```
Academic license - for non-commercial use only - expires 2021-04-26
Using license file /home/zijie/gurobi.lic
Changed value of parameter timelimit to 180.0
   Prev: inf Min: 0.0 Max: inf Default: inf
Changed value of parameter varbranch to 2
   Prev: -1 Min: -1 Max: 3 Default: -1
Gurobi Optimizer version 9.1.1 build v9.1.1rc0 (linux64)
Thread count: 8 physical cores, 8 logical processors, using up to 8 threads
Optimize a model with 2305 rows, 2352 columns and 11045 nonzeros
Model fingerprint: 0x72774eba
Variable types: 0 continuous, 2352 integer (2304 binary)
Coefficient statistics:
                   [1e+00, 5e+01]
  Matrix range
  Objective range [7e+00, 1e+08]
  Bounds range
                   [1e+00, 5e+01]
                   [1e+00, 5e+01]
  RHS range
Presolve removed 47 rows and 49 columns
Presolve time: 0.01s
Presolved: 2258 rows, 2303 columns, 10998 nonzeros
Variable types: 0 continuous, 2303 integer (2256 binary)
Found heuristic solution: objective 7533.0000000
```

Root relaxation: objective 1.655816e+03, 199 iterations, 0.00 seconds

| Nodes | | | Current Node | | 9 | Objective Bounds | | | Work | |
|-------------|---|-----------|--------------|---|-----------|------------------|------------|---------|------|----|
| Expl Unexpl | | Obj Depth | | | Incumbent | | Gap | It/Node | Time | |
| | | • | , , , | | | | | | | |
| | 0 | 0 | 1655.81560 | 0 | 61 | 7533.00000 | 1655.81560 | 78.0% | - | 0s |
| | 0 | 0 | 1725.46809 | 0 | 77 | 7533.00000 | 1725.46809 | 77.1% | - | 0s |
| Н | 0 | 0 | | | 18 | 91.0000000 | 1725.46809 | 8.75% | - | 0s |
| | 0 | 0 | 1725.46809 | 0 | 73 | 1891.00000 | 1725.46809 | 8.75% | - | 0s |
| | 0 | 0 | 1737.50355 | 0 | 66 | 1891.00000 | 1737.50355 | 8.12% | - | 0s |
| | 0 | 0 | 1738.17021 | 0 | 60 | 1891.00000 | 1738.17021 | 8.08% | - | 0s |
| | 0 | 0 | 1738.17021 | 0 | 69 | 1891.00000 | 1738.17021 | 8.08% | - | 0s |
| | 0 | 0 | 1740.11348 | 0 | 46 | 1891.00000 | 1740.11348 | 7.98% | - | 0s |
| | 0 | 0 | 1740.11348 | 0 | 63 | 1891.00000 | 1740.11348 | 7.98% | - | 0s |
| | 0 | 0 | 1740.11348 | 0 | 71 | 1891.00000 | 1740.11348 | 7.98% | - | 0s |
| | 0 | 0 | 1740.11348 | 0 | 72 | 1891.00000 | 1740.11348 | 7.98% | - | 0s |
| | 0 | 0 | 1740.11348 | 0 | 73 | 1891.00000 | 1740.11348 | 7.98% | - | 0s |
| | 0 | 0 | 1740.11348 | 0 | 79 | 1891.00000 | 1740.11348 | 7.98% | - | 0s |
| | 0 | 0 | 1741.42222 | 0 | 76 | 1891.00000 | 1741.42222 | 7.91% | - | 0s |
| | 0 | 0 | 1741.42222 | 0 | 81 | 1891.00000 | 1741.42222 | 7.91% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 67 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 70 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 85 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 85 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 37 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 34 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 36 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 36 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 33 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 33 | 1891.00000 | 1745.00000 | 7.72% | - | 0s |
| Н | 0 | 0 | | | 18 | 08.0000000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 31 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 62 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 61 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 62 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 73 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 73 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 83 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 82 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 64 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 77 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 41 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| | 0 | 0 | 1745.00000 | 0 | 27 | 1808.00000 | 1745.00000 | 3.48% | - | 0s |
| Н | 0 | 0 | | | 17 | 82.0000000 | 1745.00000 | 2.08% | - | 0s |

| 0 0 1745.00000 | 0 | 32 1782.00000 1745.00000 2.08% - 0s |
|--|----------|--|
| 0 0 1745.00000 | Õ | 49 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | Ō | 18 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 73 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 45 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 59 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 63 1782.00000 1745.00000 2.08% - 0s |
| 0 0 1745.00000 | 0 | 67 1782.00000 1745.00000 2.08% - 0s |
| 0 0 1745.00000 | 0 | 74 1782.00000 1745.00000 2.08% - 0s |
| 0 0 1745.00000 | 0 | 57 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 57 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 31 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 19 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 24 1782.00000 1745.00000 2.08% - 0s |
| 0 0 1745.00000 | 0 | 32 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 19 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 31 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 31 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 31 1782.00000 1745.00000 2.08% - Os |
| 0 0 1745.00000 | 0 | 31 1782.00000 1745.00000 2.08% - Os |
| 0 2 1745.00000 | 0 | 31 1782.00000 1745.00000 2.08% - Os |
| H 533 433 | | 1777.0000000 1746.80000 1.70% 6.7 1s |
| 24613 9986 1773.84217 | 54 | 72 1777.00000 1758.00335 1.07% 17.0 5s |
| 44857 15553 1763.66667 | 45 | 70 1777.00000 1758.00335 1.07% 17.4 10s |
| H44860 14776 | | 1776.0000000 1758.00335 1.01% 17.4 10s |
| | 111 | 1776.00000 1758.00335 1.01% 16.5 15s |
| 85797 16738 cutoff | 93 | 1776.00000 1765.00000 0.62% 16.4 20s |
| 111770 15590 1765.00000 | 98 | 51 1776.00000 1765.00000 0.62% 16.2 25s |
| 135977 15399 1765.00000 | 125 | 94 1776.00000 1765.00000 0.62% 16.9 30s |
| 162381 17874 cutoff | 102 | 1776.00000 1765.00000 0.62% 17.5 35s |
| 182871 19862 infeasible | 112 | 1776.00000 1765.00000 0.62% 17.6 40s |
| 198141 22338 cutoff | 101 | 1776.00000 1765.00000 0.62% 18.0 45s |
| 215314 26375 1765.00000 | 104 | 37 1776.00000 1765.00000 0.62% 18.2 50s |
| 243995 31852 1765.00000 | 112 | 81 1776.00000 1765.00000 0.62% 18.4 55s |
| 271196 34364 1771.27306 | 127 | 60 1776.00000 1765.00000 0.62% 18.8 60s |
| 301019 38415 1765.00000 | 119 | 87 1776.00000 1765.00000 0.62% 19.1 65s |
| 329750 41077 infeasible | 116 | 1776.00000 1765.00000 0.62% 19.3 70s |
| 358067 43174 infeasible | 127 | 1776.00000 1765.00000 0.62% 19.6 75s |
| 387699 45768 1769.18729 | 93 | 60 1776.00000 1765.00000 0.62% 19.7 80s |
| 418493 47259 1765.00000 | 90 | 52 1776.00000 1765.00000 0.62% 19.9 85s |
| 447473 50679 1771.21497 | 94 | 47 1776.00000 1765.00000 0.62% 20.1 90s |
| 479919 52855 infeasible | 110 | 1776.00000 1765.00000 0.62% 20.2 95s |
| 513167 54100 cutoff | 94 | 1776.00000 1765.00000 0.62% 20.4 100s |
| 544845 54324 cutoff | 126 | 1776.00000 1765.00000 0.62% 20.4 105s |
| 580687 55511 1765.00000 | 93 71 | 49 1776.00000 1765.00000 0.62% 20.4 110s |
| 611231 57369 1765.00000 | 71 | 97 1776.00000 1765.00000 0.62% 20.5 115s |
| 643158 59404 infeasible 673849 61837 infeasible | 91 77 | 1776.00000 1765.00000 0.62% 20.5 120s 1776.00000 1765.00000 0.62% 20.5 125s |
| 705223 65206 1765.00000 | 90 | 1776.00000 1765.00000 0.62% 20.5 125s 62 1776.00000 1765.00000 0.62% 20.4 130s |
| 736986 67068 cutoff | 76 | 1776.00000 1765.00000 0.62% 20.4 1365 |
| 766062 68646 1765.60640 | 68 | 65 1776.00000 1765.00000 0.62% 20.3 140s |
| 796686 69335 infeasible | 118 | 1776.00000 1765.00000 0.62% 20.3 145s |
| 828284 70065 infeasible | 127 | 1776.00000 1765.00000 0.62% 20.3 150s |
| 858657 70675 1770.36076 | 115 | 88 1776.00000 1765.00000 0.62% 20.3 156s |
| 890141 71871 1765.00000 | 66 | 40 1776.00000 1765.00000 0.62% 20.2 160s |
| 921286 71751 infeasible | 116 | 1776.00000 1765.00000 0.62% 20.2 165s |
| 952324 71116 infeasible | 110 | 1776.00000 1765.00000 0.62% 20.2 170s |
| 982742 70246 cutoff | 90 | 1776.00000 1765.00000 0.62% 20.2 1765 1776.00000 1765.00000 0.62% 20.1 175s |
| 1013397 69034 1769.35592 | | |
| 1013337 03034 1703.33332 | 0-1 | 75 1770.00000 1705.00000 0.020 20.1 1003 |

Cutting planes:
Learned: 5
Gomory: 22
Cover: 58
Implied bound: 8
Projected implied bound: 6

File: /home/zijie/Documents/2021Spr...Assignments/hw2/output_2_1.txtage 3 of 3

Clique: 3 MIR: 58 StrongCG: 1 Flow cover: 193 Inf proof: 86 Zero half: 32 RLT: 10

Relax-and-lift: 30

Explored 1013749 nodes (20363177 simplex iterations) in 180.01 seconds Thread count was 8 (of 8 available processors)

Solution count 6: 1776 1777 1782 ... 7533

Time limit reached

Best objective 1.776000000000e+03, best bound 1.765000000000e+03, gap 0.6194%