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80  MIR: 41
81  StrongCG: 24
82  GUB cover: 5
83  Zero half: 1
84  RLT: 5
85  Relax-and-lift: 644
86
87  Explored 80 nodes (70377 simplex iterations) in 29.08 seconds (47.23 work units)
88  Thread count was 8 (of 8 available processors)
89
90  Solution count 5: 846 1106 1206 ... 3806
91
92  Optimal solution found (tolerance 1.00e-10)
93  Best objective 8.460000000000e+02, best bound 8.460000000000e+02, gap 0.0000%
94  Set parameter MIPGap to value 1e-08
95  Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
96
97  CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
98  Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
99
100 Optimize a model with 2481576 rows, 1955335 columns and 17235895 nonzeros
101 Model fingerprint: 0xc019af1b
102 Variable types: 963295 continuous, 992040 integer (985965 binary)
103 Coefficient statistics:
104   Matrix range    [1e-01, 1e+10]
105   Objective range [6e-05, 5e+01]
106   Bounds range    [1e+00, 8e+01]
107   RHS range       [8e-01, 1e+10]
108 Warning: Model contains large matrix coefficients
109 Warning: Model contains large rhs
110   Consider reformulating model or setting NumericFocus parameter
111   to avoid numerical issues.
112 Presolve removed 2478775 rows and 1954283 columns (presolve time = 5s) ...
113 Presolve removed 2478775 rows and 1954283 columns
114 Presolve time: 5.04s
115 Presolved: 2801 rows, 1052 columns, 7492 nonzeros
116 Variable types: 5 continuous, 1047 integer (623 binary)
117 Found heuristic solution: objective 3368.0500186
118 Found heuristic solution: objective 3454.0500186
119
120 Root simplex log...
121
122 Iteration  Objective    Primal Inf.  Dual Inf.  Time
123      0  7.9102796e+03  2.792431e+03  0.000000e+00  6s
124     802  4.6850500e+03  0.000000e+00  0.000000e+00  6s
125
126 Root relaxation: objective 4.685050e+03, 802 iterations, 0.00 seconds (0.01 work units)
127
128   Nodes | Current Node | Objective Bounds | Work
129 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
130
131      0  0 4685.05002  0 27 3454.05002 4685.05002 35.6% - 6s
132 H  0  0          4658.0500186 4685.05002 0.58% - 6s
133 H  0  0          4678.0500186 4685.05002 0.15% - 6s
134 *  0  0          0 4685.0500186 4685.05002 0.00% - 6s
135
136 Cutting planes:
137   Learned: 6
138   Mod-K: 1
139
140 Explored 1 nodes (1211 simplex iterations) in 6.64 seconds (7.81 work units)
141 Thread count was 8 (of 8 available processors)
142
143 Solution count 5: 4685.05 4678.05 4658.05 ... 3368.05
144
145 Optimal solution found (tolerance 1.00e-08)
146 Best objective 4.685050018628e+03, best bound 4.685050018628e+03, gap 0.0000%
147 SP is solved
148 SP's optimal solution is'□4685
149
150   Itr = 0
151 Collect_LB = [846.0]
152 Collect_UB = [10216.100037255637]
153 Collect_Hua = [0.0]
154 Collect_SPObjVal = [4685.050018627819]
155 Collect_MPObjValNHua = [846.0]
156
157
158 Set parameter MIPGap to value 0.05
159 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
160
161 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
162 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
163

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164 Optimize a model with 1145710 rows, 303661 columns and 3380490 nonzeros
165 Model fingerprint: 0xb6c4ccaa
166 Variable types: 1 continuous, 303660 integer (292257 binary)
167 Coefficient statistics:
168   Matrix range   [1e-01, 1e+10]
169   Objective range [1e+00, 2e+01]
170   Bounds range   [1e+00, 1e+00]
171   RHS range      [1e+00, 2e+10]
172 Warning: Model contains large matrix coefficients
173 Warning: Model contains large rhs
174   Consider reformulating model or setting NumericFocus parameter
175   to avoid numerical issues.
176 Presolve removed 941260 rows and 280166 columns (presolve time = 5s) ...
177 Presolve removed 962161 rows and 281637 columns (presolve time = 10s) ...
178 Presolve removed 1053459 rows and 290518 columns
179 Presolve time: 13.04s
180 Presolved: 92251 rows, 13143 columns, 282153 nonzeros
181 Variable types: 1 continuous, 13142 integer (10919 binary)
182
183 Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
184 Showing first log only...
185
186 Root relaxation presolved: 13143 rows, 105394 columns, 295296 nonzeros
187
188
189 Root simplex log...
190
191 Iteration   Objective    Primal Inf.   Dual Inf.    Time
192      0  5.5310500e+03  0.000000e+00  1.698640e+04  14s
193 Concurrent spin time: 0.58s
194
195 Solved with dual simplex (primal model)
196
197 Root relaxation: objective 5.531050e+03, 6851 iterations, 1.58 seconds (1.99 work units)
198
199   Nodes | Current Node | Objective Bounds | Work
200 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
201
202    0    0 5531.05002    0 358      - 5531.05002    -   -   17s
203    0    0 5531.05002    0 1136     - 5531.05002    -   -   21s
204    0    0 5531.05002    0 1036     - 5531.05002    -   -   21s
205    0    0 5531.05002    0 1077     - 5531.05002    -   -   24s
206    0    0 5531.05002    0 1069     - 5531.05002    -   -   24s
207    0    0 5531.05002    0 493      - 5531.05002    -   -   33s
208    0    0 5531.05002    0 490      - 5531.05002    -   -   34s
209    0    0 5531.05002    0 521      - 5531.05002    -   -   35s
210    0    0 5531.05002    0 405      - 5531.05002    -   -   42s
211    0    0 5531.05002    0 412      - 5531.05002    -   -   42s
212    0    0 5531.05002    0 427      - 5531.05002    -   -   43s
213    0    0 5531.05002    0 487      - 5531.05002    -   -   50s
214    0    0 5531.05002    0 471      - 5531.05002    -   -   50s
215    0    0 5531.05002    0 365      - 5531.05002    -   -   52s
216 H    0    0          5531.0500186 5531.05002 0.00%    -   57s
217    0    0 5531.05002    0 365 5531.05002 5531.05002 0.00%    -   57s
218
219 Cutting planes:
220   Learned: 8
221   Gomory: 3
222   Cover: 202
223   Implied bound: 96
224   Clique: 4155
225   MIR: 142
226   StrongCG: 23
227   Flow cover: 8
228   GUB cover: 29
229   Zero half: 21
230   RLT: 64
231   Relax-and-lift: 123
232   BQP: 39
233
234 Explored 1 nodes (138344 simplex iterations) in 57.79 seconds (178.16 work units)
235 Thread count was 8 (of 8 available processors)
236
237 Solution count 1: 5531.05
238
239 Optimal solution found (tolerance 5.00e-02)
240 Best objective 5.531050018628e+03, best bound 5.531050018628e+03, gap 0.0000%
241 Set parameter MIPGap to value 1e-08
242 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
243
244 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
245 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
246
247 Optimize a model with 2481576 rows, 1955335 columns and 17235895 nonzeros

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248 Model fingerprint: 0x5de226fe
249 Variable types: 963295 continuous, 992040 integer (985965 binary)
250 Coefficient statistics:
251   Matrix range   [1e-01, 1e+10]
252   Objective range [6e-05, 5e+01]
253   Bounds range   [1e+00, 8e+01]
254   RHS range      [8e-01, 1e+10]
255 Warning: Model contains large matrix coefficients
256 Warning: Model contains large rhs
257   Consider reformulating model or setting NumericFocus parameter
258   to avoid numerical issues.
259 Presolve removed 2476269 rows and 1953602 columns
260 Presolve time: 4.83s
261 Presolved: 5307 rows, 1733 columns, 14084 nonzeros
262 Variable types: 8 continuous, 1725 integer (992 binary)
263 Found heuristic solution: objective 3583.0500186
264
265 Root simplex log...
266
267 Iteration   Objective      Primal Inf.   Dual Inf.    Time
268      0    1.1033280e+04  4.859916e+03  0.000000e+00  6s
269    1731   5.3071929e+03  0.000000e+00  0.000000e+00  6s
270
271 Root relaxation: objective 5.307193e+03, 1731 iterations, 0.02 seconds (0.02 work units)
272
273   Nodes | Current Node | Objective Bounds | Work
274 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
275
276 H  0  0           5307.1928758 15552.7410 193% - 6s
277   0  0   -  0    5307.19288 5307.19288 0.00% - 6s
278
279 Explored 1 nodes (2433 simplex iterations) in 6.34 seconds (7.44 work units)
280 Thread count was 8 (of 8 available processors)
281
282 Solution count 2: 5307.19 3583.05
283
284 Optimal solution found (tolerance 1.00e-08)
285 Best objective 5.307192875771e+03, best bound 5.307192875771e+03, gap 0.0000%
286 SP is solved
287 SP's optimal solution is '5307
288
289 Itr = 1
290 Collect_LB = [846.0, 5531.050018627819]
291 Collect_UB = [10216.100037255637, 6153.192875770674]
292 Collect_Hua = [0.0, 4685.050018627819]
293 Collect_SPObjVal = [4685.050018627819, 5307.192875770674]
294 Collect_MPObjValNHua = [846.0, 846.0]
295
296
297 Set parameter MIPGap to value 0.05
298 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
299
300 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
301 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
302
303 Optimize a model with 1681912 rows, 323344 columns and 5078950 nonzeros
304 Model fingerprint: 0xe0f42ce4
305 Variable types: 1 continuous, 323343 integer (300573 binary)
306 Coefficient statistics:
307   Matrix range   [1e-01, 1e+10]
308   Objective range [1e+00, 2e+01]
309   Bounds range   [1e+00, 1e+00]
310   RHS range      [1e+00, 2e+10]
311 Warning: Model contains large matrix coefficients
312 Warning: Model contains large rhs
313   Consider reformulating model or setting NumericFocus parameter
314   to avoid numerical issues.
315 Presolve removed 1428696 rows and 294424 columns (presolve time = 5s) ...
316 Presolve removed 1478678 rows and 297890 columns (presolve time = 16s) ...
317 Presolve removed 1551821 rows and 305450 columns (presolve time = 20s) ...
318 Presolve removed 1551821 rows and 305450 columns
319 Presolve time: 20.07s
320 Presolved: 130091 rows, 17894 columns, 423432 nonzeros
321 Variable types: 1 continuous, 17893 integer (13554 binary)
322
323 Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
324 Showing first log only...
325
326 Root relaxation presolved: 17894 rows, 147985 columns, 441326 nonzeros
327
328
329 Root simplex log...
330
331 Iteration   Objective      Primal Inf.   Dual Inf.    Time

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332      0  6.1710500e+03  0.000000e+00  3.183655e+04  21s
333  18131  6.1710500e+03  0.000000e+00  0.000000e+00  23s
334  18131  6.1710500e+03  0.000000e+00  0.000000e+00  23s
335 Concurrent spin time: 0.61s
336
337 Solved with primal simplex
338
339 Root relaxation: objective 6.171050e+03, 18131 iterations, 2.86 seconds (3.17 work units)
340 Total elapsed time = 26.60s
341
342   Nodes | Current Node | Objective Bounds | Work
343 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
344
345   0   0 6171.05002   0 831      -6171.05002   -   - 30s
346   0   0 6171.05002   0 811      -6171.05002   -   - 31s
347   0   0 6171.05002   0 1336     -6171.05002   -   - 38s
348   0   0 6171.05002   0 1257     -6171.05002   -   - 46s
349   0   0 6171.05002   0 1236     -6171.05002   -   - 46s
350   0   0 6171.05002   0 484      -6171.05002   -   - 60s
351   0   0 6171.05002   0 809      -6171.05002   -   - 63s
352   0   0 6171.05002   0 570      -6171.05002   -   - 72s
353   0   0 6171.05002   0 701      -6171.05002   -   - 74s
354   0   0 6171.05002   0 571      -6171.05002   -   - 82s
355   0   0 6171.05002   0 556      -6171.05002   -   - 82s
356   0   0 6171.05002   0 816      -6171.05002   -   - 87s
357   0   0 6171.05002   0 647      -6171.05002   -   - 99s
358   0   0 6171.05002   0 538      -6171.05002   -   - 99s
359   0   0 6171.05002   0 513      -6171.05002   -   - 102s
360 H   0   0                6171.0500186 6171.05002 0.00%   - 112s
361   0   0 6171.05002   0 513 6171.05002 6171.05002 0.00%   - 112s
362
363 Cutting planes:
364   Learned: 12
365   Gomory: 2
366   Cover: 1113
367   Implied bound: 178
368   Clique: 1994
369   MIR: 177
370   StrongCG: 156
371   Flow cover: 25
372   GUB cover: 758
373   Zero half: 46
374   RLT: 96
375   Relax-and-lift: 421
376   BQP: 20
377   PSD: 1
378
379 Explored 1 nodes (245471 simplex iterations) in 112.96 seconds (370.52 work units)
380 Thread count was 8 (of 8 available processors)
381
382 Solution count 1: 6171.05
383
384 Optimal solution found (tolerance 5.00e-02)
385 Best objective 6.171050018628e+03, best bound 6.171050018628e+03, gap 0.0000%
386 Warning: linear constraint 609509 and linear constraint 1145711 have the same name "ConSP25_1[0,0]"
387 Set parameter MIPGap to value 1e-08
388 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
389
390 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
391 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
392
393 Optimize a model with 2481576 rows, 1955335 columns and 17235895 nonzeros
394 Model fingerprint: 0x19369fd1
395 Variable types: 963295 continuous, 992040 integer (985965 binary)
396 Coefficient statistics:
397   Matrix range    [1e-01, 1e+10]
398   Objective range [6e-05, 5e+01]
399   Bounds range    [1e+00, 8e+01]
400   RHS range       [8e-01, 1e+10]
401 Warning: Model contains large matrix coefficients
402 Warning: Model contains large rhs
403   Consider reformulating model or setting NumericFocus parameter
404   to avoid numerical issues.
405 Presolve removed 2476314 rows and 1953607 columns
406 Presolve time: 4.78s
407 Presolved: 5262 rows, 1728 columns, 14007 nonzeros
408 Variable types: 8 continuous, 1720 integer (992 binary)
409
410 Root simplex log...
411
412 Iteration Objective Primal Inf. Dual Inf. Time
413      0  1.1305452e+04  5.567298e+03  0.000000e+00  6s
414  1528  5.3611929e+03  0.000000e+00  0.000000e+00  6s
415

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416 Root relaxation: objective 5.361193e+03, 1528 iterations, 0.02 seconds (0.02 work units)
417
418   Nodes | Current Node | Objective Bounds | Work
419 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
420
421 * 0 0 0 5361.1928758 5361.19288 0.00% - 6s
422
423 Explored 1 nodes (2319 simplex iterations) in 6.34 seconds (7.37 work units)
424 Thread count was 8 (of 8 available processors)
425
426 Solution count 1: 5361.19
427
428 Optimal solution found (tolerance 1.00e-08)
429 Best objective 5.361192875771e+03, best bound 5.361192875771e+03, gap 0.0000%
430 SP is solved
431 SP's optimal solution is'□5361
432
433 Itr = 2
434 Collect_LB = [846.0, 5531.050018627819, 6171.050018627817]
435 Collect_UB = [10216.100037255637, 6153.192875770674, 6153.192875770674]
436 Collect_Hua = [0.0, 4685.050018627819, 5307.192875770674]
437 Collect_SPObjVal = [4685.050018627819, 5307.192875770674, 5361.192875770674]
438 Collect_MPObjValNHua = [846.0, 846.0, 863.8571428571431]
439
440
441 Reach the termination conditions, stop iteration
442 Values adopted from the judgeCount's th iteration, and Itr = {2}, judgeCount = {1}
443
444 ~~~~~judgeCount = 1, SPObj_SPF = 5307.192875770674
445 Vessel i: 0: pi: 0-7, ai-di: 6-22, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 6-22, taoi-deltai: 6-21, taoPi_SP-deltaPi_SP: 6-21, betaNi: 15
, bi: 15
446 Vessel i: 1: pi: 0-7, ai-di: 48-75, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 48-75, taoi-deltai: 48-74, taoPi_SP-deltaPi_SP: 50-74, betaNi:
26, bi: 26
447 Vessel i: 2: pi: 14-21, ai-di: 25-52, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 25-52, taoi-deltai: 25-51, taoPi_SP-deltaPi_SP: 25-51,
betaNi: 26, bi: 26
448 Vessel i: 3: pi: 14-19, ai-di: 14-21, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 14-21, taoi-deltai: 14-20, taoPi_SP-deltaPi_SP: 14-20,
betaNi: 6, bi: 6
449 Vessel i: 4: pi: 7-14, ai-di: 6-30, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 6-30, taoi-deltai: 6-29, taoPi_SP-deltaPi_SP: 6-29, betaNi: 23
, bi: 23
450 Vessel i: 5: pi: 7-14, ai-di: 37-62, gi_SP-gpi_SP: 0.821429-0.400000, ai_SP-di: 41-62, taoi-deltai: 42-55, taoPi_SP-deltaPi_SP: 42-55, betaNi:
13, bi: 13
451 Vessel i: 6: pi: 14-19, ai-di: 2-21, gi_SP-gpi_SP: 0.750000-0.000000, ai_SP-di: 8-21, taoi-deltai: 5-11, taoPi_SP-deltaPi_SP: 8-11, betaNi: 6
, bi: 6
452 Vessel i: 7: pi: 28-34, ai-di: 7-27, gi_SP-gpi_SP: 0.400000-1.000000, ai_SP-di: 11-27, taoi-deltai: 9-14, taoPi_SP-deltaPi_SP: 11-14, betaNi:
5, bi: 5
453 Vessel i: 8: pi: 14-21, ai-di: 51-71, gi_SP-gpi_SP: 0.428571-1.000000, ai_SP-di: 54-71, taoi-deltai: 54-59, taoPi_SP-deltaPi_SP: 54-59,
betaNi: 5, bi: 5
454
455 round LB = [846, 5531, 6171]
456 round UB = [10216, 6153, 6153]
457 round Hua = [0, 4685, 5307]
458 round SPObjVal = [4685, 5307, 5361]
459 round MPObjValNHua = [846, 846, 864]
460
461 Time: 667.000000
462
463
464
465
```