


```

80 0 0 943.00000 0 90 943.00000 943.00000 0.00% - 36s
81
82 Cutting planes:
83 Gomory: 2
84 Cover: 97
85 Implied bound: 8
86 Clique: 53
87 MIR: 28
88 StrongCG: 10
89 GUB cover: 12
90 Zero half: 2
91 RLT: 7
92 Relax-and-lift: 16
93 BQP: 8
94
95 Explored 1 nodes (45882 simplex iterations) in 36.55 seconds (48.26 work units)
96 Thread count was 8 (of 8 available processors)
97
98 Solution count 6: 943 1223 1263 ... 6303
99
100 Optimal solution found (tolerance 1.00e-10)
101 Best objective 9.430000000000e+02, best bound 9.430000000000e+02, gap 0.0000%
102 Set parameter MIPGap to value 1e-08
103 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
104
105 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
106 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
107
108 Optimize a model with 3645178 rows, 2881123 columns and 25540696 nonzeros
109 Model fingerprint: 0xb4a69083
110 Variable types: 1422995 continuous, 1458128 integer (1450703 binary)
111 Coefficient statistics:
112 Matrix range [1e-01, 1e+10]
113 Objective range [6e-05, 5e+01]
114 Bounds range [1e+00, 8e+01]
115 RHS range [8e-01, 1e+10]
116 Warning: Model contains large matrix coefficients
117 Warning: Model contains large rhs
118 Consider reformulating model or setting NumericFocus parameter
119 to avoid numerical issues.
120 Presolve removed 3639017 rows and 2878805 columns (presolve time = 6s) ...
121 Presolve removed 3641408 rows and 2879815 columns
122 Presolve time: 8.46s
123 Presolved: 3770 rows, 1308 columns, 9976 nonzeros
124 Variable types: 10 continuous, 1298 integer (755 binary)
125 Found heuristic solution: objective 4996.1709983
126 Found heuristic solution: objective 5129.1709983
127
128 Root simplex log...
129
130 Iteration Objective Primal Inf. Dual Inf. Time
131 0 1.0572222e+04 5.221551e+03 0.000000e+00 11s
132 1312 6.9248383e+03 0.000000e+00 0.000000e+00 11s
133
134 Root relaxation: objective 6.924838e+03, 1312 iterations, 0.02 seconds (0.02 work units)
135
136 Nodes | Current Node | Objective Bounds | Work
137 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
138
139 0 0 6924.83826 0 62 5129.17100 6924.83826 35.0% - 10s
140 H 0 0 6902.0382553 6924.83826 0.33% - 10s
141 0 0 6923.82238 0 34 6902.03826 6923.82238 0.32% - 10s
142 0 0 6923.82238 0 35 6902.03826 6923.82238 0.32% - 10s
143 H 0 0 6922.8160331 6923.82238 0.01% - 10s
144 0 0 6923.46683 0 24 6922.81603 6923.46683 0.01% - 10s
145 0 0 6923.46683 0 23 6922.81603 6923.46683 0.01% - 10s
146 0 0 6923.46683 0 23 6922.81603 6923.46683 0.01% - 10s
147 0 0 6923.46683 0 40 6922.81603 6923.46683 0.01% - 10s
148 0 0 6923.46683 0 9 6922.81603 6923.46683 0.01% - 10s
149 0 0 6923.46683 0 8 6922.81603 6923.46683 0.01% - 10s
150 0 0 cutoff 0 6922.81603 6922.81603 0.00% - 10s
151
152 Cutting planes:
153 Learned: 1
154 Gomory: 3
155 Implied bound: 2
156 MIR: 1
157
158 Explored 1 nodes (2590 simplex iterations) in 11.40 seconds (11.63 work units)
159 Thread count was 8 (of 8 available processors)
160
161 Solution count 4: 6922.82 6902.04 5129.17 4996.17
162
163 Optimal solution found (tolerance 1.00e-08)

```

```

164 Best objective 6.922816033068e+03, best bound 6.922816033068e+03, gap 0.0000%
165 SP is solved
166 SP's optimal solution is'□6922
167
168 Itr = 0
169 Collect_LB = [943.0]
170 Collect_UB = [14788.632066136313]
171 Collect_Hua = [0.0]
172 Collect_SPObjVal = [6922.816033068157]
173 Collect_MPObjValNHua = [943.0]
174
175
176 Set parameter TimeLimit to value 10800
177 Set parameter MIPGap to value 0.05
178 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
179
180 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
181 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
182
183 Optimize a model with 1436754 rows, 434457 columns and 4290011 nonzeros
184 Model fingerprint: 0x204ad638
185 Variable types: 1 continuous, 434456 integer (420519 binary)
186 Coefficient statistics:
187 Matrix range [1e-01, 1e+10]
188 Objective range [1e+00, 2e+01]
189 Bounds range [1e+00, 1e+00]
190 RHS range [1e+00, 2e+10]
191 Warning: Model contains large matrix coefficients
192 Warning: Model contains large rhs
193 Consider reformulating model or setting NumericFocus parameter
194 to avoid numerical issues.
195 Presolve removed 1226918 rows and 407334 columns (presolve time = 5s) ...
196 Presolve removed 1268489 rows and 410873 columns (presolve time = 10s) ...
197 Presolve removed 1268489 rows and 410873 columns (presolve time = 15s) ...
198 Presolve removed 1341564 rows and 419175 columns (presolve time = 20s) ...
199 Presolve removed 1341572 rows and 419181 columns
200 Presolve time: 21.83s
201 Presolved: 95182 rows, 15276 columns, 301583 nonzeros
202 Variable types: 1 continuous, 15275 integer (12812 binary)
203
204 Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
205 Showing first log only...
206
207 Root relaxation presolved: 15276 rows, 110456 columns, 316847 nonzeros
208
209
210 Root simplex log...
211
212 Iteration Objective Primal Inf. Dual Inf. Time
213 0 8.2658160e+03 0.000000e+00 1.040460e+05 24s
214 12632 8.2791691e+03 0.000000e+00 9.962639e+04 25s
215 Concurrent spin time: 0.71s
216
217 Solved with dual simplex (primal model)
218
219 Root relaxation: objective 8.265816e+03, 8745 iterations, 3.52 seconds (2.44 work units)
220
221 Nodes | Current Node | Objective Bounds | Work
222 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
223
224 0 0 8265.81603 0 545 -8265.81603 - - 31s
225 0 0 8265.81603 0 924 -8265.81603 - - 36s
226 0 0 8265.81603 0 823 -8265.81603 - - 36s
227 0 0 8265.81603 0 866 -8265.81603 - - 38s
228 0 0 8265.81603 0 850 -8265.81603 - - 38s
229 0 0 8265.81603 0 844 -8265.81603 - - 38s
230 0 0 8265.81603 0 535 -8265.81603 - - 49s
231 0 0 8265.81603 0 532 -8265.81603 - - 49s
232 0 0 8265.81603 0 409 -8265.81603 - - 50s
233 0 0 8265.81603 0 555 -8265.81603 - - 60s
234 0 0 8265.81603 0 488 -8265.81603 - - 60s
235 0 0 8265.81603 0 486 -8265.81603 - - 60s
236 0 0 8265.81603 0 617 -8265.81603 - - 61s
237 0 0 8265.81603 0 459 -8265.81603 - - 61s
238 0 0 8265.81603 0 401 -8265.81603 - - 65s
239 0 0 8265.81603 0 499 -8265.81603 - - 66s
240 0 0 8265.81603 0 463 -8265.81603 - - 66s
241 0 0 8265.81603 0 378 -8265.81603 - - 70s
242 0 0 8265.81603 0 322 -8265.81603 - - 70s
243 0 0 8265.81603 0 564 -8265.81603 - - 72s
244 0 0 8265.81603 0 561 -8265.81603 - - 72s
245 0 0 8265.81603 0 460 -8265.81603 - - 76s
246 0 0 8265.81603 0 454 -8265.81603 - - 76s
247 0 0 8265.81603 0 406 -8265.81603 - - 76s

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unknown

248	0	0	8265.81603	0	546	-8265.81603	-	-	77s
249	0	0	8265.81603	0	533	-8265.81603	-	-	77s
250	0	0	8265.81603	0	180	-8265.81603	-	-	81s
251	0	0	8265.81603	0	287	-8265.81603	-	-	82s
252	0	0	8265.81603	0	506	-8265.81603	-	-	86s
253	0	0	8265.81603	0	462	-8265.81603	-	-	86s
254	0	0	8265.81603	0	260	-8265.81603	-	-	90s
255	0	2	8265.81603	0	260	-8265.81603	-	-	97s
256	3	8	8265.81603	2	847	-8265.81603	-	3574	111s
257	7	12	8265.81603	3	1095	-8265.81603	-	4247	115s
258	11	16	8265.81603	3	773	-8265.81603	-	5105	123s
259	19	24	8265.81603	5	1384	-8265.81603	-	6260	133s
260	23	28	8265.81603	5	1156	-8265.81603	-	5812	135s
261	31	42	8265.81603	6	1123	-8265.81603	-	5280	145s
262	43	90	8265.81603	9	1086	-8265.81603	-	4952	166s
263	112	160	8345.81603	19	871	-8265.81603	-	3695	194s
264	266	274	8345.81603	67	679	-8265.81603	-	2238	217s
265	482	544	8345.81603	161	647	-8265.81603	-	1459	239s
266	835	844	8345.81603	268	560	-8265.81603	-	907	255s
267	1192	1051	8385.81603	350	589	-8265.81603	-	670	267s
268	1457	1335	8265.81603	5	927	-8265.81603	-	586	278s
269	1819	1540	8265.81603	11	486	-8265.81603	-	501	289s
270	2075	1859	8290.37011	13	1123	-8265.81603	-	462	302s
271	2425	1966	8605.81603	24	611	-8265.81603	-	417	312s
272	2559	2062	8605.81603	52	598	-8265.81603	-	416	322s
273	2700	2063	9045.81603	272	260	-8265.81603	-	417	370s
274	2702	2064	8385.81603	316	297	-8265.81603	-	417	388s
275	2703	2065	8325.81603	393	551	-8265.81603	-	416	405s
276	2704	2066	8365.81603	683	746	-8265.81603	-	416	413s
277	2705	2066	9025.81603	455	428	-8265.81603	-	416	434s
278	2706	2067	8265.81603	4	882	-8265.81603	-	416	445s
279	2707	2068	8865.81603	200	722	-8265.81603	-	416	474s
280	2708	2068	8405.81603	338	849	-8265.81603	-	416	479s
281	2709	2069	8345.81603	394	557	-8265.81603	-	416	500s
282	2710	2070	9165.81603	369	838	-8265.81603	-	415	507s
283	2711	2070	8825.81603	427	594	-8265.81603	-	415	527s
284	2712	2071	8265.81603	40	826	-8265.81603	-	415	538s
285	2713	2072	8350.10175	419	495	-8265.81603	-	415	572s
286	2714	2072	8265.81603	17	714	-8265.81603	-	415	581s
287	2715	2073	8585.81603	7	726	-8265.81603	-	415	609s
288	2716	2074	8845.81603	658	930	-8265.81603	-	414	624s
289	2717	2074	9165.81603	406	587	-8265.81603	-	414	657s
290	2718	2075	8765.81603	220	957	-8265.81603	-	414	677s
291	2719	2076	8725.81603	430	626	-8265.81603	-	414	707s
292	2720	2076	9205.81603	315	461	-8265.81603	-	414	714s
293	2721	2077	9125.81603	380	461	-8265.81603	-	414	722s
294	2722	2081	8265.81603	11	522	-8265.81603	-	119	730s
295	2724	2084	8265.81603	12	516	-8265.81603	-	124	742s
296	2728	2087	8265.81603	13	534	-8265.81603	-	135	760s
297	2732	2089	8265.81603	13	823	-8265.81603	-	155	791s
298	2736	2092	8265.81603	14	592	-8265.81603	-	192	796s
299	2740	2095	8265.81603	14	761	-8265.81603	-	197	801s
300	2744	2099	8265.81603	15	573	-8265.81603	-	201	809s
301	2750	2103	8265.81603	16	545	-8265.81603	-	210	816s
302	2756	2108	8265.81603	17	537	-8265.81603	-	218	845s
303	2763	2114	8265.81603	18	568	-8265.81603	-	254	870s
304	2771	2134	8265.81603	19	810	-8265.81603	-	271	907s
305	2796	2160	8265.81603	23	655	-8265.81603	-	332	973s
306	H 2821	2047	16158.816033	8265.81603	48.8%	370	973s		
307	H 2830	2018	8725.8160331	8265.81603	5.27%	384	1051s		
308	H 2830	1924	8685.8160331	8265.81603	4.84%	384	1051s		
309									
310	Cutting planes:								
311	Gomory: 6								
312	Cover: 284								
313	Implied bound: 97								
314	Projected implied bound: 2								
315	Clique: 48								
316	MIR: 71								
317	StrongCG: 42								
318	Flow cover: 120								
319	GUB cover: 146								
320	Zero half: 35								
321	RLT: 68								
322	Relax-and-lift: 90								
323	BQP: 29								
324									
325	Explored 2923 nodes (2819753 simplex iterations) in 1051.24 seconds (2048.85 work units)								
326	Thread count was 8 (of 8 available processors)								
327									
328	Solution count 3: 8685.82 8725.82 16158.8								
329									
330	Optimal solution found (tolerance 5.00e-02)								
331	Best objective 8.685816033068e+03, best bound 8.265816033068e+03, gap 4.8355%								

```

332 Set parameter MIPGap to value 1e-08
333 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
334
335 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
336 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
337
338 Optimize a model with 3645178 rows, 2881123 columns and 25540696 nonzeros
339 Model fingerprint: 0x05d65167
340 Variable types: 1422995 continuous, 1458128 integer (1450703 binary)
341 Coefficient statistics:
342   Matrix range    [1e-01, 1e+10]
343   Objective range [6e-05, 5e+01]
344   Bounds range    [1e+00, 8e+01]
345   RHS range       [8e-01, 1e+10]
346 Warning: Model contains large matrix coefficients
347 Warning: Model contains large rhs
348   Consider reformulating model or setting NumericFocus parameter
349   to avoid numerical issues.
350 Presolve removed 3636700 rows and 2878313 columns (presolve time = 6s) ...
351 Presolve removed 3638289 rows and 2878980 columns
352 Presolve time: 8.52s
353 Presolved: 6889 rows, 2143 columns, 18406 nonzeros
354 Variable types: 10 continuous, 2133 integer (1226 binary)
355 Found heuristic solution: objective 5120.7918421
356 Found heuristic solution: objective 5134.5600878
357
358 Root simplex log...
359
360 Iteration   Objective      Primal Inf.   Dual Inf.    Time
361      0  1.2814000e+04  7.602024e+03  0.000000e+00  11s
362    2212  7.2094444e+03  0.000000e+00  0.000000e+00  11s
363
364 Root relaxation: objective 7.209444e+03, 2212 iterations, 0.03 seconds (0.03 work units)
365
366   Nodes | Current Node | Objective Bounds | Work
367 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
368
369   0   0 7209.44444  0 18 5134.56009 7209.44444 40.4% - 11s
370 H  0   0          7191.4444444 7209.44444 0.25% - 11s
371   0   0 7209.44444  0  5 7191.44444 7209.44444 0.25% - 11s
372 *  0   0          7209.4444444 7209.44444 0.00% - 11s
373
374 Cutting planes:
375 Gomory: 1
376 Cover: 10
377 Implied bound: 2
378 Clique: 5
379 MIR: 1
380 Flow cover: 1
381 Zero half: 4
382 RLT: 1
383
384 Explored 1 nodes (3184 simplex iterations) in 11.57 seconds (10.55 work units)
385 Thread count was 8 (of 8 available processors)
386
387 Solution count 4: 7209.44 7191.44 5134.56 5120.79
388
389 Optimal solution found (tolerance 1.00e-08)
390 Best objective 7.209444444444e+03, best bound 7.209444444444e+03, gap 0.0000%
391 SP is solved
392 SP's optimal solution is'□7209
393
394 Itr = 1
395 Collect_LB = [943.0, 8685.816033068157]
396 Collect_UB = [14788.632066136313, 8972.444444444445]
397 Collect_Hua = [0.0, 6922.816033068157]
398 Collect_SPObjVal = [6922.816033068157, 7209.444444444445]
399 Collect_MPObjValNHua = [943.0, 1763.0]
400 Time: 1640.000000
401
402
403
404
405
406 Set parameter TimeLimit to value 10800
407 Set parameter MIPGap to value 0.05
408 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
409
410 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
411 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
412
413 Optimize a model with 2220365 rows, 458514 columns and 6751114 nonzeros
414 Model fingerprint: 0x8b0e0774
415 Variable types: 1 continuous, 458513 integer (430683 binary)

```

```
416 Coefficient statistics:
417   Matrix range   [1e-01, 1e+10]
418   Objective range [1e+00, 2e+01]
419   Bounds range   [1e+00, 1e+00]
420   RHS range      [1e+00, 2e+10]
421 Warning: Model contains large matrix coefficients
422 Warning: Model contains large rhs
423   Consider reformulating model or setting NumericFocus parameter
424   to avoid numerical issues.
425 Presolve removed 8217 rows and 368489 columns
426 Presolve time: 0.46s
427
428 Explored 0 nodes (0 simplex iterations) in 1.16 seconds (1.26 work units)
429 Thread count was 1 (of 8 available processors)
430
431 Solution count 0
432
433 Model is infeasible
434 Best objective -, best bound -, gap -
435 Traceback (most recent call last):
436   File "<input>", line 1, in <module>
437   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
438     pydev_imports.execfile(filename, global_vars, local_vars) # execute the script
439   File "D:\Python\Pycharm\setroute\PyCharm Community Edition 2021.2.3\plugins\python-ce\helpers\pydev\_pydevimps\_pydev_execfile.py", line 18, in execfile
440     exec(compile(contents+"\n", file, 'exec'), glob, loc)
441   File "E:/1 □□□□/3 □□□□□/1 □□□□□□□/1 □□□□□□□□□□/1_LW_□□□□□/4 □□□□□/3 python_code/9 Code for this paper/
442     main_RO_CCG.py", line 1363, in <module>
443     HuaValG = Hua.x
444   File "src\gurobipy\var.pxi", line 125, in gurobipy.Var.__getattr__
445   File "src\gurobipy\var.pxi", line 153, in gurobipy.Var.getAttr
446   File "src\gurobipy\attrutil.pxi", line 100, in gurobipy.__getattr__
447   AttributeError: Unable to retrieve attribute 'x'
```