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80 Optimize a model with 1153912 rows, 901813 columns and 7830024 nonzeros
81 Model fingerprint: 0xa19e74cb
82 Variable types: 441325 continuous, 460488 integer (456438 binary)
83 Coefficient statistics:
84   Matrix range    [1e-01, 1e+10]
85   Objective range [6e-05, 5e+01]
86   Bounds range    [1e+00, 8e+01]
87   RHS range       [8e-01, 1e+10]
88 Warning: Model contains large matrix coefficients
89 Warning: Model contains large rhs
90   Consider reformulating model or setting NumericFocus parameter
91   to avoid numerical issues.
92 Presolve removed 1151641 rows and 900922 columns
93 Presolve time: 2.69s
94 Presolved: 2271 rows, 891 columns, 6113 nonzeros
95 Variable types: 4 continuous, 887 integer (498 binary)
96 Found heuristic solution: objective 3790.3983806
97 Found heuristic solution: objective 3850.3983806
98
99 Root relaxation: objective 5.221000e+03, 575 iterations, 0.00 seconds (0.00 work units)
100
101   Nodes | Current Node | Objective Bounds | Work
102   Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
103
104   H   0   0           5221.0000000 10131.0000 94.0%   -   3s
105     0   0   -   0   5221.00000 5221.00000 0.00%   -   3s
106
107 Explored 1 nodes (836 simplex iterations) in 3.49 seconds (3.69 work units)
108 Thread count was 8 (of 8 available processors)
109
110 Solution count 3: 5221 3850.4 3790.4
111
112 Optimal solution found (tolerance 1.00e-08)
113 Best objective 5.221000000000e+03, best bound 5.221000000000e+03, gap 0.0000%
114 SP is solved
115 SP's optimal solution is'□5221
116
117   Itr = 0
118 Collect_LB = [788.0]
119 Collect_UB = [11230.0000000000004]
120 Collect_Hua = [0.0]
121 Collect_SPObjVal = [5221.0000000000002]
122 Collect_MPObjValNHua = [788.0]
123
124
125 Set parameter TimeLimit to value 12000
126 Set parameter MIPGap to value 0.0005
127 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
128
129 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
130 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
131
132 Optimize a model with 382374 rows, 137605 columns and 1045789 nonzeros
133 Model fingerprint: 0x24a877f6
134 Variable types: 1 continuous, 137604 integer (137580 binary)
135 Coefficient statistics:
136   Matrix range    [1e+00, 1e+10]
137   Objective range [1e+00, 2e+01]
138   Bounds range    [1e+00, 1e+00]
139   RHS range       [1e+00, 2e+10]
140 Warning: Model contains large matrix coefficients
141 Warning: Model contains large rhs
142   Consider reformulating model or setting NumericFocus parameter
143   to avoid numerical issues.
144 Presolve removed 247725 rows and 121850 columns (presolve time = 5s) ...
145 Presolve removed 364021 rows and 131279 columns
146 Presolve time: 5.81s
147 Presolved: 18353 rows, 6326 columns, 77807 nonzeros
148 Variable types: 0 continuous, 6326 integer (6312 binary)
149
150 Root simplex log...
151
152 Iteration Objective Primal Inf. Dual Inf. Time
153     0 6.0610000e+03 7.871250e+02 0.000000e+00 6s
154   2660 6.0610000e+03 0.000000e+00 0.000000e+00 6s
155
156 Root relaxation: objective 6.061000e+03, 2660 iterations, 0.06 seconds (0.07 work units)
157
158   Nodes | Current Node | Objective Bounds | Work
159   Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
160
161     0   0 6061.00000 0 19      -6061.00000 - - 6s
162     0   0 6061.00000 0 268     -6061.00000 - - 7s
163     0   0 6061.00000 0 269     -6061.00000 - - 7s

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164 0 0 6061.00000 0 245 - 6061.00000 - - 7s
165 0 0 6061.00000 0 243 - 6061.00000 - - 7s
166 0 0 6061.00000 0 54 - 6061.00000 - - 8s
167 0 0 6061.00000 0 52 - 6061.00000 - - 8s
168 H 0 0 6061.0000000 6061.00000 0.00% - 8s
169 0 0 6061.00000 0 134 6061.00000 6061.00000 0.00% - 8s
170
171 Cutting planes:
172 Learned: 2
173 Gomory: 1
174 Cover: 267
175 Implied bound: 14
176 Clique: 58
177 MIR: 28
178 StrongCG: 7
179 GUB cover: 38
180 RLT: 1
181 Relax-and-lift: 5
182 BQP: 3
183
184 Explored 1 nodes (16800 simplex iterations) in 8.72 seconds (12.74 work units)
185 Thread count was 8 (of 8 available processors)
186
187 Solution count 1: 6061
188
189 Optimal solution found (tolerance 5.00e-04)
190 Best objective 6.061000000000e+03, best bound 6.061000000000e+03, gap 0.0000%
191 Set parameter MIPGap to value 1e-08
192 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
193
194 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
195 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
196
197 Optimize a model with 1153912 rows, 901813 columns and 7830024 nonzeros
198 Model fingerprint: 0x20bd45f8
199 Variable types: 441325 continuous, 460488 integer (456438 binary)
200 Coefficient statistics:
201 Matrix range [1e-01, 1e+10]
202 Objective range [6e-05, 5e+01]
203 Bounds range [1e+00, 8e+01]
204 RHS range [8e-01, 1e+10]
205 Warning: Model contains large matrix coefficients
206 Warning: Model contains large rhs
207 Consider reformulating model or setting NumericFocus parameter
208 to avoid numerical issues.
209 Presolve removed 1148656 rows and 900070 columns
210 Presolve time: 2.46s
211 Presolved: 5256 rows, 1743 columns, 14014 nonzeros
212 Variable types: 4 continuous, 1739 integer (994 binary)
213 Found heuristic solution: objective 3874.6085125
214 Found heuristic solution: objective 3894.6085125
215
216 Root relaxation: objective 5.472000e+03, 1534 iterations, 0.02 seconds (0.02 work units)
217
218 Nodes | Current Node | Objective Bounds | Work
219 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
220
221 H 0 0 5472.0000000 15500.0000 183% - 3s
222 0 0 - 0 5472.00000 5472.00000 0.00% - 3s
223
224 Explored 1 nodes (2292 simplex iterations) in 3.23 seconds (3.44 work units)
225 Thread count was 8 (of 8 available processors)
226
227 Solution count 3: 5472 3894.61 3874.61
228
229 Optimal solution found (tolerance 1.00e-08)
230 Best objective 5.472000000000e+03, best bound 5.472000000000e+03, gap 0.0000%
231 SP is solved
232 SP's optimal solution is'□5472
233
234 Itr = 1
235 Collect_LB = [788.0, 6061.0000000000002]
236 Collect_UB = [11230.0000000000004, 6312.0000000000002]
237 Collect_Hua = [0.0, 5221.0000000000002]
238 Collect_SPObjVal = [5221.0000000000002, 5472.0000000000002]
239 Collect_MPObjValNHua = [788.0, 840.0]
240
241
242 Set parameter TimeLimit to value 12000
243 Set parameter MIPGap to value 0.0005
244 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
245
246 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
247 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads

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248
249 Optimize a model with 382375 rows, 137605 columns and 1045802 nonzeros
250 Model fingerprint: 0x71360ad1
251 Variable types: 1 continuous, 137604 integer (137580 binary)
252 Coefficient statistics:
253   Matrix range   [1e+00, 1e+10]
254   Objective range [1e+00, 2e+01]
255   Bounds range   [1e+00, 1e+00]
256   RHS range      [1e+00, 2e+10]
257 Warning: Model contains large matrix coefficients
258 Warning: Model contains large rhs
259   Consider reformulating model or setting NumericFocus parameter
260   to avoid numerical issues.
261 Presolve removed 247726 rows and 121850 columns (presolve time = 5s) ...
262 Presolve removed 364022 rows and 131279 columns
263 Presolve time: 5.71s
264 Presolved: 18353 rows, 6326 columns, 77807 nonzeros
265 Variable types: 0 continuous, 6326 integer (6312 binary)
266
267 Root simplex log...
268
269 Iteration   Objective    Primal Inf.   Dual Inf.    Time
270      0    6.3120000e+03  7.871250e+02  0.000000e+00   6s
271    2660    6.3120000e+03  0.000000e+00  0.000000e+00   6s
272
273 Root relaxation: objective 6.312000e+03, 2660 iterations, 0.05 seconds (0.07 work units)
274
275   Nodes | Current Node | Objective Bounds | Work
276 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
277
278   0   0 6312.00000   0 19    -6312.00000   -   -   6s
279   0   0 6312.00000   0 268    -6312.00000   -   -   7s
280   0   0 6312.00000   0 269    -6312.00000   -   -   7s
281   0   0 6312.00000   0 245    -6312.00000   -   -   7s
282   0   0 6312.00000   0 243    -6312.00000   -   -   7s
283   0   0 6312.00000   0 54    -6312.00000   -   -   8s
284   0   0 6312.00000   0 52    -6312.00000   -   -   8s
285 H   0   0                6312.0000000 6312.00000 0.00%   -   8s
286   0   0 6312.00000   0 134 6312.00000 6312.00000 0.00%   -   8s
287
288 Cutting planes:
289   Learned: 2
290   Gomory: 1
291   Cover: 267
292   Implied bound: 14
293   Clique: 58
294   MIR: 28
295   StrongCG: 7
296   GUB cover: 38
297   RLT: 1
298   Relax-and-lift: 5
299   BQP: 3
300
301 Explored 1 nodes (16800 simplex iterations) in 8.32 seconds (12.74 work units)
302 Thread count was 8 (of 8 available processors)
303
304 Solution count 1: 6312
305
306 Optimal solution found (tolerance 5.00e-04)
307 Best objective 6.312000000000e+03, best bound 6.312000000000e+03, gap 0.0000%
308 Set parameter MIPGap to value 1e-08
309 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
310
311 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
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319   Objective range [6e-05, 5e+01]
320   Bounds range   [1e+00, 8e+01]
321   RHS range      [8e-01, 1e+10]
322 Warning: Model contains large matrix coefficients
323 Warning: Model contains large rhs
324   Consider reformulating model or setting NumericFocus parameter
325   to avoid numerical issues.
326 Presolve removed 1148656 rows and 900070 columns
327 Presolve time: 2.41s
328 Presolved: 5256 rows, 1743 columns, 14014 nonzeros
329 Variable types: 4 continuous, 1739 integer (994 binary)
330 Found heuristic solution: objective 3874.6085125
331 Found heuristic solution: objective 3894.6085125

```

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332
333 Root relaxation: objective 5.472000e+03, 1534 iterations, 0.02 seconds (0.02 work units)
334
335   Nodes | Current Node | Objective Bounds | Work
336 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
337
338 H 0 0          5472.0000000 15500.0000 183% - 3s
339 0 0 - 0    5472.00000 5472.00000 0.00% - 3s
340
341 Explored 1 nodes (2292 simplex iterations) in 3.19 seconds (3.44 work units)
342 Thread count was 8 (of 8 available processors)
343
344 Solution count 3: 5472 3894.61 3874.61
345
346 Optimal solution found (tolerance 1.00e-08)
347 Best objective 5.4720000000000e+03, best bound 5.4720000000000e+03, gap 0.0000%
348 SP is solved
349 SP's optimal solution is'□5472
350
351 Itr = 2
352 Collect_LB = [788.0, 6061.0000000000002, 6312.0000000000002]
353 Collect_UB = [11230.0000000000004, 6312.0000000000002, 6312.0000000000002]
354 Collect_Hua = [0.0, 5221.0000000000002, 5472.0000000000002]
355 Collect_SPObjVal = [5221.0000000000002, 5472.0000000000002, 5472.0000000000002]
356 Collect_MPObjValNHua = [788.0, 840.0, 840.0]
357
358
359 Reach the termination conditions, stop iteration
360 Values adopted from the Itr' th iteration, and Itr = {2}, judgeCount = {2}
361
362 ~~~~~judge = 2, SPObj_SPF = 5472.0000000000002
363 Vessel i: 0: pi: 0-7, ai-di: 8-25, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 8-25, taoi-deltai: 8-25, taoPi_SP-deltaPi_SP: 8-25, betaNi: 17
, bi: 17
364 Vessel i: 1: pi: 22-28, ai-di: 14-24, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 14-24, taoi-deltai: 14-25, taoPi_SP-deltaPi_SP: 14-25,
betaNi: 11, bi: 11
365 Vessel i: 2: pi: 16-22, ai-di: 14-49, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 14-49, taoi-deltai: 14-47, taoPi_SP-deltaPi_SP: 14-47,
betaNi: 33, bi: 33
366 Vessel i: 3: pi: 11-16, ai-di: 22-48, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 22-48, taoi-deltai: 22-49, taoPi_SP-deltaPi_SP: 22-49,
betaNi: 27, bi: 27
367 Vessel i: 4: pi: 16-22, ai-di: 43-56, gi_SP-gpi_SP: 1.000000-0.600000, ai_SP-di: 48-56, taoi-deltai: 48-58, taoPi_SP-deltaPi_SP: 48-58,
betaNi: 10, bi: 10
368 Vessel i: 5: pi: 22-27, ai-di: 35-75, gi_SP-gpi_SP: 0.200000-0.600000, ai_SP-di: 35-75, taoi-deltai: 36-70, taoPi_SP-deltaPi_SP: 36-70,
betaNi: 34, bi: 34
369
370 round LB = [788, 6061, 6312]
371 round UB = [11230, 6312, 6312]
372 round Hua = [0, 5221, 5472]
373 round SPObjVal = [5221, 5472, 5472]
374 round MPObjValNHua = [788, 840, 840]
375
376 OptimalObj = 6312.0000000000002
377 Time: 241.000000
378
379
380
381
```