1079.24964    0 1594         - 1079.24964     -     -   58s
  97      0    0 1079.66961    0 1621         - 1079.66961     -     -   62s
  98      0    0 1079.66961    0 1591         - 1079.66961     -     -   63s
  99      0    0 1079.78779    0 1593         - 1079.78779     -     -   64s
 100      0    0 1079.78779    0 1582         - 1079.78779     -     -   64s
 101      0    0 1079.78779    0 1635         - 1079.78779     -     -   64s
 102      0    0 1080.11222    0 1529         - 1080.11222     -     -   67s
 103      0    0 1080.11222    0 1507         - 1080.11222     -     -   67s
 104      0    0 1080.16011    0 1435         - 1080.16011     -     -   68s
 105      0    0 1080.16752    0 1396         - 1080.16752     -     -   68s
 106      0    0 1080.29788    0 1364         - 1080.29788     -     -   70s
 107      0    0 1080.30091    0 1472         - 1080.30091     -     -   71s
 108      0    0 1080.30091    0 1448         - 1080.30091     -     -   72s
 109      0    0 1080.32828    0 1443         - 1080.32828     -     -   74s
 110      0    0 1080.32828    0 1436         - 1080.32828     -     -   74s
 111      0    0 1080.32828    0 1466         - 1080.32828     -     -   75s
 112      0    0 1080.32828    0 1413         - 1080.32828     -     -   75s
 113      0    0 1080.33390    0 1455         - 1080.33390     -     -   77s
 114      0    0 1080.33390    0 1451         - 1080.33390     -     -   77s
 115      0    0 1080.33514    0 1490         - 1080.33514     -     -   78s
 116      0    0 1080.33514    0 1474         - 1080.33514     -     -   78s
 117      0    0 1080.36578    0 1450         - 1080.36578     -     -   80s
 118      0    0 1080.36578    0 1452         - 1080.36578     -     -   80s
 119      0    0 1080.36578    0 1018         - 1080.36578     -     -   82s
 120      0    2 1080.36578    0 1013         - 1080.36578     -     -   91s
 121      3    8 1090.52670    2  809         - 1086.06583     -  2562   95s
 122     28   36 1093.00000    7  135         - 1093.00000     -  1148  100s
 123    104  124 1093.47378   13  796         - 1093.00000     -   673  107s
 124    156  159 infeasible   25             - 1093.00000     -   684  113s
 125    171  180 1093.00000   27  471         - 1093.00000     -   757  119s
 126    198  212 1301.47608   30  674         - 1093.00000     -   879  123s
 127    238  233 1429.66667   37  489         - 1093.00000     -   870  127s
 128    265  260 1501.48485   39  538         - 1093.00000     -   894  132s
 129    297  308 1460.33146   40  514         - 1093.00000     -   906  137s
 130    362  344 1823.00000   43  489         - 1093.00000     -   896  142s
 131    398  383 1829.66667   58  337         - 1093.00000     -   954  149s
 132    470  441 1096.33333    7  286         - 1093.00000     -   910  158s
 133    560  480 1099.66667   17  657         - 1093.00000     -   889  167s
 134    599  528 1100.50000   23  559         - 1093.00000     -   947  178s
 135    670  631 1171.41270   43  410         - 1093.00000     -   986  193s
 136    858  796 1103.00000   11  526         - 1093.00000     -   938  209s
 137   H  902   721                1353.0000000 1093.00000  19.2%   998  209s
 138    1068   720 1094.65310    7 1018 1353.00000 1093.00000  19.2%   878  262s
 139    1070   721 1121.58289   40  408 1353.00000 1093.00000  19.2%   876  272s
 140    1071   722 1206.33333   63  870 1353.00000 1093.00000  19.2%   876  290s
 141    1072   723 1113.72930   27  996 1353.00000 1093.00000  19.2%   875  298s
 142    1073   723 1173.87923   47  945 1353.00000 1093.00000  19.2%   874  302s
 143    1074   724 1184.66667   66 1068 1353.00000 1093.00000  19.2%   873  305s
 144    1076   725 1129.66667   11  917 1353.00000 1093.00000  19.2%   871  311s
 145    1077   726 1111.41176   33  701 1353.00000 1093.00000  19.2%   871  321s
 146    1080   728 1173.02764   18  873 1353.00000 1093.00000  19.2%   868  329s
 147    1081   729 1131.53333   35  600 1353.00000 1093.00000  19.2%   867  337s
 148    1082   729 1099.66667   66 1099 1353.00000 1093.00000  19.2%   867  340s
 149    1084   731 1184.66667   77  923 1353.00000 1093.00000  19.2%   865  346s
 150    1085   731 1129.66667   16  509 1353.00000 1093.00000  19.2%   864  357s
 151    1088   733 1093.88235   28  427 1353.00000 1093.00000  19.2%   862  363s
 152    1089   734 1216.33333   78  527 1353.00000 1093.00000  19.2%   861  378s
 153   H 1089   696                1339.0000000 1093.00000  18.4%   861  385s
 154    1092   698 1129.41520    5  863 1339.00000 1093.00000  18.4%   859  392s
 155   H 1092   663                1239.0000000 1093.00000  11.8%   859  399s
 156    1093   664 1216.33333   78  645 1239.00000 1093.00000  11.8%   858  403s
 157    1094   664 1096.33333   10 1182 1239.00000 1093.00000  11.8%   857  406s
 158    1097   668 1093.66667   12 1018 1239.00000 1093.00000  11.8%   962  435s
 159    1099   669 1095.66667   27  365 1239.00000 1093.00000  11.8%   960  445s
 160   H 1099   635                1193.0000000 1093.00000  8.38%   960  452s
 161    1100   636 1137.57630   44  549 1193.00000 1093.00000  8.38%   959  457s
 162    1101   637 1193.00000   62  415 1193.00000 1093.00000  8.38%   958  460s
 163    1103   638 1099.66667   67  588 1193.00000 1093.00000  8.38%   957  466s
```

```
164    1104   639 1117.77676   30  416 1193.00000 1093.00000  8.38%   956  481s
165    1106   640 1107.77285   15  436 1193.00000 1093.00000  8.38%   954  489s
166    1107   641 1131.88889   34  780 1193.00000 1093.00000  8.38%   953  494s
167  H 1107   609               1173.0000000 1093.00000  6.82%   953  500s
168  H 1109   579               1153.0000000 1093.00000  5.20%   951  509s
169    1111   580 1153.00000   64  283 1153.00000 1093.00000  5.20%   950  510s
170    1112   581 1153.00000   62  235 1153.00000 1093.00000  5.20%   949  515s
171    1114   582 1097.44444   38  320 1153.00000 1093.00000  5.20%   947  521s
172    1117   584 1153.00000   74  336 1153.00000 1093.00000  5.20%   945  528s
173    1119   586 1131.00000   21  336 1153.00000 1093.00000  5.20%   943  530s
174    1120   586 1098.40053    5  350 1153.00000 1093.00000  5.20%   942  535s
175    1123   591 1093.00000   27  306 1153.00000 1093.00000  5.20%  1010  542s
176    1125   595 1093.00000   28  303 1153.00000 1093.00000  5.20%  1013  545s
177    1150   610 1093.00000   31  324 1153.00000 1093.00000  5.20%  1008  550s
178    1173   633 1093.00000   34  295 1153.00000 1093.00000  5.20%  1013  556s
179    1202   659 1093.00000   37  125 1153.00000 1093.00000  5.20%  1025  565s
180    1228   689 1093.00000   39  379 1153.00000 1093.00000  5.20%  1035  572s
181    1285   691 1093.00000   43   30 1153.00000 1093.00000  5.20%  1023  579s
182    1318   694 1124.35729   47  505 1153.00000 1093.00000  5.20%  1041  587s
183    1362   702 1108.34444   35  710 1153.00000 1093.00000  5.20%  1051  595s
184    1395   708     cutoff   41      1153.00000 1093.00000  5.20%  1089  606s
185    1464   741 1108.16129   41  201 1153.00000 1093.00000  5.20%  1078  619s
186    1591   722 1101.96591   37  753 1153.00000 1093.00000  5.20%  1028  634s
187    1653   721 1111.43137   37  993 1153.00000 1093.00000  5.20%  1047  648s
188    1700   732 1132.00006   39  887 1153.00000 1093.00000  5.20%  1056  666s
189    1768   769     cutoff   47      1153.00000 1093.00000  5.20%  1079  683s
190  H 1836   687               1133.0000000 1093.00000  3.53%  1055  683s
191    1870   803 1093.00000   39  656 1133.00000 1093.00000  3.53%  1065  711s
192    2060   763 1099.65414   71  884 1133.00000 1093.00000  3.53%  1034  757s
193    2193   717     cutoff   43      1133.00000 1093.00000  3.53%  1097  804s
194    2339   649 1128.40058   44  619 1133.00000 1093.00000  3.53%  1220  847s
195    2432   594     cutoff   50      1133.00000 1093.00000  3.53%  1307  898s
196    2561   541 1125.92517   50  223 1133.00000 1093.00000  3.53%  1442  955s
197    2682   497     cutoff   54      1133.00000 1093.00000  3.53%  1511 1013s
198    2832   453 1116.84615   48  285 1133.00000 1093.00000  3.53%  1633 1060s
199    2969   522 1103.00000   33  434 1133.00000 1093.00000  3.53%  1664 1113s
200  * 3126   390              50    1113.0000000 1093.00000  1.80%  1642 1113s
201    3206   394     cutoff   42      1113.00000 1093.00000  1.80%  1634 1169s
202    3473   381 1094.39841   43 1125 1113.00000 1093.00000  1.80%  1638 1217s
203    3726   398 1100.50000   37  964 1113.00000 1093.00000  1.80%  1662 1260s
204    3908   381 1096.69231   42  559 1113.00000 1093.00000  1.80%  1682 1332s
205    4062   383     cutoff   38      1113.00000 1093.00000  1.80%  1709 1372s
206    4262   380 1103.00000   43  530 1113.00000 1093.00000  1.80%  1719 1409s
207    4438   371 1096.33333   44  662 1113.00000 1093.00000  1.80%  1719 1445s
208    4622   363 1101.13734   45  696 1113.00000 1093.06293  1.79%  1724 1484s
209    4856   368     cutoff   41      1113.00000 1093.55594  1.75%  1713 1524s
210    5061   361     cutoff   35      1113.00000 1094.66667  1.65%  1704 1566s
211    5197   335 1109.18798   43  726 1113.00000 1094.82268  1.63%  1699 1605s
212    5352   310 1103.00000   36  444 1113.00000 1095.59259  1.56%  1715 1645s
213    5490   268 1103.00000   47  641 1113.00000 1096.33333  1.50%  1731 1688s
214    5658   235 1110.07478   47  617 1113.00000 1097.75989  1.37%  1740 1734s
215    5850   147     cutoff   43      1113.00000 1098.13889  1.34%  1742 1783s
216    6088    70 1103.97561   42  952 1113.00000 1103.00000  0.90%  1750 1837s
217    6411    19 1105.50508   47  752 1113.00000 1103.00000  0.90%  1728 1875s
218    6555     0     cutoff   54      1113.00000 1103.00000  0.90%  1717 1884s
219
220  Cutting planes:
221    Learned: 37
222    Gomory: 8
223    Cover: 145
224    Implied bound: 86
225    Projected implied bound: 4
226    Clique: 57
227    MIR: 136
228    StrongCG: 52
229    Flow cover: 149
230    GUB cover: 95
231    Inf proof: 1
232    Zero half: 50
233    RLT: 40
234    Relax-and-lift: 28
235    BQP: 15
236
237  Explored 6622 nodes (11394682 simplex iterations) in 1884.89 seconds (4155.37 work units)
238  Thread count was 8 (of 8 available processors)
239
240  Solution count 8: 1113 1133 1153 ... 1353
241
242  Optimal solution found (tolerance 1.00e-04)
243  Best objective 1.113000000000e+03, best bound 1.113000000000e+03, gap 0.0000%
244  Optimal Obj:  1113.0
245  Obj = 1113.0
246  Solutions
247  Vessel i: 0:     li: 6,     pi: 14-20,     ai-di: 7-27,     taoi-deltai: 7-29,     periodi: 22,     taoPi_SP-deltaPi_SP: 7-13,     periodPi: 6,     betaNi: 13,     bi: 22,     Txijt
```

: 132, o1i: 172, o2i: 120, o3i: -416, o4i: 260, Ti: 136
Vessel i: 1: li: 6, pi: 6-12, ai-di: 9-18, taoi-deltai: 9-18, periodi: 9, taoPi_SP-deltaPi_SP: 9-14, periodPi: 5, betaNi: 7, bi: 9, Txijt: 54, o1i: 54, o2i: 100, o3i: -104, o4i: 140, Ti: 190
Vessel i: 2: li: 6, pi: 28-34, ai-di: 11-40, taoi-deltai: 11-42, periodi: 31, taoPi_SP-deltaPi_SP: 11-19, periodPi: 8, betaNi: 18, bi: 31, Txijt: 186, o1i: 226, o2i: 160, o3i: -598, o4i: 360, Ti: 148
Vessel i: 3: li: 6, pi: 8-14, ai-di: 17-31, taoi-deltai: 20-30, periodi: 10, taoPi_SP-deltaPi_SP: 20-24, periodPi: 4, betaNi: 5, bi: 10, Txijt: 60, o1i: 120, o2i: 80, o3i: -156, o4i: 100, Ti: 144
Vessel i: 4: li: 6, pi: 22-28, ai-di: 18-23, taoi-deltai: 18-23, periodi: 5, taoPi_SP-deltaPi_SP: 18-20, periodPi: 2, betaNi: 3, bi: 5, Txijt: 30, o1i: 30, o2i: 40, o3i: -78, o4i: 60, Ti: 52
Vessel i: 5: li: 7, pi: 20-27, ai-di: 26-30, taoi-deltai: 26-31, periodi: 5, taoPi_SP-deltaPi_SP: 26-29, periodPi: 3, betaNi: 3, bi: 5, Txijt: 35, o1i: 55, o2i: 60, o3i: -54, o4i: 60, Ti: 121
Vessel i: 6: li: 6, pi: 14-20, ai-di: 33-42, taoi-deltai: 33-42, periodi: 9, taoPi_SP-deltaPi_SP: 33-36, periodPi: 3, betaNi: 5, bi: 9, Txijt: 54, o1i: 54, o2i: 60, o3i: -156, o4i: 100, Ti: 58
Vessel i: 7: li: 6, pi: 8-14, ai-di: 37-68, taoi-deltai: 37-67, periodi: 30, taoPi_SP-deltaPi_SP: 37-45, periodPi: 8, betaNi: 17, bi: 30, Txijt: 180, o1i: 180, o2i: 160, o3i: -572, o4i: 340, Ti: 108
Vessel i: 8: li: 6, pi: 15-21, ai-di: 46-64, taoi-deltai: 46-67, periodi: 21, taoPi_SP-deltaPi_SP: 46-52, periodPi: 6, betaNi: 12, bi: 21, Txijt: 126, o1i: 186, o2i: 120, o3i: -390, o4i: 240, Ti: 156
TimeSolveModel: 1911.000000

TimeAll: 1915.000000