


```

80 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
81 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
82
83 Optimize a model with 654127 rows, 16030 columns and 1337489 nonzeros
84 Model fingerprint: 0x51579be7
85 Variable types: 40 continuous, 15990 integer (9240 binary)
86 Coefficient statistics:
87   Matrix range   [1e-01, 1e+10]
88   Objective range [6e-05, 5e+01]
89   Bounds range   [1e+00, 1e+00]
90   RHS range      [8e-01, 1e+10]
91 Warning: Model contains large matrix coefficients
92 Warning: Model contains large rhs
93   Consider reformulating model or setting NumericFocus parameter
94   to avoid numerical issues.
95 Presolve removed 651894 rows and 15180 columns
96 Presolve time: 0.48s
97 Presolved: 2233 rows, 850 columns, 6060 nonzeros
98 Variable types: 9 continuous, 841 integer (502 binary)
99 Found heuristic solution: objective 3482.4264926
100
101 Root relaxation: objective 4.861489e+03, 668 iterations, 0.00 seconds (0.01 work units)
102
103   Nodes | Current Node | Objective Bounds | Work
104 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
105
106   0   0 4861.48879   0 41 3482.42649 4861.48879 39.6% - 0s
107 H  0   0           4858.5213765 4861.48879 0.06% - 0s
108   0   0 4861.48879   0 12 4858.52138 4861.48879 0.06% - 0s
109   0   0 4861.48879   0 10 4858.52138 4861.48879 0.06% - 0s
110   0   0 4861.48879   0  9 4858.52138 4861.48879 0.06% - 0s
111 H  0   0           4860.4829105 4861.48879 0.02% - 0s
112   0   0 4861.48879   0  8 4860.48291 4861.48879 0.02% - 0s
113   0   0 4861.48879   0  7 4860.48291 4861.48879 0.02% - 0s
114 H  0   0           4861.0769320 4861.48879 0.01% - 0s
115
116 Cutting planes:
117   MIR: 1
118
119 Explored 1 nodes (1204 simplex iterations) in 0.70 seconds (0.95 work units)
120 Thread count was 8 (of 8 available processors)
121
122 Solution count 4: 4861.08 4860.48 4858.52 3482.43
123
124 Optimal solution found (tolerance 1.00e-08)
125 Best objective 4.861076932024e+03, best bound 4.861076932024e+03, gap 0.0000%
126 SP is solved
127 SP's optimal solution is'□4861
128
129 Itr = 0
130 Collect_LB = [743.0]
131 Collect_UB = [10465.153864048989]
132 Collect_Hua = [0.0]
133 Collect_SPObjVal = [4861.076932024494]
134 Collect_MPObjValNHua = [743.0]
135
136
137 Set parameter MIPGap to value 1e-10
138 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
139
140 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
141 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
142
143 Optimize a model with 603389 rows, 344301 columns and 1681642 nonzeros
144 Model fingerprint: 0xe9ba1522
145 Variable types: 1 continuous, 344300 integer (344260 binary)
146 Coefficient statistics:
147   Matrix range   [1e+00, 1e+10]
148   Objective range [1e+00, 2e+01]
149   Bounds range   [1e+00, 1e+00]
150   RHS range      [1e+00, 2e+10]
151 Warning: Model contains large matrix coefficients
152 Warning: Model contains large rhs
153   Consider reformulating model or setting NumericFocus parameter
154   to avoid numerical issues.
155 Presolve removed 413624 rows and 321128 columns (presolve time = 5s) ...
156 Presolve removed 413624 rows and 321128 columns (presolve time = 10s) ...
157 Presolve removed 535577 rows and 333380 columns
158 Presolve time: 12.68s
159 Presolved: 67812 rows, 10921 columns, 173175 nonzeros
160 Variable types: 0 continuous, 10921 integer (10891 binary)
161
162 Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
163 Showing first log only...

```

```

164
165 Root relaxation presolved: 10921 rows, 78733 columns, 184096 nonzeros
166
167
168 Root simplex log...
169
170 Iteration   Objective    Primal Inf.   Dual Inf.    Time
171      0  5.6040769e+03  0.000000e+00  5.338000e+03  13s
172 Concurrent spin time: 0.05s
173
174 Solved with dual simplex (primal model)
175
176 Root relaxation: objective 5.604077e+03, 4299 iterations, 0.58 seconds (0.62 work units)
177
178   Nodes | Current Node | Objective Bounds | Work
179 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
180
181    0    0 5604.07693    0 10    -5604.07693    -    - 14s
182    0    0 5604.07693    0 75    -5604.07693    -    - 15s
183    0    0 5604.07693    0 68    -5604.07693    -    - 15s
184    0    0 5604.07693    0 24    -5604.07693    -    - 17s
185    0    0 5604.07693    0 35    -5604.07693    -    - 17s
186    0    0 5604.07693    0 78    -5604.07693    -    - 18s
187    0    0 5604.07693    0 75    -5604.07693    -    - 19s
188    0    0 5604.07693    0 68    -5604.07693    -    - 23s
189    0    0 5604.07693    0 68    -5604.07693    -    - 24s
190 H    0    0          5604.0769320 5604.07693 0.00%    - 24s
191    0    0 5604.07693    0 68 5604.07693 5604.07693 0.00%    - 24s
192
193 Cutting planes:
194   Learned: 2
195   Gomory: 2
196   Cover: 217
197   Implied bound: 18
198   Clique: 678
199   MIR: 158
200   StrongCG: 167
201   GUB cover: 11
202   RLT: 2
203   Relax-and-lift: 9
204   BQP: 2
205
206 Explored 1 nodes (29914 simplex iterations) in 24.76 seconds (28.74 work units)
207 Thread count was 8 (of 8 available processors)
208
209 Solution count 1: 5604.08
210
211 Optimal solution found (tolerance 1.00e-10)
212 Best objective 5.604076932024e+03, best bound 5.604076932024e+03, gap 0.0000%
213 Set parameter MIPGap to value 1e-08
214 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
215
216 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
217 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
218
219 Optimize a model with 654127 rows, 16030 columns and 1337489 nonzeros
220 Model fingerprint: 0x13d72df0
221 Variable types: 40 continuous, 15990 integer (9240 binary)
222 Coefficient statistics:
223   Matrix range    [1e-01, 1e+10]
224   Objective range [6e-05, 5e+01]
225   Bounds range    [1e+00, 1e+00]
226   RHS range       [8e-01, 1e+10]
227 Warning: Model contains large matrix coefficients
228 Warning: Model contains large rhs
229   Consider reformulating model or setting NumericFocus parameter
230   to avoid numerical issues.
231 Presolve removed 648293 rows and 14140 columns
232 Presolve time: 0.44s
233 Presolved: 5834 rows, 1890 columns, 15471 nonzeros
234 Variable types: 10 continuous, 1880 integer (1090 binary)
235 Found heuristic solution: objective 4133.9680293
236
237 Root relaxation: objective 5.987873e+03, 1816 iterations, 0.02 seconds (0.02 work units)
238
239   Nodes | Current Node | Objective Bounds | Work
240 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
241
242    0    0 5987.87302    0 83 4133.96803 5987.87302 44.8%    - 0s
243 H    0    0          5513.4444444 5987.87302 8.60%    - 0s
244 H    0    0          5617.6563219 5987.87302 6.59%    - 0s
245 H    0    0          5964.4444444 5986.94444 0.38%    - 0s
246    0    0 5986.94444    0 42 5964.44444 5986.94444 0.38%    - 0s
247    0    0 5986.94444    0 34 5964.44444 5986.94444 0.38%    - 0s

```

```
248 H 0 0 5986.9444444 5986.94444 0.00% - 0s
249 0 0 5986.94444 0 34 5986.94444 5986.94444 0.00% - 0s
250
251 Cutting planes:
252 Learned: 1
253 Gomory: 3
254 Cover: 2
255 Implied bound: 4
256 Clique: 16
257 MIR: 3
258 Flow cover: 1
259 RLT: 7
260 Relax-and-lift: 2
261
262 Explored 1 nodes (3595 simplex iterations) in 0.77 seconds (0.96 work units)
263 Thread count was 8 (of 8 available processors)
264
265 Solution count 5: 5986.94 5964.44 5617.66 ... 4133.97
266
267 Optimal solution found (tolerance 1.00e-08)
268 Best objective 5.986944444444e+03, best bound 5.986944444444e+03, gap 0.0000%
269 SP is solved
270 SP's optimal solution is'□5986
271
272 Itr = 1
273 Collect_LB = [743.0, 5604.076932024494]
274 Collect_UB = [10465.153864048989, 6729.944444444445]
275 Collect_Hua = [0.0, 4861.076932024494]
276 Collect_SPObjVal = [4861.076932024494, 5986.944444444445]
277 Collect_MPObjValNHua = [743.0, 743.0]
278
279
280 Set parameter MIPGap to value 1e-10
281 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
282
283 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
284 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
285
286 Optimize a model with 603389 rows, 344301 columns and 1681642 nonzeros
287 Model fingerprint: 0x324f3ded
288 Variable types: 1 continuous, 344300 integer (344260 binary)
289 Coefficient statistics:
290 Matrix range [1e+00, 1e+10]
291 Objective range [1e+00, 2e+01]
292 Bounds range [1e+00, 1e+00]
293 RHS range [1e+00, 2e+10]
294 Warning: Model contains large matrix coefficients
295 Warning: Model contains large rhs
296 Consider reformulating model or setting NumericFocus parameter
297 to avoid numerical issues.
298 Presolve removed 417665 rows and 321479 columns (presolve time = 5s) ...
299 Presolve removed 417665 rows and 321479 columns (presolve time = 10s) ...
300 Presolve removed 536163 rows and 333455 columns
301 Presolve time: 12.79s
302 Presolved: 67226 rows, 10846 columns, 170827 nonzeros
303 Variable types: 0 continuous, 10846 integer (10816 binary)
304
305 Deterministic concurrent LP optimizer: primal and dual simplex (primal and dual model)
306 Showing first log only...
307
308 Root relaxation presolved: 10846 rows, 78072 columns, 181673 nonzeros
309
310
311 Root simplex log...
312
313 Iteration Objective Primal Inf. Dual Inf. Time
314 0 6.7324444e+03 0.000000e+00 5.338000e+03 13s
315 Concurrent spin time: 0.06s
316
317 Solved with dual simplex (primal model)
318
319 Root relaxation: objective 6.732444e+03, 4502 iterations, 0.61 seconds (0.67 work units)
320
321 Nodes | Current Node | Objective Bounds | Work
322 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
323
324 0 0 6732.44444 0 23 - 6732.44444 - - 14s
325 0 0 6732.44444 0 353 - 6732.44444 - - 16s
326 0 0 6732.44444 0 296 - 6732.44444 - - 17s
327 0 0 6732.44444 0 201 - 6732.44444 - - 17s
328 0 0 6732.44444 0 93 - 6732.44444 - - 21s
329 0 0 6732.44444 0 101 - 6732.44444 - - 21s
330 0 0 6732.44444 0 47 - 6732.44444 - - 22s
331 0 0 6732.44444 0 101 - 6732.44444 - - 23s
```

```
332 0 0 6732.44444 0 64 - 6732.44444 - - 24s
333 H 0 0 6832.4444444 6732.44444 1.46% - 24s
334 H 0 0 6812.4444444 6732.44444 1.17% - 24s
335 H 0 0 6732.4444444 6732.44444 0.00% - 26s
336 0 0 6732.44444 0 64 6732.44444 6732.44444 0.00% - 26s
337
338 Cutting planes:
339 Learned: 1
340 Gomory: 1
341 Cover: 89
342 Implied bound: 394
343 Clique: 1070
344 MIR: 26
345 StrongCG: 19
346 GUB cover: 8
347 Zero half: 2
348 RLT: 2
349 Relax-and-lift: 20
350 BQP: 9
351
352 Explored 1 nodes (29232 simplex iterations) in 26.43 seconds (32.16 work units)
353 Thread count was 8 (of 8 available processors)
354
355 Solution count 3: 6732.44 6812.44 6832.44
356
357 Optimal solution found (tolerance 1.00e-10)
358 Best objective 6.73244444444e+03, best bound 6.73244444444e+03, gap 0.0000%
359 Set parameter MIPGap to value 1e-08
360 Gurobi Optimizer version 10.0.2 build v10.0.2rc0 (win64)
361
362 CPU model: 11th Gen Intel(R) Core(TM) i7-11370H @ 3.30GHz, instruction set [SSE2|AVX|AVX2|AVX512]
363 Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
364
365 Optimize a model with 654127 rows, 16030 columns and 1337489 nonzeros
366 Model fingerprint: 0x515aaef2
367 Variable types: 40 continuous, 15990 integer (9240 binary)
368 Coefficient statistics:
369 Matrix range [1e-01, 1e+10]
370 Objective range [6e-05, 5e+01]
371 Bounds range [1e+00, 1e+00]
372 RHS range [8e-01, 1e+10]
373 Warning: Model contains large matrix coefficients
374 Warning: Model contains large rhs
375 Consider reformulating model or setting NumericFocus parameter
376 to avoid numerical issues.
377 Presolve removed 649482 rows and 14472 columns
378 Presolve time: 0.47s
379 Presolved: 4645 rows, 1558 columns, 12363 nonzeros
380 Variable types: 10 continuous, 1548 integer (906 binary)
381
382 Root relaxation: objective 5.826944e+03, 1300 iterations, 0.02 seconds (0.01 work units)
383
384 Nodes | Current Node | Objective Bounds | Work
385 Expl Unexpl | Obj Depth IntInf | Incumbent BestBd Gap | It/Node Time
386
387 0 0 5826.94444 0 10 - 5826.94444 - - 0s
388 H 0 0 5826.9444444 5826.94444 0.00% - 0s
389
390 Explored 1 nodes (2028 simplex iterations) in 0.67 seconds (0.92 work units)
391 Thread count was 8 (of 8 available processors)
392
393 Solution count 1: 5826.94
394
395 Optimal solution found (tolerance 1.00e-08)
396 Best objective 5.82694444444e+03, best bound 5.82694444444e+03, gap 0.0000%
397 SP is solved
398 SP's optimal solution is' 5826
399
400 Itr = 2
401 Collect_LB = [743.0, 5604.076932024494, 6732.444444444445]
402 Collect_UB = [10465.153864048989, 6729.944444444445, 6572.444444444445]
403 Collect_Hua = [0.0, 4861.076932024494, 5986.944444444445]
404 Collect_SPObjVal = [4861.076932024494, 5986.944444444445, 5826.944444444445]
405 Collect_MPObjValNHua = [743.0, 743.0, 745.5]
406
407
408 Ops, stop iteration
409 Values adopted from the Itr' th iteration, and Itr = {2}, judgeCount = {2}
410
411 ~~~~~judge = 2, SPObj_SPF = 5826.944444444445
412 Vessel i: 0: pi: 0-5, ai-di: 5-15, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 5-15, taoi-deltai: 5-10, taoPi_SP-deltaPi_SP: 8-10, betaNi: 5,
bi: 5
413 Vessel i: 1: pi: 0-7, ai-di: 22-44, gi_SP-gpi_SP: 0.000000-0.000000, ai_SP-di: 22-44, taoi-deltai: 22-34, taoPi_SP-deltaPi_SP: 22-34, betaNi:
12, bi: 12
```

unknown

| | | | | | | | | |
|-----|------------------------------|---------------------|---------------|----------------------------------|------------------|---------------------|-----------------------------|------------|
| 414 | Vessel i: 2: , bi: 11 | pi: 5-10, | ai-di: 8-26, | gi_SP-gpi_SP: 0.000000-0.000000, | ai_SP-di: 8-26, | taoi-deltai: 8-19, | taoPi_SP-deltaPi_SP: 8-19, | betaNi: 11 |
| 415 | Vessel i: 3: : 12, bi: 12 | pi: 5-10, | ai-di: 41-62, | gi_SP-gpi_SP: 0.000000-0.000000, | ai_SP-di: 41-62, | taoi-deltai: 41-53, | taoPi_SP-deltaPi_SP: 45-49, | betaNi |
| 416 | Vessel i: 4: : 20, bi: 20 | pi: 6-13, | ai-di: 55-82, | gi_SP-gpi_SP: 0.000000-0.000000, | ai_SP-di: 55-82, | taoi-deltai: 55-75, | taoPi_SP-deltaPi_SP: 55-75, | betaNi |
| 417 | Vessel i: 5: betaNi: 25, | pi: 15-20, | ai-di: 18-61, | gi_SP-gpi_SP: 0.000000-1.000000, | ai_SP-di: 18-61, | taoi-deltai: 18-43, | taoPi_SP-deltaPi_SP: 18-43, | |
| 418 | Vessel i: 6: : 9, bi: 9 | pi: 20-25, | ai-di: 9-39, | gi_SP-gpi_SP: 0.875000-0.400000, | ai_SP-di: 16-39, | taoi-deltai: 16-25, | taoPi_SP-deltaPi_SP: 16-25, | betaNi |
| 419 | Vessel i: 7: betaNi: 19, | pi: 14-20, | ai-di: 35-77, | gi_SP-gpi_SP: 1.000000-0.600000, | ai_SP-di: 45-77, | taoi-deltai: 45-64, | taoPi_SP-deltaPi_SP: 45-64, | |
| 420 | Vessel i: 8: , bi: 13 | pi: 10-15, | ai-di: 5-41, | gi_SP-gpi_SP: 0.571429-1.000000, | ai_SP-di: 9-41, | taoi-deltai: 9-22, | taoPi_SP-deltaPi_SP: 9-22, | betaNi: 13 |
| 421 | Vessel i: 9: betaNi: 6, | pi: 21-26, | ai-di: 29-55, | gi_SP-gpi_SP: 0.553571-0.000000, | ai_SP-di: 32-55, | taoi-deltai: 33-39, | taoPi_SP-deltaPi_SP: 33-39, | |
| 422 | | | | | | | | |
| 423 | round LB = | [743, 5604, 6732] | | | | | | |
| 424 | round UB = | [10465, 6730, 6572] | | | | | | |
| 425 | round Hua = | [0, 4861, 5987] | | | | | | |
| 426 | round SPObjVal = | [4861, 5987, 5827] | | | | | | |
| 427 | round MPObjValNHua = | [743, 743, 746] | | | | | | |
| 428 | | | | | | | | |
| 429 | OptimalObj = | 6732.444444444445 | | | | | | |
| 430 | Time: 149.000000 | | | | | | | |
| 431 | | | | | | | | |
| 432 | | | | | | | | |
| 433 | | | | | | | | |
| 434 | | | | | | | | |