```
"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=42649

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 1205076 rows, 80570 columns and 3612810 nonzeros
Model fingerprint: 0xa930af42
Variable types: 0 continuous, 80570 integer (67900 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 868436 rows and 44277 columns (presolve time = 5s) ...
Presolve removed 922040 rows and 46882 columns (presolve time = 10s) ...
Presolve removed 922040 rows and 46882 columns (presolve time = 15s) ...
Presolve removed 1005086 rows and 56581 columns
Presolve time: 16.87s
Presolved: 199990 rows, 23989 columns, 620753 nonzeros
Variable types: 0 continuous, 23989 integer (23595 binary)

Deterministic concurrent LP optimizer: primal simplex, dual simplex, and barrier
Showing barrier log only...

Root relaxation presolved: 23975 rows, 223937 columns, 642784 nonzeros

Root barrier log...

Ordering time: 4.87s

Barrier statistics:
 Dense cols : 78
 Free vars  : 404
 AA' NZ     : 1.064e+06
 Factor NZ  : 7.342e+07 (roughly 700 MB of memory)
 Factor Ops : 4.333e+11 (roughly 12 seconds per iteration)
 Threads    : 1

Barrier performed 0 iterations in 24.42 seconds (35.89 work units)
Barrier solve interrupted - model solved by another algorithm

Concurrent spin time: 1.26s (can be avoided by choosing Method=3)

Solved with primal simplex

Root relaxation: objective 5.432609e+02, 16690 iterations, 6.24 seconds (6.80 work units)
Total elapsed time = 25.98s

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

     0     0  543.26091    0 1114          -  543.26091      -     -   28s
     0     0  543.27074    0  962          -  543.27074      -     -   29s
     0     0  550.80138    0 1088          -  550.80138      -     -   33s
     0     0  550.80138    0 1078          -  550.80138      -     -   34s
     0     0  558.43696    0  998          -  558.43696      -     -   35s
     0     0  560.96476    0 1248          -  560.96476      -     -   36s
     0     0  561.12169    0 1217          -  561.12169      -     -   37s
```

80	0	0	561.27040	0	1222	-	561.27040	-	-	37s
81	0	0	561.33904	0	1230	-	561.33904	-	-	38s
82	0	0	561.35895	0	1129	-	561.35895	-	-	38s
83	0	0	561.44190	0	1120	-	561.44190	-	-	39s
84	0	0	561.45425	0	916	-	561.45425	-	-	39s
85	0	0	561.45425	0	910	-	561.45425	-	-	39s
86	0	0	567.79973	0	1178	-	567.79973	-	-	44s
87	0	0	574.16872	0	1223	-	574.16872	-	-	45s
88	0	0	576.92504	0	1303	-	576.92504	-	-	46s
89	0	0	577.27821	0	1295	-	577.27821	-	-	46s
90	0	0	577.66451	0	1308	-	577.66451	-	-	47s
91	0	0	577.66983	0	1323	-	577.66983	-	-	47s
92	0	0	577.67130	0	1320	-	577.67130	-	-	47s
93	0	0	596.45949	0	1234	-	596.45949	-	-	51s
94	0	0	596.49611	0	1231	-	596.49611	-	-	51s
95	0	0	598.02666	0	1020	-	598.02666	-	-	53s
96	0	0	598.02666	0	1011	-	598.02666	-	-	53s
97	0	0	598.33971	0	1021	-	598.33971	-	-	53s
98	0	0	598.55505	0	1143	-	598.55505	-	-	54s
99	0	0	598.55505	0	1137	-	598.55505	-	-	54s
100	0	0	598.55505	0	1104	-	598.55505	-	-	54s
101	0	0	612.96885	0	1168	-	612.96885	-	-	59s
102	0	0	612.96885	0	1147	-	612.96885	-	-	59s
103	0	0	613.98576	0	1305	-	613.98576	-	-	60s
104	0	0	613.98576	0	1302	-	613.98576	-	-	60s
105	0	0	614.29871	0	1066	-	614.29871	-	-	60s
106	0	0	614.40210	0	957	-	614.40210	-	-	61s
107	0	0	614.40210	0	891	-	614.40210	-	-	61s
108	0	0	618.92023	0	1224	-	618.92023	-	-	64s
109	0	0	619.03770	0	1068	-	619.03770	-	-	64s
110	0	0	619.03770	0	1067	-	619.03770	-	-	64s
111	0	0	619.07062	0	1092	-	619.07062	-	-	65s
112	0	0	619.07197	0	1415	-	619.07197	-	-	66s
113	0	0	619.10990	0	1297	-	619.10990	-	-	68s
114	0	0	619.11088	0	1331	-	619.11088	-	-	68s
115	0	0	621.25472	0	1066	-	621.25472	-	-	71s
116	0	0	621.25472	0	982	-	621.25472	-	-	72s
117	0	0	621.99588	0	1060	-	621.99588	-	-	73s
118	0	0	622.04985	0	1310	-	622.04985	-	-	74s
119	0	0	622.06616	0	1221	-	622.06616	-	-	74s
120	0	0	622.06616	0	1243	-	622.06616	-	-	75s
121	0	0	622.25645	0	1421	-	622.25645	-	-	77s
122	0	0	622.25645	0	1339	-	622.25645	-	-	77s
123	0	0	622.34673	0	1454	-	622.34673	-	-	80s
124	0	0	622.35822	0	1277	-	622.35822	-	-	80s
125	0	0	622.50248	0	1561	-	622.50248	-	-	83s
126	0	0	622.50248	0	1560	-	622.50248	-	-	84s
127	0	0	622.63881	0	1427	-	622.63881	-	-	86s
128	0	0	622.63881	0	1424	-	622.63881	-	-	86s
129	0	0	622.64116	0	1367	-	622.64116	-	-	87s
130	0	0	622.76466	0	961	-	622.76466	-	-	89s
131	0	0	622.76466	0	906	-	622.76466	-	-	90s
132	0	0	622.88349	0	1315	-	622.88349	-	-	92s
133	0	0	622.88455	0	874	-	622.88455	-	-	93s
134	0	0	623.05082	0	1287	-	623.05082	-	-	96s
135	0	0	623.05082	0	1280	-	623.05082	-	-	96s
136	0	0	623.05082	0	1309	-	623.05082	-	-	97s
137	0	0	623.05082	0	1308	-	623.05082	-	-	97s
138	0	0	623.19735	0	1220	-	623.19735	-	-	99s
139	0	0	623.20288	0	1505	-	623.20288	-	-	100s
140	0	0	623.36399	0	1328	-	623.36399	-	-	102s
141	0	0	623.36399	0	1303	-	623.36399	-	-	102s
142	0	0	623.55141	0	1458	-	623.55141	-	-	104s
143	0	0	623.55141	0	1446	-	623.55141	-	-	104s
144	0	0	623.55141	0	1515	-	623.55141	-	-	105s
145	0	0	623.76001	0	1448	-	623.76001	-	-	107s
146	0	0	623.76001	0	1553	-	623.76001	-	-	109s
147	0	0	623.76001	0	1548	-	623.76001	-	-	109s
148	0	0	623.97420	0	1431	-	623.97420	-	-	111s
149	0	0	623.97420	0	1421	-	623.97420	-	-	111s
150	0	0	623.98417	0	1387	-	623.98417	-	-	112s
151	0	0	624.23011	0	1390	-	624.23011	-	-	114s
152	0	0	624.23011	0	1371	-	624.23011	-	-	115s
153	0	0	624.40737	0	1500	-	624.40737	-	-	117s
154	0	0	624.40737	0	1499	-	624.40737	-	-	117s
155	0	0	624.42406	0	1443	-	624.42406	-	-	118s
156	0	0	624.45877	0	1598	-	624.45877	-	-	119s
157	0	0	624.46929	0	1440	-	624.46929	-	-	120s
158	0	0	624.65003	0	1439	-	624.65003	-	-	121s
159	0	0	624.65003	0	1438	-	624.65003	-	-	122s
160	0	0	624.65003	0	1515	-	624.65003	-	-	122s
161	0	0	624.81953	0	1549	-	624.81953	-	-	125s
162	0	0	624.84807	0	1628	-	624.84807	-	-	126s
163	0	0	624.85050	0	1427	-	624.85050	-	-	127s

```
164      0    0  624.96686    0 1591          -  624.96686     -    -  129s
165      0    0  625.01796    0 1582          -  625.01796     -    -  130s
166      0    0  625.03494    0 1586          -  625.03494     -    -  130s
167      0    0  625.04960    0 1622          -  625.04960     -    -  131s
168      0    0  625.07992    0 1579          -  625.07992     -    -  133s
169      0    0  625.07992    0 1563          -  625.07992     -    -  133s
170      0    0  625.07992    0 1010          -  625.07992     -    -  136s
171      0    2  625.07992    0 1010          -  625.07992     -    -  146s
172     19   24  661.56714    5  924          -  633.35543     -  718  151s
173     38   43  641.12142   10 1032          -  633.35543     -  895  155s
174    119  128  662.45263   25  751          -  633.35543     -  412  160s
175    220  240  669.00000   43  266          -  633.35543     -  291  165s
176    317  333  669.00000   56  172          -  633.35543     -  280  170s
177    400  422  669.00000   64  146          -  633.35543     -  275  175s
178    574  594  709.00000  104  124          -  634.15904     -  222  181s
179    689  702  677.17101   14  156          -  634.15904     -  210  185s
180    841  797  684.00000   39  174          -  634.15904     -  202  190s
181    957  886  684.00000   56  105          -  634.15904     -  213  195s
182   1041  923  684.00000   25 1010          -  634.15904     -  236  271s
183   1043  924  709.00000  108  920          -  634.15904     -  235  290s
184   1044  925  650.66667   23  562          -  634.15904     -  235  307s
185   1045  926  704.00000   37 1120          -  634.15904     -  235  315s
186   H 1045   879                       829.0000000  634.15904  23.5%  235  318s
187   1046  879  705.50200   66  958  829.00000  634.15904  23.5%  235  320s
188   1049  881  724.00000   59 1067  829.00000  634.15904  23.5%  234  325s
189   1050  882  644.00000   46 1057  829.00000  634.15904  23.5%  234  331s
190   1051  883  664.00000   46  791  829.00000  636.02966  23.3%  234  348s
191   H 1051   839                       784.0000000  636.02966  18.9%  234  349s
192   1052  839  744.00000  150  804  784.00000  636.67725  18.8%  233  350s
193   1055  841  664.00000   61  781  784.00000  636.85615  18.8%  233  356s
194   H 1055   799                       724.0000000  637.84890  11.9%  233  377s
195   1057  801  711.96296  107  877  724.00000  638.33664  11.8%  232  386s
196   1058  801  664.00000   68  843  724.00000  638.34013  11.8%  232  393s
197   1059  802  664.00000   55  503  724.00000  638.37349  11.8%  232  406s
198   1060  803  698.16667   56  737  724.00000  638.38221  11.8%  232  414s
199   1061  803  724.00000   24  531  724.00000  638.39346  11.8%  231  425s
200   1062  804  700.50200   62  655  724.00000  638.39887  11.8%  231  430s
201   1063  805  709.00000  103  519  724.00000  638.40338  11.8%  231  436s
202   1065  806  704.00000  127  507  724.00000  638.41213  11.8%  231  447s
203   1066  807  714.00000   99  557  724.00000  638.41213  11.8%  230  450s
204   1067  807  669.00000   51  522  724.00000  638.41213  11.8%  230  456s
205   1069  809  664.00000   59  583  724.00000  638.41321  11.8%  230  466s
206   1070  809  709.00000  102  657  724.00000  638.42329  11.8%  230  471s
207   1071  810  724.00000  188  619  724.00000  638.42514  11.8%  229  479s
208   1072  811  704.00000   84  571  724.00000  638.42514  11.8%  229  486s
209   1074  813  724.00000   90 1010  724.00000  638.42514  11.8%  314  521s
210   1076  814  677.57540   64  425  724.00000  638.42514  11.8%  313  528s
211   1077  815  644.00000   43  349  724.00000  638.42514  11.8%  313  540s
212   1079  816  714.00000  106  591  724.00000  638.42514  11.8%  313  548s
213   1082  818  717.33333   99  676  724.00000  638.47701  11.8%  312  552s
214   1083  819  724.00000  198  439  724.00000  638.50937  11.8%  311  559s
215   1084  820  724.00000   33  482  724.00000  638.52208  11.8%  311  561s
216   1085  820  711.96296  107  446  724.00000  638.53946  11.8%  311  567s
217   1086  821  682.00000   62  579  724.00000  638.55041  11.8%  310  571s
218   1087  822  705.48930   79  412  724.00000  639.19530  11.7%  310  580s
219   1089  823  724.00000  179  518  724.00000  639.22447  11.7%  310  590s
220   1091  824  724.00000   26  403  724.00000  639.52896  11.7%  309  599s
221   1093  826  704.00000  127  392  724.00000  639.58637  11.7%  309  603s
222   1094  826  724.00000  195  364  724.00000  639.81055  11.6%  308  611s
223   H 1094   784                       704.0000000  639.81055  9.12%  308  612s
224   1095  785  644.00000   38  413  704.00000  639.84782  9.11%  308  615s
225   H 1095   745                       684.0000000  639.84782  6.45%  308  620s
226   1096  746  639.86358   25  308  684.00000  639.86358  6.45%  308  625s
227   H 1096   709                       664.0000000  639.86358  3.64%  308  625s
228   1098  710  664.00000   67  407  664.00000  644.00000  3.01%  307  635s
229   1099  711  664.00000   57  432  664.00000  644.00000  3.01%  307  640s
230   1100  711  664.00000   82  307  664.00000  644.00000  3.01%  307  646s
231   1102  713  650.66667   29  291  664.00000  644.00000  3.01%  306  653s
232   1105  715  664.00000   57  378  664.00000  644.00000  3.01%  305  657s
233   1106  715  644.00000   42  114  664.00000  644.00000  3.01%  305  660s
234   H 1106   678                       644.0000000  644.00000  0.00%  305  662s
235
236   Cutting planes:
237     Learned: 23
238     Gomory: 51
239     Lift-and-project: 2
240     Cover: 137
241     Implied bound: 199
242     Projected implied bound: 8
243     Clique: 112
244     MIR: 22
245     StrongCG: 15
246     Flow cover: 96
247     GUB cover: 79
```

```
  Zero half: 44
  Network: 3
  RLT: 164
  Relax-and-lift: 24
  BQP: 47

Explored 1106 nodes (508507 simplex iterations) in 662.93 seconds (1128.93 work units)
Thread count was 8 (of 8 available processors)

Solution count 7: 644 664 684 ... 829

Optimal solution found (tolerance 1.00e-04)
Best objective 6.440000000000e+02, best bound 6.440000000000e+02, gap 0.0000%
Optimal Obj:  644.0
Obj = 644.0
Solutions
Vessel i: 0:    li: 5,    pi: 19-24,    ai-di: 9-20,    taoi-deltai: 9-18,    periodi: 9,    taoPi_SP-deltaPi_SP: 9-12,    periodPi: 3,    betaNi: 6,    bi: 9,    Txijt: 45
, o1i: 45,    o2i: 60,    o3i: -150,    o4i: 120,    Ti: 75
Vessel i: 1:    li: 5,    pi: 29-34,    ai-di: 33-51,    taoi-deltai: 33-49,    periodi: 16,    taoPi_SP-deltaPi_SP: 33-37,    periodPi: 4,    betaNi: 10,    bi: 16,
Txijt: 80,    o1i: 80,    o2i: 80,    o3i: -300,    o4i: 200,    Ti: 60
Vessel i: 2:    li: 5,    pi: 18-23,    ai-di: 57-67,    taoi-deltai: 57-65,    periodi: 8,    taoPi_SP-deltaPi_SP: 57-59,    periodPi: 2,    betaNi: 5,    bi: 8,    Txijt
: 40,    o1i: 40,    o2i: 40,    o3i: -150,    o4i: 100,    Ti: 30
Vessel i: 3:    li: 5,    pi: 14-19,    ai-di: 15-27,    taoi-deltai: 15-25,    periodi: 10,    taoPi_SP-deltaPi_SP: 15-18,    periodPi: 3,    betaNi: 6,    bi: 10,
Txijt: 50,    o1i: 50,    o2i: 60,    o3i: -175,    o4i: 120,    Ti: 55
Vessel i: 4:    li: 5,    pi: 12-17,    ai-di: 42-62,    taoi-deltai: 42-60,    periodi: 18,    taoPi_SP-deltaPi_SP: 42-47,    periodPi: 5,    betaNi: 11,    bi: 18,
Txijt: 90,    o1i: 90,    o2i: 100,    o3i: -325,    o4i: 220,    Ti: 85
Vessel i: 5:    li: 6,    pi: 8-14,    ai-di: 17-40,    taoi-deltai: 17-27,    periodi: 10,    taoPi_SP-deltaPi_SP: 17-20,    periodPi: 3,    betaNi: 6,    bi: 10,
Txijt: 60,    o1i: 60,    o2i: 60,    o3i: -182,    o4i: 120,    Ti: 58
Vessel i: 6:    li: 5,    pi: 24-29,    ai-di: 21-48,    taoi-deltai: 21-34,    periodi: 13,    taoPi_SP-deltaPi_SP: 21-25,    periodPi: 4,    betaNi: 8,    bi: 13,
Txijt: 65,    o1i: 65,    o2i: 80,    o3i: -225,    o4i: 160,    Ti: 80
Vessel i: 7:    li: 6,    pi: 11-17,    ai-di: 37-57,    taoi-deltai: 37-41,    periodi: 4,    taoPi_SP-deltaPi_SP: 37-38,    periodPi: 1,    betaNi: 3,    bi: 4,    Txijt
: 24,    o1i: 24,    o2i: 20,    o3i: -78,    o4i: 60,    Ti: 26
Vessel i: 8:    li: 5,    pi: 29-34,    ai-di: 8-41,    taoi-deltai: 8-25,    periodi: 17,    taoPi_SP-deltaPi_SP: 8-13,    periodPi: 5,    betaNi: 10,    bi: 17,    Txijt
: 85,    o1i: 85,    o2i: 100,    o3i: -300,    o4i: 200,    Ti: 85
Vessel i: 9:    li: 5,    pi: 19-24,    ai-di: 25-58,    taoi-deltai: 25-47,    periodi: 22,    taoPi_SP-deltaPi_SP: 25-31,    periodPi: 6,    betaNi: 13,    bi: 22,
Txijt: 110,    o1i: 110,    o2i: 120,    o3i: -400,    o4i: 260,    Ti: 90
TimeSolveModel: 688.000000



TimeAll: 692.000000
```