In [78]:
```
## IE 3311 Final Project Code File
## Team JMC
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```

In [26]:
```
from gerrychain import Graph
```

In [28]:
```
# Read Kansas county graph from .json file
filename = 'C:/Users/Mason/Downloads/COUNTY_20.json'

# Use built-in GerryChain function to read graph
G = Graph.from_json(filename )
```

In [29]:
```
# Impose a 1% population deviation (+/- 0.5%)
deviation = 0.01

import math
k = 4       # number of districts
total_population = sum(G.nodes[node]['TOTPOP'] for node in G.nodes)

L = math.ceil((1-deviation/2)*total_population/k)
U = math.floor((1+deviation/2)*total_population/k)
print("Using L =",L,"and U =",U,"and k =",k)
```

```
Using L = 709714 and U = 716845 and k = 4
```

In [30]:
```
import gurobipy as gp
from gurobipy import GRB

# Create model
m = gp.Model()

# Set variables
x = m.addVars(G.nodes, k, vtype=GRB.BINARY) # x[i,j] equals one when county i is assigned to district j
y = m.addVars(G.edges, vtype=GRB.BINARY)  # y[u,v] equals one when edge {u,v} is cut
```

In [31]:
```
# Objective is to minimize cut edges
m.setObjective( gp.quicksum( y[u,v] for u,v in G.edges ), GRB.MINIMIZE )
```

In [32]:
```
# Constraint: each county i is assigned to one district
m.addConstrs( gp.quicksum(x[i,j] for j in range(k)) == 1 for i in G.nodes)

# Constraint: each district has population at least L and at most U
m.addConstrs( gp.quicksum( G.nodes[i]['TOTPOP'] * x[i,j] for i in G.nodes) >= L for j in range(k) )
m.addConstrs( gp.quicksum( G.nodes[i]['TOTPOP'] * x[i,j] for i in G.nodes) <= U for j in range(k) )

# Constraint: edge {i,j} is cut if i is assigned to district v but j is not.
m.addConstrs( x[i,v] - x[j,v] <= y[i,j] for i,j in G.edges for v in range(k))

m.update()
```

In [33]:
```
# Add root variables: r[i,j] equals 1 if node i is the "root" of district j
r = m.addVars(G.nodes, k, vtype=GRB.BINARY)

# Add flow variables: f[u,v] = amount of flow sent across arc uv
#  Flows are sent across arcs of the directed version of G
import networkx as nx
DG = nx.DiGraph(G) # directed version of G
f = m.addVars(DG.edges, vtype=GRB.CONTINUOUS)
```

In [34]:
```
M = G.number_of_nodes() - k + 1

# Each district j should have one root
m.addConstrs( gp.quicksum( r[i,j] for i in DG.nodes) == 1 for j in range(k) )

# If node i is not assigned to district j, then it cannot be its root
m.addConstrs( r[i,j] <= x[i,j] for i in DG.nodes for j in range(k) )

# if not a root, consume some flow.
# if a root, only send out (so much) flow.
m.addConstrs( gp.quicksum( f[u,v] - f[v,u] for u in DG.neighbors(v) ) >= 1 - M * gp.quicksum( r[v,j] for j in r

# do not send flow across cut edges
m.addConstrs( f[i,j] + f[j,i] <= M * (1 - y[i,j]) for (i,j) in G.edges )

m.update()
```

In [35]:
```
# solve LP model
m.optimize()
```

```
Gurobi Optimizer version 10.0.3 build v10.0.3rc0 (win64)

CPU model: Intel(R) Core(TM) i5-8250U CPU @ 1.60GHz, instruction set [SSE2|AVX|AVX2]
Thread count: 4 physical cores, 8 logical processors, using up to 8 threads
```

```
Optimize a model with 1957 rows, 1629 columns and 7937 nonzeros
Model fingerprint: 0x0400fca7
Variable types: 526 continuous, 1103 integer (1103 binary)
Coefficient statistics:
  Matrix range     [1e+00, 5e+05]
  Objective range  [1e+00, 1e+00]
  Bounds range     [1e+00, 1e+00]
  RHS range        [1e+00, 7e+05]
Presolve time: 0.09s
Presolved: 1957 rows, 1629 columns, 7937 nonzeros
Variable types: 526 continuous, 1103 integer (1103 binary)

Root relaxation: objective 0.000000e+00, 756 iterations, 0.11 seconds (0.02 work units)

    Nodes    |    Current Node    |     Objective Bounds      |     Work
 Expl Unexpl |  Obj  Depth IntInf | Incumbent    BestBd   Gap | It/Node Time

     0     0    0.00000    0  436          -    0.00000      -     -    0s
     0     0    1.30605    0  447          -    1.30605      -     -    1s
     0     0    2.72272    0  444          -    2.72272      -     -    1s
     0     0    2.79273    0  440          -    2.79273      -     -    1s
     0     0    2.81053    0  438          -    2.81053      -     -    1s
     0     0    3.43741    0  437          -    3.43741      -     -    1s
     0     0    3.44585    0  439          -    3.44585      -     -    1s
     0     0    3.44585    0  439          -    3.44585      -     -    1s
     0     0    3.44803    0  438          -    3.44803      -     -    1s
     0     0    3.46093    0  439          -    3.46093      -     -    1s
     0     0    3.46093    0  437          -    3.46093      -     -    1s
     0     0    3.46093    0  436          -    3.46093      -     -    1s
     0     0    3.46093    0  445          -    3.46093      -     -    2s
     0     0    3.46093    0  445          -    3.46093      -     -    2s
     0     0    3.46093    0  437          -    3.46093      -     -    2s
     0     0    3.46093    0  438          -    3.46093      -     -    2s
     0     0    3.46093    0  439          -    3.46093      -     -    2s
     0     0    3.46093    0  441          -    3.46093      -     -    2s
     0     0    3.46093    0  438          -    3.46093      -     -    2s
     0     0    3.46093    0  438          -    3.46093      -     -    2s
     0     2    3.52166    0  436          -    3.52166      -     -    2s
   154   170   21.87642   19  330          -    5.93506      -   205    5s
  1064   984   20.52440   18  430          -    7.82777      -   113   10s
  1098  1016   16.55223   16  384          -    7.98426      -  12.5   15s
  1228  1104   34.27689   25  315          -   11.83827      -  44.3   20s
  1693  1454   57.54376   68   72          -   11.83827      -  70.4   25s
  2139  1702   66.36959  105   71          -   11.83827      -  80.4   30s
  2878  2062   23.44653   21  360          -   12.26374      -  90.1   35s
  3723  2572   46.44754   67  218          -   12.26374      -   100   40s
  4526  3222   21.26671   23  413          -   13.97271      -   107   45s
  5050  3530   40.30499   67   48          -   13.97271      -   111   52s
  5473  3958   20.36657   21  380          -   14.92428      -   113   55s
  6327  4966   43.10678   64  260          -   14.92428      -   116   61s
  7153  5526 infeasible  102               -   15.57184      -   118   65s
  8277  6325   48.65374   58  101          -   15.71056      -   117   71s
  9209  7302   42.05227   94  138          -   16.32493      -   118   76s
 10315  8117   36.19672   45   49          -   16.32493      -   116   81s
 11052  8747   29.94095   29  412          -   16.46038      -   117   85s
 11603  8812   48.67108   67   94          -   16.46038      -   117   90s
 12405  9873   26.14384   30  206          -   16.53876      -   116   95s
 13954 10944   24.19779   24  415          -   16.77343      -   113  100s
 15144 12134   72.59367   87  100          -   17.04811      -   112  106s
 16467 13140   41.24732   40  257          -   17.04811      -   111  111s
 17681 14197   32.27265   30  126          -   17.25301      -   111  117s
 18304 14523   52.22264   57  193          -   17.54748      -   112  120s
 19341 15557   60.00606   70  216          -   17.59053      -   113  127s
 20063 15623   30.72852   32  360          -   17.63534      -   114  133s
 20205 16515   41.32907   38  238          -   17.63534      -   114  137s
 21189 17334   72.22009  105  102          -   17.74536      -   114  141s
 22137 18109   54.04029   58   49          -   17.85161      -   113  145s
 23978 19422   63.25799  100  109          -   18.01462      -   112  154s
 24693 20168   45.82840   51  199          -   18.15462      -   113  157s
 25553 20721   22.16040   25  363          -   18.15462      -   113  161s
 26993 21979   40.29452   39  224          -   18.24997      -   113  168s
 27879 22495   59.57904   80  284          -   18.28116      -   113  172s
 28508 23170   41.48857   43  387          -   18.33880      -   114  176s
 29345 23738   48.15093   96   24          -   18.34029      -   114  215s
 30025 24262   40.18934   49   81          -   18.48110      -   114  222s
 30689 25423   28.94069   22  388          -   18.54354      -   114  228s
 32125 25925   50.42351   50  217          -   18.54354      -   114  232s
 32752 26503   64.24235   97  173          -   18.64746      -   114  236s
 33515 27361   39.56286   53  291          -   18.78231      -   115  240s
 35444 28819   21.91843   20  325          -   18.90262      -   115  248s
 36339 29312 infeasible   99               -   18.92673      -   115  252s
 36894 29950   48.88747   60  113          -   19.03864      -   116  256s
 37652 30630   41.54030   37  262          -   19.09532      -   116  261s
 38500 31098 infeasible   77               -   19.15710      -   116  267s
 39150 31924   23.42636   24  457          -   19.15710      -   116  271s
 40134 32611   54.86598   79   50          -   19.24635      -   115  276s
 40909 33412   47.50348   77   28          -   19.35905      -   115  281s
 41919 33963   46.30766   72  240          -   19.43281      -   115  285s
 42602 34786   34.27503   31  344          -   19.49441      -   116  290s
```

```
43574 35646   40.81052   39  332          -   19.53872      -   116  295s
45477 37033   24.90683   21  432          -   19.56420      -   115  303s
46335 37288   54.45892   53   99          -   19.56420      -   115  308s
46636 37880   59.21764   61  168          -   19.61271      -   115  313s
47514 38761   45.70172   43  335          -   19.69484      -   116  317s
48555 39633   36.18565   32  258          -   19.75881      -   115  321s
49677 40257   22.69275   27  348          -   19.80059      -   115  325s
51311 41782   27.43655   37  152          -   19.84657      -   115  333s
52271 42387   24.41912   21  408          -   19.84657      -   115  337s
53041 43134   51.91890   50  192          -   19.95312      -   115  341s
53991 43976   41.51397   37  251          -   19.97664      -   115  345s
55680 45322   51.94576   50  185          -   19.99903      -   114  353s
56642 45988 infeasible  123               -   20.03303      -   114  356s
57459 46093   45.21030   46  251          -   20.06541      -   114  361s
58419 47238   67.74675   96  110          -   20.06934      -   115  368s
59035 47973   42.69291   70  204          -   20.14370      -   115  372s
59904 48565   44.10345   58  279          -   20.18053      -   115  376s
60747 49220   34.59173   40   46          -   20.24755      -   115  380s
62410 50894   24.61437   32  290          -   20.29192      -   115  388s
63487 51568   56.92503  127   81          -   20.31756      -   115  392s
64375 52265   57.45762   75  219          -   20.33302      -   115  396s
66110 53380   56.70551   69  266          -   20.41176      -   114  403s
66835 54013   41.24512   46   57          -   20.41790      -   114  406s
68240 54728   33.26958   36  282          -   20.46487      -   114  415s
69267 55969 infeasible   87               -   20.47607      -   114  422s
70044 56728   49.08064   63  155          -   20.51582      -   114  426s
70974 57257   34.32715   28  328          -   20.54931      -   114  430s
72394 58591   40.58952   39  324          -   20.59504      -   114  437s
73320 59190 infeasible   96               -   20.61687      -   114  440s
74068 59881   36.49746   56  243          -   20.64285      -   114  445s
75889 61328   26.21577   36  126          -   20.69044      -   114  453s
76628 61810   40.38824  114   45          -   20.70615      -   114  456s
77267 62457   38.52456   43  206          -   20.72596      -   115  461s
78017 62767   22.97413   24  391          -   20.72596      -   115  467s
78390 63520   33.93415   32  260          -   20.77235      -   115  471s
79348 64313   37.31193   36  161          -   20.84563      -   115  476s
80281 65146   25.84618   25  486          -   20.84563      -   115  480s
82111 66512   40.26505   81  212          -   20.89992      -   115  488s
82981 67239   35.44770   44  187          -   20.91461      -   115  492s
83904 68064   40.38840   49  228          -   20.93976      -   115  496s
85046 68429   34.39882   30  235          -   20.98229      -   114  500s
86282 69608   30.12481   28  344          -   20.99794      -   115  507s
87049 69890   71.06885   80  166          -   21.04239      -   115  512s
87381 70449   24.81966   26  381          -   21.04694      -   115  516s
88151 71169   36.01468   40  175          -   21.09050      -   115  520s
90107 72724   28.64541   24  325          -   21.09591      -   115  527s
90929 73161   55.82016   92   36          -   21.13733      -   115  531s
92316 74393   41.26737   47  226          -   21.16873      -   115  537s
93005 74874   33.53540   32  193          -   21.17328      -   115  540s
94184 76036   58.13383   66  307          -   21.18534      -   115  548s
95067 76706   42.11567   48  100          -   21.20515      -   115  552s
95888 76841   39.66161   39  449          -   21.20515      -   115  557s
96051 77511   40.73174   41  235          -   21.20515      -   115  561s
96841 78135   65.95431   96   54          -   21.23255      -   115  565s
98473 79281   37.45673   35  302          -   21.27489      -   115  573s
99216 80018   35.74315   36  162          -   21.29739      -   115  577s
100192 80729   27.76926   25  346          -   21.29739      -   115  581s
101858 82157   29.90814   29  326          -   21.31649      -   115  588s
102750 82754   56.19397   98  160          -   21.36016      -   115  592s
103506 83595   56.06954   59  152          -   21.38192      -   115  597s
104485 84276   40.31894   47  265          -   21.39262      -   115  600s
105907 85022   46.00050   48  312          -   21.42772      -   115  608s
106376 85728   48.28144   59  229          -   21.46467      -   115  612s
107286 86332   27.31102   23  465          -   21.47915      -   115  616s
108017 87000   30.76105   28  202          -   21.50573      -   115  620s
109726 88425   34.37557   59  291          -   21.53020      -   115  628s
110667 88930 infeasible   77               -   21.53673      -   115  632s
111320 89665   31.08358   38  231          -   21.56126      -   115  636s
112217 90393   38.04434   36  337          -   21.56126      -   115  640s
113871 91542   45.31396   57   99          -   21.59144      -   115  648s
114564 91920   54.31654   98  118          -   21.59144      -   115  654s
115107 92713   66.69412  127   34          -   21.59746      -   115  658s
116097 93504 infeasible   73               -   21.64064      -   115  661s
116994 94079   40.72416   38  318          -   21.64223      -   115  665s
118429 95254   33.01106   28  382          -   21.66158      -   115  673s
119237 95937   54.58101   54   87          -   21.66480      -   115  677s
120104 96635   28.72341   33  316          -   21.67949      -   115  682s
121030 97363   48.66149   64  109          -   21.67949      -   115  686s
121900 97547   57.61899  109   93          -   21.71386      -   115  692s
122171 98305   29.48795   47  306          -   21.71669      -   115  696s
123075 98978   46.72244   99   78          -   21.72421      -   115  700s
123912 99814   58.83138   52  104          -   21.75991      -   115  705s
125761 101109   30.68226   30  439          -   21.77629      -   115  713s
126578 101781   44.00569   53  301          -   21.79566      -   115  717s
127440 102387   35.67267   71  162          -   21.80354      -   115  721s
128202 102925   29.42654   32  372          -   21.80354      -   115  725s
129546 104069   32.86945   37  307          -   21.84720      -   115  733s
130298 104892   32.97506   29  453          -   21.84720      -   115  738s
131243 105584   73.50983  111   50          -   21.86938      -   115  742s
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132183 106047   41.11822   88   67          -   21.88577      -   115  748s
132752 106820   53.68683   75   67          -   21.90596      -   115  752s
133671 107321 infeasible  127               -   21.90991      -   115  756s
134280 108224   30.52340   30  285          -   21.92888      -   115  762s
135451 108619   41.71121   45  325          -   21.94151      -   115  769s
135918 109453   61.49539   67   73          -   21.94151      -   115  774s
137074 110239 infeasible  124               -   21.96776      -   115  779s
137994 111037   24.38551   33  371          -   21.98459      -   115  784s
138980 111667   44.20279   96   51          -   22.00404      -   115  788s
139782 112381 infeasible   80               -   22.00840      -   115  793s
140599 113022   40.82243   34  271          -   22.00840      -   115  797s
141430 113736   87.38331  117   85          -   22.04617      -   115  802s
142324 114295   56.73571   55  259          -   22.06830      -   115  806s
142989 114945   42.10681   43  118          -   22.08970      -   115  811s
143843 115268   35.80316   32  366          -   22.08970      -   115  817s
144279 115876   52.81552   58  190          -   22.10288      -   115  821s
145021 116652   28.83900   43  308          -   22.12401      -   115  825s
147053 118376   58.31443  105   19          -   22.16170      -   115  834s
148017 118959   52.81331   61  304          -   22.16288      -   115  838s
148721 119841   80.55395  100  154          -   22.20420      -   115  843s
149781 120517   48.53398   46  233          -   22.20962      -   115  847s
150730 120904   33.23031   33  366          -   22.22150      -   115  850s
152008 122197 infeasible  125               -   22.22356      -   115  857s
152847 122392   50.69977   51  136          -   22.23414      -   114  861s
153064 123124   53.87932   64  107          -   22.23414      -   114  865s
154620 124258 infeasible   66               -   22.26287      -   114  872s
155436 124882   79.82807  141   51          -   22.26379      -   114  877s
156246 125345   58.55447   68   78          -   22.26721      -   114  880s
157517 126467   40.62769   32  311          -   22.28691      -   115  888s
158137 127290   26.49008   30  399          -   22.31127      -   115  892s
159111 127835   44.41971   58  169          -   22.31380      -   114  895s
160683 128852   41.78011   82  124          -   22.31380      -   114  904s
161238 129381   42.16167   84   83          -   22.33165      -   114  908s
161891 129906   34.58045   29  337          -   22.33863      -   114  913s
162519 130534   27.84808   36  289          -   22.33863      -   114  918s
163401 131112   49.08586   62  391          -   22.34268      -   114  923s
164107 131887   33.60582   43  332          -   22.36668      -   114  928s
165149 132537   43.33400   48  336          -   22.38297      -   114  933s
165934 133199   46.16841   46  115          -   22.38938      -   114  937s
166745 133948   25.04496   25  284          -   22.40062      -   115  941s
167609 134483 infeasible   57               -   22.40467      -   115  946s
168300 135256   45.88259   48  346          -   22.40647      -   115  951s
169302 135470 infeasible   93               -   22.41347      -   115  956s
169572 136329   45.87345   48  138          -   22.41948      -   115  961s
170689 136927   29.40203   52   72          -   22.44529      -   115  965s
172099 138071   51.38871   68   77          -   22.46044      -   115  974s
172794 138724   36.57276   33  310          -   22.46261      -   115  978s
173586 139435   38.56924   48   64          -   22.47218      -   115  982s
174421 140028   40.18069   34  243          -   22.47818      -   115  986s
175228 140788   30.52707   32  160          -   22.48568      -   115  991s
176127 141535   55.20878   64  239          -   22.49835      -   115  995s
177853 142592   33.44470   32  325          -   22.52659      -   115 1004s
178459 143296   26.66806   27  384          -   22.53357      -   115 1009s
179355 144156   29.59011   35  389          -   22.54922      -   115 1014s
180461 144909   37.82073   50   50          -   22.55663      -   115 1019s
181392 145537   27.84149   29  370          -   22.56014      -   115 1023s
182165 146320   51.51056   58  107          -   22.58102      -   115 1028s
183224 146769   42.43053   36  285          -   22.59442      -   115 1034s
183700 147855   43.05874   36  266          -   22.59708      -   115 1039s
185038 148381   37.58634   35  231          -   22.61310      -   115 1043s
185737 148980   45.13742   56   71          -   22.62088      -   115 1047s
186434 149691   40.38061   53  282          -   22.62145      -   115 1051s
187368 150316   35.12500   34  114          -   22.62332      -   115 1055s
189108 151639   44.91625   53  334          -   22.63322      -   115 1063s
189856 152172   33.32223   35  381          -   22.63813      -   115 1067s
190494 152835   31.32254   29  357          -   22.65538      -   115 1071s
191402 153082   25.36225   22  467          -   22.65538      -   115 1076s
191705 153747   26.55973   24  227          -   22.65538      -   115 1080s
193333 154990   42.96067   45  282          -   22.68802      -   115 1088s
194138 155696   25.32394   29  430          -   22.69173      -   115 1093s
195079 156463   49.59633   83   96          -   22.70879      -   115 1097s
195986 157087   48.10052   66   61          -   22.71027      -   115 1101s
197388 158134   36.17844   44  325          -   22.72344      -   115 1108s
198163 158822   30.48903   31  423          -   22.72517      -   115 1112s
199014 159500   38.54584   41  204          -   22.73067      -   115 1116s
199833 160200   31.06434   32  151          -   22.74420      -   115 1120s
200715 160525   61.77924   96   33          -   22.74766      -   115 1125s
201775 161692   40.44930   49  240          -   22.75696      -   115 1133s
202642 162306   52.85460   50  147          -   22.76559      -   115 1137s
203392 162927   37.08248   36   85          -   22.76639      -   115 1142s
204133 163536   51.76144   60   53          -   22.77704      -   115 1145s
205753 164952   25.74552   26  385          -   22.79563      -   115 1154s
206917 165536   39.23245   39  139          -   22.81237      -   115 1157s
207609 166308   55.11383   80  265          -   22.81270      -   115 1161s
208554 166688   62.56976   81  239          -   22.82767      -   115 1165s
209017 167426   31.18860   30  379          -   22.83143      -   115 1170s
210645 168750   50.17799   67  259          -   22.85250      -   115 1178s
211600 169188   44.64566   48  205          -   22.85999      -   115 1182s
212177 169966   41.98622   53   69          -   22.88331      -   115 1186s
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213110	170609	52.82867	63	163	-	22.88922	-	115	1190s
213922	170853	62.73635	75	159	-	22.90204	-	115	1196s
214247	171616	24.39924	24	431	-	22.90337	-	115	1200s
215265	172265	58.34229	83	51	-	22.90859	-	115	1205s
216800	173670	53.69684	56	185	-	22.91543	-	115	1213s
218017	174325	infeasible	107		-	22.92707	-	115	1217s
218876	174987	38.92195	50	147	-	22.93781	-	115	1221s
220636	176142	43.75654	56	38	-	22.95949	-	115	1228s
221240	176939	57.06244	78	98	-	22.97139	-	115	1233s
222230	177640	47.64246	44	126	-	22.97139	-	115	1238s
223133	178075	58.10314	70	89	-	22.99235	-	115	1241s
223696	178723	32.17425	28	157	-	22.99748	-	115	1245s
225488	180071	44.53434	51	323	-	23.00534	-	115	1254s
226222	180703	47.68661	63	277	-	23.00647	-	115	1258s
226946	181520	39.35276	41	257	-	23.02273	-	115	1262s
228001	182105	30.09102	28	405	-	23.03708	-	115	1266s
228856	182607	27.36390	30	386	-	23.04118	-	115	1270s
230590	184360	33.78247	44	76	-	23.06438	-	115	1277s
231590	184486	36.05819	54	77	-	23.06443	-	115	1283s
231763	185081	37.38960	66	342	-	23.06662	-	115	1286s
232534	185715	27.60508	28	430	-	23.07443	-	115	1290s
234049	187054	41.27432	42	256	-	23.08284	-	115	1298s
234959	187646	36.61519	37	177	-	23.08284	-	115	1302s
235675	188186	54.18571	62	24	-	23.09731	-	115	1305s
237294	189476	26.06395	25	388	-	23.10196	-	115	1313s
237998	190236	61.53503	85	72	-	23.10911	-	115	1318s
239004	190738	53.89903	56	286	-	23.11283	-	115	1322s
239638	191411	37.40157	42	312	-	23.12374	-	115	1326s
240565	191861	48.02613	78	261	-	23.12380	-	115	1331s
241252	192487	25.50512	32	392	-	23.12380	-	115	1335s
242081	193084	53.00754	66	255	-	23.13433	-	115	1340s
243831	194612	51.33048	71	179	-	23.14431	-	115	1348s
244780	195353	42.03250	70	147	-	23.14728	-	115	1352s
245661	196138	49.32944	62	43	-	23.15649	-	115	1356s
246711	196806	53.77187	57	175	-	23.16442	-	115	1360s
247509	197014	26.36678	31	343	-	23.17020	-	115	1367s
247752	197802	27.40916	33	441	-	23.17020	-	115	1371s
248726	198563	52.58258	79	128	-	23.17020	-	115	1375s
250470	200062	48.61060	51	164	-	23.18831	-	115	1383s
251533	200743	52.95019	93	16	-	23.19468	-	115	1387s
252363	201499	53.74164	78	67	-	23.19657	-	115	1392s
253407	202086	28.78872	24	451	-	23.19907	-	115	1395s
254916	203212	89.73603	96	106	-	23.21616	-	115	1401s
255485	203859	47.15420	39	290	-	23.21775	-	115	1405s
257003	205100	54.58438	57	120	-	23.22436	-	115	1412s
257816	205618	48.00287	56	29	-	23.23408	-	115	1416s
258434	206000	38.79217	40	306	-	23.23928	-	115	1420s
260072	207484	40.70588	43	248	-	23.25137	-	115	1428s
260801	208091	45.82977	42	175	-	23.25395	-	115	1432s
261622	208672	69.95370	125	67	-	23.25395	-	115	1436s
262376	209239	38.25980	66	89	-	23.26716	-	115	1440s
263994	210664	infeasible	56		-	23.27265	-	115	1448s
264942	211215	40.88485	49	60	-	23.28385	-	115	1452s
265668	211821	27.54521	26	377	-	23.28831	-	115	1455s
266405	212188	58.79560	61	187	-	23.28831	-	115	1460s
267989	213484	infeasible	79		-	23.30941	-	115	1467s
268573	214148	39.87231	83	64	-	23.30941	-	115	1471s
270046	215305	44.24429	56	221	-	23.32816	-	115	1477s
270795	215728	infeasible	105		-	23.32862	-	115	1481s
271393	216401	41.38070	69	67	-	23.33399	-	115	1485s
273024	217725	28.03529	34	298	-	23.34338	-	115	1493s
273843	218280	40.88615	39	211	-	23.34471	-	115	1496s
274578	218659	38.70084	51	75	-	23.35219	-	115	1501s
275044	219078	36.31280	58	60	-	23.35219	-	115	1505s
276591	220468	53.79871	64	46	-	23.36126	-	115	1512s
277454	221194	48.49571	71	298	-	23.36132	-	115	1516s
278358	221876	39.63722	48	281	-	23.37166	-	115	1520s
280187	223197	26.01452	24	388	-	23.38063	-	115	1528s
281066	223778	infeasible	119		-	23.38360	-	115	1531s
281802	224081	infeasible	52		-	23.39659	-	115	1537s
282188	225871	27.30593	27	348	-	23.40197	-	115	1546s
284482	226571	64.09935	87	253	-	23.40955	-	115	1551s
285313	227029	32.24517	39	382	-	23.42145	-	115	1555s
286911	228202	27.57479	27	202	-	23.43403	-	115	1562s
287539	228844	40.69506	52	111	-	23.43619	-	115	1566s
288358	229390	41.72823	44	346	-	23.43856	-	115	1570s
290109	230832	48.94576	79	46	-	23.45486	-	115	1578s
290767	231013	infeasible	61		-	23.45528	-	115	1584s
290987	231764	46.82285	63	99	-	23.46005	-	115	1587s
291940	232238	46.30153	46	123	-	23.46248	-	115	1591s
292551	233021	51.97277	58	210	-	23.46819	-	115	1595s
294472	234282	25.57956	24	284	-	23.47575	-	115	1602s
295135	235050	45.19704	62	159	-	23.48533	-	115	1606s
296049	235906	50.56535	94	108	-	23.48854	-	115	1610s
297956	237361	infeasible	51		-	23.49318	-	115	1619s
298998	238071	38.52480	38	296	-	23.50066	-	115	1623s
299878	238639	37.70826	37	269	-	23.50408	-	115	1627s
300552	239299	33.44102	38	130	-	23.50483	-	115	1630s
301339	239589	71.52599	86	95	-	23.50483	-	115	1635s

301744	240217	infeasible	88		-	23.50495	-	115	1640s
302543	240944	55.10560	87	131	-	23.51546	-	115	1645s
304320	242229	34.93822	35	345	-	23.52613	-	115	1654s
305125	242823	35.55599	26	396	-	23.53029	-	115	1658s
305826	243412	51.84859	49	265	-	23.53497	-	115	1662s
306548	244075	35.38259	34	302	-	23.53884	-	115	1666s
307392	244617	infeasible	84		-	23.54133	-	115	1671s
308075	245242	41.74115	49	90	-	23.54943	-	115	1675s
309379	245995	34.72059	32	409	-	23.55738	-	115	1686s
309871	246718	49.71353	58	278	-	23.55997	-	115	1691s
310793	247303	28.87683	25	311	-	23.56386	-	115	1696s
311509	248061	53.01450	100	57	-	23.56987	-	115	1701s
312448	248910	53.67949	75	51	-	23.57526	-	115	1705s
314113	250065	34.60490	37	121	-	23.58065	-	115	1713s
314965	250642	36.24931	33	377	-	23.58121	-	115	1716s
315748	251170	27.74788	39	272	-	23.58880	-	115	1720s
317328	252394	67.49965	135	111	-	23.59058	-	115	1728s
318007	252618	44.31776	52	235	-	23.59209	-	115	1733s
318303	253420	48.67059	64	220	-	23.59538	-	115	1738s
319307	254115	46.72613	49	125	-	23.59594	-	115	1742s
320348	254485	44.52647	39	188	-	23.60094	-	115	1746s
320804	255191	70.16786	75	212	-	23.60104	-	115	1751s
321821	256052	28.71030	36	78	-	23.60104	-	115	1755s
323460	257183	36.69550	58	258	-	23.61875	-	115	1764s
324321	257925	41.71866	44	245	-	23.62220	-	115	1767s
325252	258632	26.67545	28	276	-	23.62240	-	115	1772s
326265	259074	29.78428	31	319	-	23.62833	-	115	1776s
326806	259761	52.17228	68	121	-	23.62833	-	115	1780s
327723	260429	60.49681	96	108	-	23.63633	-	115	1785s
328662	260660	44.37669	43	169	-	23.64545	-	115	1790s
328955	261368	46.18537	46	161	-	23.64560	-	115	1796s
329886	261922	47.94636	47	60	-	23.65495	-	115	1801s
330557	262719	33.84968	35	427	-	23.65669	-	115	1806s
331579	263562	38.40091	35	330	-	23.65977	-	115	1811s
332575	264403	62.47732	78	102	-	23.66428	-	115	1815s
333686	265015	40.20519	40	266	-	23.67165	-	115	1820s
335518	266442	40.31553	76	27	-	23.67451	-	115	1828s
336409	266695	46.95660	47	249	-	23.67857	-	115	1833s
336711	267547	54.03204	90	65	-	23.68092	-	115	1838s
337907	268021	infeasible	56		-	23.68096	-	115	1842s
338531	268755	47.51961	61	27	-	23.68428	-	115	1847s
339408	269288	106.39716	93	157	-	23.68523	-	115	1850s
340935	270455	48.13612	61	238	-	23.69858	-	115	1859s
341596	271121	33.97602	40	209	-	23.69973	-	115	1863s
342434	271722	26.10480	30	485	-	23.69973	-	115	1867s
343210	272379	53.81469	68	43	-	23.70607	-	115	1872s
344000	272843	44.46405	100	55	-	23.71625	-	115	1878s
344572	273708	40.47983	40	191	-	23.72185	-	115	1883s
345678	274288	54.11749	52	241	-	23.72554	-	115	1888s
346416	275096	31.54871	27	435	-	23.73351	-	115	1892s
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348367	276551	27.39532	30	432	-	23.74386	-	115	1901s
349194	277325	29.83394	32	162	-	23.74826	-	115	1905s
350217	277869	52.84183	73	85	-	23.75832	-	115	1910s
351864	279444	47.53681	60	45	-	23.76701	-	115	1918s
352971	279775	33.67641	50	43	-	23.77016	-	115	1923s
353365	280503	37.34273	68	179	-	23.77367	-	115	1928s
354290	280972	infeasible	57		-	23.77584	-	115	1932s
354865	281642	29.53211	41	220	-	23.77584	-	115	1935s
356583	282774	34.48437	71	275	-	23.78441	-	115	1943s
357282	283579	33.44629	34	318	-	23.78955	-	115	1948s
358297	284237	62.18333	63	88	-	23.78955	-	115	1952s
359132	284710	79.62078	111	85	-	23.79380	-	115	1955s
360600	285987	infeasible	40		-	23.80157	-	115	1963s
361298	286648	41.53972	46	236	-	23.80351	-	115	1966s
362088	287311	60.87756	94	93	-	23.80695	-	115	1971s
362945	287401	40.18847	41	308	-	23.81369	-	115	1977s
363083	288087	41.88930	43	153	-	23.81730	-	115	1981s
363890	288845	34.64197	46	49	-	23.81730	-	115	1985s
365572	290066	infeasible	91		-	23.82656	-	115	1992s
366490	290501	43.09997	51	183	-	23.83197	-	115	1995s
367032	291112	42.39084	41	124	-	23.83242	-	115	2000s
368614	292199	38.21612	36	82	-	23.83663	-	115	2008s
369206	292947	53.59226	67	257	-	23.83787	-	115	2013s
370250	293720	53.00000	112	24	-	23.84438	-	115	2018s
371187	294312	47.17739	82	30	-	23.84512	-	115	2022s
371924	295044	36.55883	35	285	-	23.84557	-	115	2028s
372901	295573	58.05499	75	34	-	23.84871	-	115	2033s
373601	296196	46.28380	41	199	-	23.85523	-	115	2037s
374308	296482	60.90392	73	258	-	23.85523	-	115	2043s
374652	297201	68.96524	86	79	-	23.85858	-	115	2048s
375584	297768	34.58657	56	123	-	23.86090	-	115	2053s
376355	298338	35.40091	34	463	-	23.86869	-	115	2057s
377032	299014	53.85882	80	246	-	23.87357	-	115	2062s
377904	299888	39.06495	29	353	-	23.87465	-	115	2067s
379073	300745	71.26917	88	78	-	23.88051	-	115	2071s
380162	301227	36.17935	47	78	-	23.88345	-	115	2076s
380750	301976	28.32273	30	314	-	23.88801	-	115	2080s
381643	302307	92.69946	99	97	-	23.88811	-	115	2085s

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382749 303626   65.20253   72  102          -   23.89666      -   115 2094s
383618 304340   37.48518   34  339          -   23.89776      -   115 2098s
384482 305121   67.21101  100   32          -   23.90413      -   115 2103s
385577 305621   37.95987   46  207          -   23.90730      -   115 2107s
386225 306428   32.32248   29  358          -   23.91417      -   115 2111s
387205 307141   55.74038   87  150          -   23.91633      -   115 2115s
388017 307836   61.25906   64  137          -   23.91907      -   115 2120s
388903 308172   37.75843   38  168          -   23.92117      -   115 2125s
389323 308835   51.54519   51  249          -   23.92284      -   115 2130s
390136 309639   37.23678   39   97          -   23.92950      -   115 2135s
391974 310899   39.29421   36  324          -   23.93405      -   115 2143s
392763 311711   83.30359  125   47          -   23.94035      -   115 2148s
393850 312378   51.42936   63  235          -   23.94388      -   115 2151s
394665 313050   41.58681   37  379          -   23.94666      -   115 2156s
396364 314389   35.13031   30  443          -   23.95930      -   115 2163s
397137 315097   38.72441   39  316          -   23.96333      -   115 2167s
397999 315378   40.39735   48   70          -   23.96599      -   115 2173s
398326 315946   44.33786   68   66          -   23.96838      -   115 2177s
399073 316584   42.76642   35  289          -   23.97155      -   115 2181s
399870 317246   72.49542   72  135          -   23.97614      -   115 2186s
400763 317858   46.30521   49   95          -   23.98189      -   115 2190s
402386 319116   34.13100   40  269          -   23.98824      -   115 2198s
403231 319839   24.71407   29  426          -   23.99146      -   115 2202s
404096 320711 infeasible   73               -   23.99511      -   115 2206s
405879 321806   52.28945   74  111          -   24.00030      -   115 2212s
406521 322309   53.07216   59  259          -   24.00609      -   115 2216s
407248 322534   49.57698   58  164          -   24.01595      -   115 2221s
407573 323204   30.67513   35  441          -   24.01654      -   115 2225s
408438 324081   30.66437   29  234          -   24.02163      -   115 2230s
410374 325225   53.24073   71   75          -   24.02646      -   115 2238s
410953 325947   45.06204   61  256          -   24.03686      -   115 2242s
411920 326876   37.45326   39  249          -   24.03844      -   115 2247s
413102 327390   27.62765   35  389          -   24.04215      -   114 2251s
413684 328144   24.79301   30  300          -   24.04319      -   114 2255s
414660 328737   35.31132   41  125          -   24.05143      -   114 2260s
415351 329481   42.76252   72  216          -   24.05279      -   114 2265s
417042 330652   38.74580   42  142          -   24.06277      -   114 2273s
417819 330925   42.28091   33  454          -   24.06284      -   114 2280s
418120 331899   62.23749   56  196          -   24.06411      -   114 2286s
419442 332493 infeasible  102               -   24.07216      -   114 2290s
420158 333337   59.41641   65  208          -   24.07792      -   114 2295s
421197 334172   53.03293   92   66          -   24.08102      -   114 2300s
423058 335236   58.80253   77  216          -   24.09196      -   114 2308s
423661 336013   33.54738   45  197          -   24.10039      -   114 2313s
424593 336710   56.59040   87   56          -   24.10046      -   114 2318s
425477 337257   52.70256   56  124          -   24.10673      -   114 2322s
426142 337982   39.12468   39  186          -   24.10913      -   114 2327s
427052 338666   38.84366   46  108          -   24.11301      -   114 2331s
427936 339368   70.30334   90  184          -   24.11804      -   114 2336s
428912 339787   56.08928   59   94          -   24.11950      -   114 2340s
429531 340050   47.28777   50  112          -   24.12450      -   114 2346s
429826 340698   49.70852   56   99          -   24.12450      -   114 2350s
430665 341311 infeasible   76               -   24.13065      -   114 2355s
432371 342665   55.40955   73   18          -   24.14065      -   114 2364s
433130 343650   44.84567   46  230          -   24.14282      -   114 2369s
434371 344246   49.79795   67  172          -   24.15155      -   114 2373s
435140 344796   48.36482   53   56          -   24.15437      -   114 2376s
435794 345335   40.56207   39  177          -   24.15437      -   114 2380s
437381 346681   43.84348   75  109          -   24.16342      -   114 2388s
438205 347273   37.64256   46   79          -   24.16651      -   114 2391s
438897 348112   49.98206   84  235          -   24.17253      -   114 2395s
439970 348293   40.38494   71  244          -   24.17253      -   114 2401s
441053 349561   43.14413   55  161          -   24.18089      -   114 2408s
441874 350077   53.31180   54   55          -   24.18710      -   114 2412s
442494 350752   46.11419   41  119          -   24.19210      -   114 2415s
444272 352051   62.76095   75  147          -   24.19839      -   114 2423s
444975 352571   36.23807   46   77          -   24.19915      -   114 2426s
445681 353280   46.25133   67  264          -   24.20329      -   114 2430s
447611 354603   79.72391  110   72          -   24.20748      -   114 2437s
448258 355358   46.69816   75  200          -   24.21537      -   114 2442s
449221 356111   39.70801   48  171          -   24.22045      -   114 2447s
450167 356313   47.14395   70  313          -   24.22526      -   114 2452s
450438 356990   33.47681   33  416          -   24.22526      -   114 2457s
451330 357569 infeasible   89               -   24.22705      -   114 2461s
452048 358346 infeasible   64               -   24.23516      -   114 2466s
453033 359090   53.12222   82   77          -   24.24186      -   114 2471s
454038 359720   46.57625   45  221          -   24.24631      -   114 2475s
455787 361419   51.44162   51  163          -   24.25168      -   114 2484s
456969 362222   59.05110   74   48          -   24.25524      -   114 2488s
457922 363069   40.73578   49   97          -   24.26051      -   114 2492s
459077 363711   45.54237   55   88          -   24.26240      -   114 2496s
459914 364263 infeasible   49               -   24.26577      -   114 2500s
460619 364721   53.77569   61  116          -   24.26764      -   114 2505s
462135 365883   42.16851   47   93          -   24.27267      -   114 2513s
462678 366860   45.51305   68  379          -   24.28204      -   114 2519s
464011 367431   27.79966   25  342          -   24.28895      -   114 2523s
464712 368336 infeasible   48               -   24.28895      -   114 2528s
465973 368793 infeasible  101               -   24.30084      -   114 2532s
466512 369555   54.27252   61  187          -   24.30201      -   114 2536s
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470241	372351	45.17305	49	276		-	24.31995	-	114	2558s
470986	372931	40.95002	46	75		-	24.32267	-	114	2562s
471712	373523	34.46035	35	152		-	24.32892	-	114	2566s
472454	374223	29.26745	30	295		-	24.32892	-	114	2570s
473363	375064	39.60709	70	225		-	24.33532	-	114	2575s
475123	376400	33.70357	38	136		-	24.34494	-	114	2583s
476015	377239	46.13288	72	84		-	24.34606	-	114	2587s
477011	377861	49.72412	56	258		-	24.35324	-	114	2591s
477842	378543	47.54786	57	73		-	24.35913	-	114	2595s
479480	379989	62.17562	66	80		-	24.36118	-	114	2603s
480428	380665	42.44578	54	68		-	24.36711	-	114	2607s
481316	380847	35.99217	37	200		-	24.36843	-	114	2612s
481526	381503	41.97386	46	131		-	24.37141	-	114	2615s
483176	382958	44.03733	43	156		-	24.38254	-	114	2623s
484182	383662	40.65394	45	129		-	24.38254	-	114	2627s
485079	384408	56.32228	68	52		-	24.38489	-	114	2630s
486948	385818	32.21719	32	361		-	24.38643	-	114	2637s
487762	386391	72.75725	104	60		-	24.39230	-	114	2641s
488533	386841	43.68377	52	55		-	24.39415	-	114	2645s
489899	387965	66.12286	106	74		-	24.40020	-	114	2652s
490688	388665	47.31277	47	194		-	24.40267	-	114	2656s
491624	389510	30.09566	28	444		-	24.40290	-	114	2660s
492616	389652	56.07196	64	252		-	24.40290	-	114	2666s
492832	390477	56.08470	65	235		-	24.40501	-	114	2670s
494827	391762	32.69163	40	114		-	24.41066	-	114	2678s
495549	392459	46.53990	72	263		-	24.41685	-	114	2681s
496474	393015	40.64997	40	57		-	24.41715	-	114	2685s
498106	394454	42.21474	61	61		-	24.42794	-	114	2692s
499055	395116	35.52750	64	322		-	24.43319	-	114	2695s
500657	396304	68.24119	102	69		-	24.43685	-	114	2702s
501367	396922	29.35781	29	368		-	24.43951	-	114	2706s
502117	397523	26.02979	33	246		-	24.44618	-	114	2710s
503567	398728	30.05941	43	67		-	24.45421	-	114	2718s
504354	398980	29.78718	28	403		-	24.45423	-	114	2723s
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506235	400822	41.75517	38	361		-	24.46213	-	114	2735s
507993	401860	70.06815	108	86		-	24.46321	-	114	2743s
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509516	403503	51.80487	104	161		-	24.47193	-	114	2751s
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511228	404666	31.81266	29	453		-	24.48035	-	114	2760s
512992	405783	58.60626	93	76		-	24.48518	-	114	2769s
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514254	406879	54.51485	68	254		-	24.49077	-	114	2776s
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517241	409563	49.64475	51	77		-	24.50751	-	114	2798s
518380	410267	30.20234	38	331		-	24.51013	-	114	2802s
519229	410978	infeasible	113			-	24.51150	-	114	2806s
520079	411928	47.47888	61	60		-	24.51652	-	114	2811s
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524128	414487	infeasible	47			-	24.52585	-	114	2828s
524787	415102	53.59745	78	94		-	24.52885	-	114	2832s
525491	415848	36.73169	96	178		-	24.53072	-	114	2836s
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541733	428503	39.51718	72	262		-	24.58542	-	114	2925s
543250	429803	35.68861	36	301		-	24.59027	-	114	2933s
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560856 443666   42.01209   55  234          -   24.65039      -   114 3028s
561770 444320   31.26116   34  269          -   24.65273      -   114 3031s
562605 444842   40.73094   42   88          -   24.65763      -   114 3035s
564024 446119 infeasible   69               -   24.66247      -   114 3043s
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565877 447493   31.30676   36  178          -   24.66953      -   114 3058s
566489 448415   48.29299   69   71          -   24.67003      -   114 3066s
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568442 449825   72.24761   90   58          -   24.68574      -   114 4076s
569452 450555   66.52982   87   78          -   24.68656      -   114 4081s
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576360 456178   40.24197   37  312          -   24.70901      -   114 4116s
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577752 456952 infeasible   56               -   24.71166      -   114 4125s
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581454 460041   61.76334   73   65          -   24.72280      -   114 4145s
583086 461174   47.71862   65   52          -   24.73481      -   114 4152s
583777 461817   51.09690   47  205          -   24.73717      -   114 4157s
584642 462452   42.39721   49  188          -   24.73717      -   114 4161s
586226 463461   68.46452   84  134          -   24.74322      -   114 4168s
587006 463629   37.97104   31  242          -   24.74381      -   114 4174s
587274 464344   35.40231   31  248          -   24.74381      -   114 4178s
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589952 466557   48.73451   49  288          -   24.75803      -   114 4190s
591784 467893   44.19099   36  316          -   24.76345      -   114 4198s
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594326 469876   45.78644   52   73          -   24.76894      -   114 4210s
596173 471171   38.14248   47  225          -   24.77224      -   114 4217s
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601786 475603   51.19097   66  251          -   24.79373      -   114 4245s
603195 476945   57.12731   66   70          -   24.79740      -   114 4252s
604149 477542 infeasible   66               -   24.80046      -   114 4255s
605737 478859   36.66624   47  247          -   24.80890      -   114 4262s
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673300 531391   57.12222   85  202          -   24.97791      -   114 4619s
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675221 532738   31.77843   36  275          -   24.98632      -   114 4627s
676094 533437   54.66940   71   59          -   24.98846      -   114 4632s
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681966 537651   58.39011   67  216          -   25.00262      -   114 4662s
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686270 541376   35.63897   46   61          -   25.01390      -   114 4685s
687628 542503   33.75805   42  345          -   25.01774      -   114 4692s
688545 543125   52.94126  117   92          -   25.02365      -   114 4696s
689357 543634   64.24451   53  135          -   25.02460      -   114 4700s
690833 544851   32.57707   34  119          -   25.02990      -   114 4707s
691521 545490   44.50869   52  287          -   25.03016      -   114 4711s
692338 545642 infeasible   94               -   25.03318      -   114 4718s
692500 546379   28.90638   28  459          -   25.03318      -   114 4722s
693449 547222   62.71466   70  122          -   25.03610      -   114 4726s
694483 547915   40.21149   41  244          -   25.04013      -   114 4730s
696344 549248   30.59911   35  418          -   25.04069      -   114 4738s
697096 549968   49.56217   70  282          -   25.04528      -   114 4742s
698013 550539   44.42164   49  250          -   25.04601      -   114 4746s
698739 551275   51.98821   56   99          -   25.04797      -   114 4750s
700243 552414   63.29105   91  143          -   25.05084      -   114 4758s
701161 553013   31.70298   30  446          -   25.05284      -   114 4761s
701858 553639   49.99968   74  238          -   25.05565      -   114 4765s
703338 554961   38.91035   71  199          -   25.05841      -   114 4773s
704316 555578   37.65185   37  340          -   25.06019      -   114 4777s
705133 555735   49.46021   71   47          -   25.06151      -   114 4782s
705330 556513   41.59237   41  170          -   25.06151      -   114 4786s
707039 557918   58.67442   75   38          -   25.06570      -   114 4793s
708015 558401   38.64533   35  313          -   25.06672      -   114 4797s
708676 558813   51.01045   61  245          -   25.06672      -   115 4801s
709281 559414   41.80245   90   30          -   25.06996      -   115 4805s
710921 560927   48.31009   49   95          -   25.07436      -   115 4813s
711972 561559 infeasible   51               -   25.07575      -   115 4817s
712729 562225   41.77440   52  272          -   25.07650      -   115 4821s
713642 562933   42.14895   47  231          -   25.07873      -   115 4825s
715101 563592   81.22444  113   58          -   25.08285      -   115 4834s
715385 564261   80.43803  120   90          -   25.08438      -   115 4838s
716432 564996   30.47194   31  400          -   25.08438      -   115 4843s
717349 565716   62.79739   91   49          -   25.08816      -   115 4847s
718292 566496   33.26313   33  179          -   25.09449      -   115 4851s
719266 567161   45.96170   54   83          -   25.09594      -   115 4855s
720966 568630   35.60903   50  253          -   25.10289      -   115 4863s
721920 569438   47.33010   56  221          -   25.10768      -   115 4867s
722932 569971   42.99663   54  189          -   25.10930      -   115 4871s
723600 570740   52.33340   89  179          -   25.11010      -   115 4875s
725461 571983   36.42238   47  114          -   25.11664      -   115 4883s
726177 572651   34.65146   44   74          -   25.11680      -   115 4887s
727025 572815   55.40357   74  237          -   25.11680      -   115 4893s
727196 573458 infeasible   98               -   25.12247      -   115 4897s
728120 574118   33.35762   33  295          -   25.12247      -   115 4901s
729521 575227   62.07963   99   59          -   25.12763      -   115 4909s
730399 575795   30.18962   35  350          -   25.12763      -   115 4912s
731107 576676   51.42984   66   51          -   25.13418      -   115 4916s
732163 577267   51.67071   70  239          -   25.13514      -   115 4921s
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732929	578029	42.75757	52	222	-	25.13572	-	115	4925s
734680	579427	41.96655	88	50	-	25.14153	-	115	4934s
735835	580014	48.88887	52	57	-	25.14690	-	115	4937s
736561	580874	48.43055	58	240	-	25.14777	-	115	4942s
737662	581528	35.22954	42	250	-	25.14918	-	115	4945s
738452	581784	42.16355	35	252	-	25.15005	-	115	4951s
738779	582576	60.45304	54	180	-	25.15122	-	115	4956s
740453	583728	37.81863	39	197	-	25.15490	-	115	4963s
741207	584512	51.27220	86	146	-	25.15870	-	115	4967s
742238	585104	36.87497	45	102	-	25.15886	-	115	4971s
742971	586114	37.77974	35	376	-	25.16251	-	115	4975s
744806	587137	49.68731	75	236	-	25.16769	-	115	4980s
746055	588188	72.29356	83	39	-	25.16937	-	115	4987s
746736	588714	50.98764	68	27	-	25.17245	-	115	4990s
748109	589506	30.97831	38	293	-	25.17370	-	115	4999s
748409	590143	31.44768	39	293	-	25.17557	-	115	5002s
749229	590819	43.95560	36	155	-	25.17625	-	115	5006s
750001	591568	40.56618	46	267	-	25.17783	-	115	5010s
751702	592614	42.14303	50	277	-	25.18270	-	115	5017s
752306	593289	43.61380	67	174	-	25.18365	-	115	5020s
754053	594619	33.48939	45	295	-	25.18562	-	115	5028s
754888	595145	53.54203	73	238	-	25.18868	-	115	5032s
755502	595806	29.16993	28	246	-	25.18868	-	115	5035s
756949	596416	32.02013	26	379	-	25.19552	-	115	5044s
757127	596974	32.12262	27	375	-	25.19552	-	115	5048s
757836	597691	infeasible	58		-	25.19553	-	115	5051s
759552	598784	30.02993	36	407	-	25.20011	-	115	5058s
760169	599377	33.51507	36	321	-	25.20045	-	115	5062s
760967	599917	38.54571	33	134	-	25.20412	-	115	5066s
761587	600624	50.52903	61	181	-	25.20685	-	115	5070s
763130	602040	39.82654	40	288	-	25.20945	-	115	5077s
764305	602778	74.82463	99	112	-	25.21333	-	115	5081s
765257	603292	43.37702	80	73	-	25.21533	-	115	5085s
766687	604632	43.08990	55	228	-	25.21956	-	115	5092s
767586	605077	infeasible	78		-	25.22102	-	115	5095s
769001	606031	69.56429	81	152	-	25.22541	-	115	5105s
770324	607336	34.31266	38	270	-	25.22978	-	115	5112s
771055	608056	31.45675	33	295	-	25.23235	-	115	5116s
772808	609299	34.02799	38	297	-	25.23725	-	115	5123s
773481	610137	40.70892	119	99	-	25.23873	-	115	5128s
774622	610612	32.98218	42	337	-	25.23873	-	115	5132s
775204	611336	infeasible	60		-	25.23947	-	115	5136s
776125	612067	54.52583	54	124	-	25.24234	-	115	5140s
778050	613270	infeasible	100		-	25.24771	-	115	5147s
778669	613449	42.35663	52	291	-	25.24771	-	115	5154s
778917	614037	45.75456	53	323	-	25.24771	-	115	5157s
779637	614652	infeasible	64		-	25.24771	-	115	5161s
780400	615436	68.48993	85	110	-	25.25206	-	115	5165s
782222	616661	39.02986	63	147	-	25.25496	-	115	5173s
782949	617357	infeasible	37		-	25.25757	-	115	5177s
783929	617971	42.66759	59	165	-	25.25799	-	115	5181s
784702	618755	35.41626	33	240	-	25.26097	-	115	5186s
785876	619346	28.66370	26	230	-	25.26160	-	115	5190s
787538	620648	33.33834	53	287	-	25.26482	-	115	5197s
788180	621431	45.36685	93	48	-	25.26701	-	115	5202s
789172	622208	46.53206	54	115	-	25.27019	-	115	5207s
790189	623016	infeasible	63		-	25.27191	-	115	5211s
791295	623605	33.82018	34	161	-	25.27214	-	115	5215s
792022	623848	55.93035	87	90	-	25.27311	-	115	5221s
792357	624769	28.32573	31	275	-	25.27602	-	115	5226s
794360	626146	55.24909	80	134	-	25.27768	-	115	5233s
795365	626728	infeasible	72		-	25.28191	-	115	5236s
796049	627454	52.84498	73	150	-	25.28219	-	115	5241s
797652	628415	36.13286	36	112	-	25.28692	-	115	5247s
798224	629009	30.01636	28	408	-	25.28754	-	115	5251s
798930	629684	58.81732	141	46	-	25.28860	-	115	5255s
800674	631136	53.16398	60	162	-	25.29324	-	115	5262s
801562	631880	80.44445	111	56	-	25.29504	-	115	5266s
802567	632539	34.35602	40	148	-	25.29514	-	115	5270s
804254	633410	51.81595	77	131	-	25.30100	-	115	5279s
804494	634398	35.30945	38	387	-	25.30237	-	115	5284s
805716	635006	28.46525	28	402	-	25.30474	-	115	5287s
806474	635789	57.01278	67	124	-	25.30602	-	115	5291s
807421	636604	43.33188	46	217	-	25.30950	-	115	5295s
809269	637956	28.84903	31	362	-	25.31522	-	115	5302s
810099	638456	39.94083	38	294	-	25.31588	-	115	5306s
811625	639565	58.51155	56	220	-	25.31887	-	115	5313s
812250	640235	75.27895	79	248	-	25.32038	-	115	5316s
813026	640729	49.25281	60	284	-	25.32374	-	115	5320s
814554	641704	44.64488	85	34	-	25.32606	-	115	5330s
815548	642867	34.07739	30	188	-	25.32886	-	115	5338s
816446	643581	infeasible	49		-	25.32961	-	115	5341s
817266	644261	42.80859	88	184	-	25.33399	-	115	5345s
818926	645517	31.49564	40	380	-	25.33715	-	115	5353s
819698	646405	30.20909	33	182	-	25.33770	-	115	5357s
820761	647099	41.51168	77	32	-	25.33786	-	115	5360s
822405	648263	48.74572	64	256	-	25.34091	-	115	5367s
823205	649059	29.09736	36	93	-	25.34510	-	115	5371s
824717	650171	39.15202	44	224	-	25.34728	-	115	5378s

825566	650286	35.77244	32	278	-	25.34731	-	115	5384s
825729	650693	37.73660	33	216	-	25.34731	-	115	5387s
826228	651255	60.16946	60	40	-	25.35127	-	115	5391s
827808	652719	37.44705	36	221	-	25.35400	-	115	5398s
828746	653234	62.03160	100	26	-	25.35487	-	115	5402s
829374	653872	41.00238	52	60	-	25.35794	-	115	5406s
830970	655161	infeasible	63		-	25.36193	-	115	5413s
831824	655865	49.50997	67	169	-	25.36237	-	115	5417s
832849	656583	38.44039	57	38	-	25.36546	-	115	5420s
834297	657746	51.33745	91	58	-	25.36631	-	115	5427s
835155	658290	infeasible	102		-	25.37088	-	115	5430s
836644	659361	28.77124	27	474	-	25.37351	-	115	5436s
837169	659592	47.04896	46	267	-	25.37351	-	115	5442s
837488	660288	63.30182	75	137	-	25.37825	-	115	5446s
838969	661426	42.22722	35	237	-	25.38116	-	115	5453s
839824	662161	63.04790	68	229	-	25.38397	-	115	5456s
840796	662658	50.78209	47	254	-	25.38430	-	115	5460s
842225	664026	54.34656	53	173	-	25.38838	-	115	5468s
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843809	665299	62.01214	81	50	-	25.39126	-	115	5475s
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846243	667070	65.65946	94	158	-	25.39377	-	115	5485s
847522	667931	infeasible	62		-	25.39797	-	115	5496s
848051	668998	infeasible	64		-	25.39968	-	115	5502s
849434	669789	67.29078	72	192	-	25.40297	-	115	5507s
850379	670606	27.26500	28	351	-	25.40500	-	115	5511s
851378	671215	30.78402	25	446	-	25.40500	-	115	5515s
852804	672499	43.31390	72	180	-	25.41222	-	115	5524s
853832	673375	48.14383	96	55	-	25.41424	-	115	5530s
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856653	675395	49.45021	59	312	-	25.42009	-	115	5544s
857626	676017	28.25687	29	440	-	25.42118	-	115	5548s
858398	676688	28.70558	37	299	-	25.42324	-	115	5552s
859325	677055	52.07873	73	47	-	25.42591	-	115	5558s
859846	677518	infeasible	53		-	25.42744	-	115	5563s
860409	678280	48.03264	84	43	-	25.42753	-	115	5568s
861400	679129	29.99380	32	413	-	25.42966	-	115	5574s
862515	679569	infeasible	80		-	25.43407	-	115	5577s
863053	680419	48.06337	61	68	-	25.43582	-	115	5582s
864162	680904	29.51870	40	220	-	25.43629	-	115	5585s
865701	682233	44.26215	66	224	-	25.43737	-	115	5592s
866567	682843	29.86760	34	197	-	25.43737	-	115	5596s
867289	682936	infeasible	111		-	25.44133	-	115	5604s
867438	683376	31.83584	36	137	-	25.44169	-	115	5607s
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868806	684680	51.32171	51	195	-	25.44392	-	115	5615s
870337	685854	44.40740	81	236	-	25.44958	-	115	5622s
871127	686270	43.42228	43	166	-	25.44958	-	115	5626s
871722	686710	infeasible	117		-	25.45188	-	115	5630s
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873736	688238	33.26776	38	352	-	25.45485	-	115	5642s
874357	688855	34.12994	41	188	-	25.45678	-	115	5648s
875146	689483	34.10407	33	426	-	25.45678	-	115	5652s
875862	690162	63.20725	77	64	-	25.45903	-	115	5657s
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877430	691366	29.12921	29	467	-	25.46172	-	115	5665s
878348	691611	52.66667	84	34	-	25.46172	-	115	5672s
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879535	692833	51.78752	71	313	-	25.46459	-	115	5680s
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882057	694753	33.85129	32	303	-	25.47158	-	115	5693s
882724	695608	36.20574	32	270	-	25.47209	-	115	5697s
883831	696362	41.78194	39	215	-	25.47607	-	115	5701s
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887278	698736	37.50023	40	347	-	25.48197	-	115	5716s
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894490	704553	36.38171	54	251	-	25.49822	-	115	5757s
895472	704695	infeasible	46		-	25.50051	-	115	5763s
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896801	706163	37.63136	35	387	-	25.50159	-	115	5771s
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907853	714554	45.22532	48	100	-	25.52733	-	115	5834s

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908095 715262   45.98851   49   98          -   25.52736      -   115 5839s
908951 716077   38.73447   43  305          -   25.52997      -   115 5844s
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910680 717421   46.69183   45  139          -   25.53505      -   115 5852s
911645 717948 infeasible   59               -   25.53540      -   115 5856s
912321 718706   30.73043   34  389          -   25.53706      -   115 5861s
913256 719373   60.84751   74  152          -   25.53840      -   115 5866s
914268 720079   32.58341   37  328          -   25.54192      -   115 5870s
916045 721369   26.70336   34  371          -   25.54557      -   115 5878s
916820 721816   31.77897   34  420          -   25.54643      -   115 5882s
917373 722348   37.41127   33  242          -   25.54718      -   115 5886s
918075 722958   32.83696   29  170          -   25.54930      -   115 5891s
918878 723180   27.45691   34  260          -   25.54930      -   115 5896s
919143 723742   45.05986   63  267          -   25.55200      -   115 5900s
920557 725049   38.97702   42  256          -   25.55643      -   115 5908s
921609 725463   43.48715   48  220          -   25.55689      -   115 5911s
922901 726664   34.80360   38  229          -   25.55909      -   115 5918s
923637 727328   56.32650   72   49          -   25.56079      -   115 5922s
924411 728020   39.94810   49  276          -   25.56211      -   115 5925s
925966 728661   55.68099   69  320          -   25.56235      -   115 5935s
927140 729859 infeasible   60               -   25.56701      -   115 5943s
927782 730472   46.85558   80  191          -   25.56827      -   115 5946s
928567 731182 infeasible   58               -   25.57065      -   115 5950s
930306 732780   56.30072   65  187          -   25.57328      -   115 5959s
931467 733549   48.22376   52  203          -   25.57535      -   115 5962s
932435 734092  108.31251  114   77          -   25.57802      -   115 5966s
933092 734768   49.66880   45  294          -   25.57897      -   115 5970s
934821 735892   39.63295   81  166          -   25.58107      -   115 5977s
935499 736591   31.93965   26  364          -   25.58146      -   115 5981s
936286 737393   60.68763   77   69          -   25.58321      -   115 5985s
937300 737544   29.78978   30  297          -   25.58631      -   115 5991s
937507 738147   35.19542   33  334          -   25.58631      -   115 5995s
939486 739794   30.37372   32  442          -   25.58939      -   115 6003s
940213 740468   26.93082   26  377          -   25.59197      -   115 6007s
941059 741040   41.07830   45  221          -   25.59197      -   115 6010s
942486 742316   50.73068   50  265          -   25.59728      -   115 6017s
943338 742896   70.64270   74  254          -   25.59728      -   115 6021s
944057 743592 infeasible   91               -   25.60286      -   115 6025s
945792 745061   46.38416   38  245          -   25.60480      -   115 6033s
946815 745301   44.76716   50   98          -   25.60724      -   115 6038s
947130 745830   28.97563   30  355          -   25.60742      -   115 6042s
947784 746489   33.45401   29  412          -   25.60793      -   115 6046s
948621 747388   64.28014   97  169          -   25.60834      -   115 6050s
950482 748829   34.06486   38  228          -   25.61801      -   115 6060s
952596 750147   40.63735   47  262          -   25.62087      -   115 6068s
953612 750888   34.42040   34  316          -   25.62346      -   115 6072s
954592 751536   32.85525   29  326          -   25.62429      -   115 6076s
956270 752823   27.10939   31  139          -   25.62765      -   115 6083s
957179 753068   28.90888   34  343          -   25.62985      -   115 6089s
957500 753836   29.02165   37  307          -   25.63022      -   115 6093s
958405 754834   28.80201   28  376          -   25.63022      -   115 6097s
959725 755410   48.35479   87   33          -   25.63312      -   115 6100s
961195 756645   30.53644   43  328          -   25.63917      -   115 6108s
962105 757177   35.00698   32  354          -   25.63957      -   115 6113s
962870 757858 infeasible   81               -   25.64304      -   115 6117s
963646 758513   45.62280   41  256          -   25.64402      -   115 6121s
964578 759229   34.96092   29  372          -   25.64530      -   115 6126s
966051 760337   51.45303   59   56          -   25.64981      -   115 6134s
967008 761100   47.03497   53  306          -   25.65099      -   115 6138s
967931 761647   41.25224   48  348          -   25.65268      -   115 6141s
968620 762195   59.60466   69  247          -   25.65310      -   115 6145s
969345 762420   40.17561   33  324          -   25.65651      -   115 6153s
969604 763196   53.29278   49  227          -   25.65682      -   115 6156s
970584 763704   37.74299   42  157          -   25.65783      -   115 6160s
971219 764479   37.12003   30  356          -   25.65929      -   115 6165s
973131 765647 infeasible   64               -   25.66531      -   115 6172s
973772 766375   47.77384   59  135          -   25.66732      -   115 6177s
974732 766948   45.66650   60  247          -   25.66838      -   115 6182s
975461 767584   34.47937   32  326          -   25.66879      -   115 6187s
976240 768432   32.93063   40  379          -   25.67196      -   115 6191s
977269 768988   40.97015   41  328          -   25.67347      -   115 6196s
978021 769481   36.10630   38  276          -   25.67347      -   115 6200s
978595 770053   44.99081   88  127          -   25.67665      -   115 6207s
979400 770654   34.78748   41  243          -   25.67869      -   115 6212s
980149 770882   31.15109   31  395          -   25.67949      -   115 6221s
980484 771668   31.93019   32  387          -   25.67949      -   115 6231s
981545 772628   80.23882   79  137          -   25.68573      -   115 6238s
982748 773298   45.55130   37  190          -   25.68707      -   115 6244s
983597 774065   32.74721   39  354          -   25.68707      -   115 6249s
984581 775050 infeasible   79               -   25.69054      -   115 6254s
985833 775572   34.55294   26  360          -   25.69054      -   115 6260s
986607 776209   82.89939   84   71          -   25.69490      -   115 6265s
987383 776805   32.85659   32  212          -   25.69553      -   115 6270s
988168 777625   41.15849   72  261          -   25.69705      -   115 6275s
989207 778195   38.54041   53   52          -   25.70049      -   115 6281s
989913 778786   42.31741   61   97          -   25.70152      -   115 6286s
990661 779440   31.72168   77   33          -   25.70206      -   115 6291s
991471 779985 infeasible   71               -   25.70245      -   115 6295s
992152 780752   33.12842   31  373          -   25.70521      -   115 6301s
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993078 781143   35.04276   35  231          -   25.70521      -   115 6307s
993515 781855   38.04610   36   85          -   25.70521      -   115 6312s
994413 782414 infeasible   54               -   25.70521      -   115 6318s
995162 783104 infeasible   61               -   25.70521      -   115 6324s
995978 783661   62.04899  106   58          -   25.71009      -   115 6329s
996722 784572   49.36547   54  171          -   25.71295      -   115 6334s
997851 785067   47.92253   44  245          -   25.71633      -   115 6339s
998449 786028   27.64129   28  382          -   25.71695      -   115 6344s
999619 786805   68.71324   80   46          -   25.71817      -   115 6348s
1000631 787406   49.04159   58  251          -   25.71929      -   115 6353s
1001309 788059   36.46346   33  335          -   25.71937      -   115 6357s
1002191 788580   55.31329   54  210          -   25.72175      -   115 6361s
1002853 788928 infeasible   82               -   25.72336      -   115 6366s
1003267 789591   33.15209   54   60          -   25.72404      -   115 6370s
1004958 791038   37.79226   45  351          -   25.72673      -   115 6378s
1005924 791696   40.55582   42  136          -   25.72692      -   115 6382s
1006869 792210   35.11475   39  350          -   25.73049      -   115 6386s
1007500 792915   37.33594   34  333          -   25.73077      -   115 6390s
1009215 794109   40.42741   56   91          -   25.73373      -   115 6398s
1009909 794853   44.50600   48   63          -   25.73540      -   115 6403s
1010911 795058   31.88789   29  354          -   25.73609      -   115 6410s
1011144 795704   40.82080   36  230          -   25.73667      -   115 6415s
1012992 797343 infeasible   79               -   25.74009      -   115 6424s
1014168 798360   44.35143   86  107          -   25.74136      -   115 6429s
1015365 799079   54.17867   67   74          -   25.74272      -   115 6432s
1016255 799689   47.98541   57  161          -   25.74276      -   115 6436s
1017001 800317   36.02449   40  351          -   25.74403      -   115 6441s
1017772 801136   41.55794   54  220          -   25.74701      -   115 6446s
1018808 801663   50.53419   86   39          -   25.74852      -   115 6450s
1019440 802189   55.17216   58  232          -   25.74852      -   115 6455s
1020121 802746   54.48461   84  115          -   25.75056      -   115 6460s
1021418 803781 infeasible   39               -   25.75354      -   115 6469s
1022291 804469   59.06832   67  311          -   25.75613      -   115 6473s
1023142 805021   70.01503   89  258          -   25.75689      -   115 6476s
1023834 805765   52.77236   62  193          -   25.75837      -   115 6481s
1024773 805840 infeasible   51               -   25.75837      -   115 6487s
1024885 806548 infeasible   52               -   25.75922      -   115 6492s
1025765 807285   39.58138   48  182          -   25.76131      -   115 6497s
1026828 808046   31.63641   38  263          -   25.76162      -   115 6502s
1027774 808565   40.27028   86   59          -   25.76170      -   115 6506s
1028473 809187   49.61793   51  245          -   25.76354      -   115 6511s
1029293 809930   33.89832   33  342          -   25.76354      -   115 6516s
1030179 810551   54.11289   79  146          -   25.76533      -   115 6520s
1030984 810931   44.11694   49  270          -   25.76611      -   115 6525s
1032560 812438   41.00230   52   73          -   25.76934      -   115 6533s
1033481 813024   57.80882  107   21          -   25.77048      -   115 6537s
1034244 813566   49.99552   52  151          -   25.77237      -   115 6541s
1034906 814214   32.19745   42  331          -   25.77300      -   115 6545s
1035772 814748 infeasible   80               -   25.77379      -   115 6550s
1037127 815546   42.07353   53  135          -   25.77541      -   115 6561s
1037464 816372   44.00490   67  281          -   25.77636      -   115 6566s
1038468 816927   42.44919   51  286          -   25.77730      -   115 6571s
1039146 817799   27.93083   35  405          -   25.77904      -   115 6577s
1040309 818526   32.08401   25  405          -   25.77952      -   115 6582s
1041207 819042   67.12883   92  124          -   25.78052      -   115 6586s
1042481 820222   34.33075   33  374          -   25.78300      -   115 6593s
1043402 820932   70.08141   75  139          -   25.78384      -   115 6597s
1044378 821388   53.05611   70  182          -   25.78570      -   115 6601s
1045008 822060   41.25552   44  137          -   25.78714      -   115 6605s
1046765 823004   31.92040   47  226          -   25.78923      -   115 6614s
1047115 823743   31.24624   27  447          -   25.78923      -   115 6619s
1048042 824256   60.36915   78  123          -   25.79333      -   115 6622s
1048672 824930   52.32857   58  158          -   25.79518      -   115 6626s
1049552 825558   53.43376   69  245          -   25.79705      -   115 6630s
1050992 826713   48.41809   56  296          -   25.79988      -   115 6638s
1051788 827151   36.37885   34  324          -   25.80024      -   115 6643s
1052358 827688   27.94691   31  168          -   25.80239      -   115 6646s
1053038 828436   37.62061   45  313          -   25.80428      -   115 6651s
1054016 828547   59.75142  130   39          -   25.80568      -   115 6658s
1054152 829077   37.59714   50  258          -   25.80629      -   115 6663s
1054771 829621   42.07512   41   77          -   25.80690      -   116 6668s
1055498 830209   51.46540   58  184          -   25.80801      -   116 6672s
1056317 830786   40.98567   56  226          -   25.80996      -   116 6677s
1057066 831477   45.35536   65  201          -   25.81243      -   116 6682s
1057909 832214   58.88876   60  240          -   25.81489      -   116 6688s
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1063708 836870   34.94487   45  235          -   25.82274      -   116 6725s
1064707 837617   32.50952   30  423          -   25.82675      -   116 6730s
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1067801 839986   48.65139   58  222          -   25.83239      -   116 6743s
1068735 840692   36.20675   38  285          -   25.83443      -   116 6746s
1069618 841204   82.14216   84  180          -   25.83632      -   116 6750s
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1071741 843050 infeasible   53               -   25.83847      -   116 6761s
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 1072727 843691 infeasible   89               -   25.84078      -   116 6765s
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 1075297 845765   72.85706   84   63          -   25.84336      -   116 6783s
 1076257 846593   54.58938   66   32          -   25.84393      -   116 6787s
 1077242 846958   36.76446   34  333          -   25.84393      -   116 6791s
 1077759 847687   46.49322   47  112          -   25.84730      -   116 6795s
 1079377 848739   52.58291   71  169          -   25.84775      -   116 6801s
 1080079 849284   43.09785   55   64          -   25.84961      -   116 6805s
 1081463 850363   30.11992   44  293          -   25.85151      -   116 6813s
 1082188 850847   39.09260   42  118          -   25.85372      -   116 6816s
 1082858 851582   35.10337   47   63          -   25.85507      -   116 6820s
 1083790 851699   33.91187   33  213          -   25.85754      -   116 6826s
 1083978 852382   34.66835   35  208          -   25.85804      -   116 6830s
H1083994 102719                      35.0000000   25.85804  26.1%   116 6834s
 1084829 102284     cutoff   69        35.00000   25.86171  26.1%   116 6838s
 1085469 102491     cutoff   32        35.00000   25.86918  26.1%   116 6842s
 1086229 102678   30.61276   40  119   35.00000   25.87596  26.1%   116 6846s
 1086857 102951   28.68046   42  263   35.00000   25.88598  26.0%   116 6850s
 1088251 103153   33.00426   32  275   35.00000   25.90513  26.0%   116 6855s
 1089017 103528     cutoff   34        35.00000   25.91210  26.0%   116 6864s
 1089709 103686   27.56278   37  355   35.00000   25.91975  25.9%   116 6870s
 1090230 103790   32.76978   32  322   35.00000   25.92301  25.9%   116 6875s
 1090695 103886     cutoff   30        35.00000   25.92597  25.9%   116 6885s
 1090932 104015     cutoff   33        35.00000   25.92787  25.9%   116 6892s
 1091376 104094   28.73201   31  376   35.00000   25.93300  25.9%   116 6899s
 1091652 104183   32.37723   27  431   35.00000   25.93812  25.9%   116 6909s
 1091956 104272   29.57487   31  270   35.00000   25.94617  25.9%   116 6918s
 1092203 104367   31.68100   29  331   35.00000   25.94759  25.9%   116 6926s
 1092566 104455   29.66198   28  362   35.00000   25.95432  25.8%   116 6936s
H1092711 86720                       34.0000000   25.95594  23.7%   116 6936s
 1092868 86857   31.16770   27  401   34.00000   25.96007  23.6%   116 6942s
 1093492 86925   32.08951   30  316   34.00000   25.96857  23.6%   116 6952s
 1093738 86971     cutoff   41        34.00000   25.97271  23.6%   116 6959s
 1094266 87045     cutoff   37        34.00000   25.97723  23.6%   116 6968s
 1094617 87199   29.31376   30  440   34.00000   25.97881  23.6%   116 6976s
 1095312 87273     cutoff   44        34.00000   25.99226  23.6%   116 6987s
 1095696 87426   30.68713   34  352   34.00000   25.99241  23.6%   116 6995s
H1095802 70340                       33.0000000   25.99317  21.2%   116 6995s
 1096244 70353   31.17492   35  274   33.00000   25.99884  21.2%   116 7005s
 1096388 70510   30.53496   40  278   33.00000   26.00469  21.2%   116 7013s
 1097241 70579   30.95742   42  276   33.00000   26.01889  21.2%   116 7022s
 1097617 70630   30.95083   27  353   33.00000   26.02406  21.1%   116 7028s
 1097912 70864   30.98717   38  120   33.00000   26.02942  21.1%   116 7041s
 1099498 71003   27.85925   32  162   33.00000   26.05671  21.0%   116 7048s
 1100298 71176   29.94481   29  395   33.00000   26.06896  21.0%   116 7056s
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H1101616 55565                       32.0000000   26.08162  18.5%   116 7062s
 1101934 55561   29.88399   28  446   32.00000   26.08807  18.5%   116 7069s
 1102510 55624   30.00317   27  359   32.00000   26.09642  18.4%   116 7077s
 1103188 55656     cutoff   37        32.00000   26.10825  18.4%   116 7084s
 1103955 55724   30.98270   46  236   32.00000   26.12889  18.3%   116 7093s
 1104704 55784   30.22141   28  318   32.00000   26.13474  18.3%   116 7102s
 1105441 55812     cutoff   44        32.00000   26.14538  18.3%   116 7110s
 1105957 55832     cutoff   37        32.00000   26.15526  18.3%   116 7118s
 1106538 55842   30.38736   31  353   32.00000   26.16914  18.2%   116 7129s
 1107218 55883     cutoff   36        32.00000   26.18893  18.2%   116 7138s
 1108029 55913   28.21972   34  301   32.00000   26.19526  18.1%   116 7147s
 1108680 55948   30.36764   26  449   32.00000   26.22039  18.1%   116 7155s
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 1112249 56051   30.13250   26  382   32.00000   26.29631  17.8%   116 7201s
 1114120 56100   29.16773   25  431   32.00000   26.32081  17.7%   116 7209s
 1114643 56099   29.86516   28  389   32.00000   26.33966  17.7%   116 7223s
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 1114706 56101   29.57068   34  392   32.00000   26.35028  17.7%   116 7253s
 1114740 56157   30.89405   35  289   32.00000   26.35090  17.7%   116 7262s
 1115807 56172     cutoff   26        32.00000   26.36898  17.6%   116 7271s
 1116943 56212     cutoff   31        32.00000   26.38686  17.5%   116 7279s
 1117787 56249   30.29862   32  279   32.00000   26.39819  17.5%   116 7285s
 1118769 56280     cutoff   38        32.00000   26.41681  17.4%   116 7293s
 1119400 56316     cutoff   27        32.00000   26.42424  17.4%   116 7301s
 1120486 56326   29.45760   37  423   32.00000   26.44668  17.4%   116 7307s
 1121501 56342     cutoff   33        32.00000   26.46518  17.3%   116 7315s
 1122267 56345   30.22468   28  404   32.00000   26.47373  17.3%   116 7321s
 1123351 56337   28.13327   29  311   32.00000   26.49843  17.2%   116 7327s
 1124338 56354     cutoff   37        32.00000   26.51143  17.2%   116 7334s
 1125226 56353   29.61587   43  363   32.00000   26.53188  17.1%   116 7340s
 1126160 56379     cutoff   31        32.00000   26.55037  17.0%   116 7346s
 1127106 56403   30.36056   30  394   32.00000   26.56828  17.0%   116 7350s
 1127584 56393     cutoff   36        32.00000   26.57461  17.0%   116 7357s
 1128548 56389   28.85208   36  131   32.00000   26.59253  16.9%   116 7362s
 1129395 56386     cutoff   35        32.00000   26.60613  16.9%   116 7368s
 1130174 56384     cutoff   28        32.00000   26.62206  16.8%   116 7373s
 1130970 56372   29.98815   29  446   32.00000   26.63833  16.8%   116 7378s
 1131799 56359   28.92717   33  355   32.00000   26.65548  16.7%   116 7383s
 1132585 56330     cutoff   29        32.00000   26.67111  16.7%   116 7389s
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1133368	56318	29.90027	31	381	32.00000	26.68897	16.6%	116 7395s
1134099	56323	29.82999	33	383	32.00000	26.70291	16.6%	116 7400s
1134905	56286	29.34674	34	362	32.00000	26.72081	16.5%	116 7405s
1135644	56287	cutoff	36		32.00000	26.73504	16.5%	116 7411s
1136501	56301	infeasible	48		32.00000	26.75176	16.4%	116 7416s
1137304	56252	30.51845	46	350	32.00000	26.76673	16.4%	116 7422s
1138107	56230	cutoff	28		32.00000	26.77754	16.3%	116 7428s
1138944	56207	28.91697	30	135	32.00000	26.79302	16.3%	116 7434s
1139705	56211	28.93026	31	335	32.00000	26.81204	16.2%	116 7440s
1140530	56184	cutoff	30		32.00000	26.82576	16.2%	116 7446s
1141373	56164	29.99980	29	403	32.00000	26.84326	16.1%	116 7451s
1142193	56134	29.44415	25	387	32.00000	26.85565	16.1%	116 7457s
1142911	56082	30.31021	30	412	32.00000	26.87055	16.0%	116 7462s
1143715	56042	30.40012	30	416	32.00000	26.88699	16.0%	116 7468s
1144475	56022	29.36670	26	450	32.00000	26.90255	15.9%	116 7473s
1145291	55999	cutoff	29		32.00000	26.91921	15.9%	116 7479s
1146131	55947	30.63375	31	314	32.00000	26.93361	15.8%	117 7485s
1146939	55947	30.81233	32	443	32.00000	26.94690	15.8%	117 7491s
1147795	55953	cutoff	32		32.00000	26.96291	15.7%	117 7498s
1148154	55915	cutoff	35		32.00000	26.96513	15.7%	117 7504s
1149034	55884	28.47304	24	413	32.00000	26.98447	15.7%	117 7510s
1149936	55828	30.14139	34	255	32.00000	26.99998	15.6%	117 7516s
1150746	55800	cutoff	35		32.00000	27.01726	15.6%	117 7521s
1151575	55761	30.10645	26	379	32.00000	27.03217	15.5%	117 7527s
1152431	55726	30.80906	30	175	32.00000	27.04907	15.5%	117 7533s
1153268	55711	cutoff	29		32.00000	27.06453	15.4%	117 7541s
1153766	55676	30.96895	33	196	32.00000	27.06923	15.4%	117 7547s
1154651	55602	30.30871	26	421	32.00000	27.08636	15.4%	117 7552s
1155395	55565	cutoff	41		32.00000	27.10695	15.3%	117 7558s
1156257	55556	cutoff	35		32.00000	27.12140	15.2%	117 7565s
1156464	55494	cutoff	26		32.00000	27.12593	15.2%	117 7571s
1157314	55441	29.55626	31	382	32.00000	27.14356	15.2%	117 7578s
1158200	55375	30.46074	25	439	32.00000	27.16135	15.1%	117 7583s
1159048	55294	29.46787	36	283	32.00000	27.17694	15.1%	117 7590s
1159924	55234	29.15719	31	357	32.00000	27.19955	15.0%	117 7595s
1160764	55140	30.77066	40	101	32.00000	27.21438	15.0%	117 7601s
1161547	55085	cutoff	35		32.00000	27.23258	14.9%	117 7607s
1162465	55031	30.29679	29	381	32.00000	27.24614	14.9%	117 7613s
1163266	54957	cutoff	37		32.00000	27.26388	14.8%	117 7619s
1164038	54883	30.44353	31	409	32.00000	27.27983	14.8%	117 7626s
1164853	54795	30.24378	35	388	32.00000	27.29771	14.7%	117 7632s
1165701	54740	30.34038	28	347	32.00000	27.31641	14.6%	117 7637s
1166518	54650	29.44746	28	400	32.00000	27.33560	14.6%	117 7643s
1167416	54593	30.69184	30	372	32.00000	27.35209	14.5%	117 7649s
1168193	54531	cutoff	40		32.00000	27.36639	14.5%	117 7655s
1169033	54425	cutoff	34		32.00000	27.38205	14.4%	117 7661s
1169767	54351	30.69316	34	313	32.00000	27.39557	14.4%	117 7667s
1170586	54248	29.98768	38	392	32.00000	27.41589	14.3%	117 7672s
1171412	54144	cutoff	35		32.00000	27.43483	14.3%	117 7678s
1172236	54046	30.01966	45	188	32.00000	27.45005	14.2%	117 7684s
1173052	53978	29.69813	38	259	32.00000	27.46600	14.2%	117 7691s
1173876	53857	cutoff	31		32.00000	27.48007	14.1%	117 7697s
1174696	53770	30.17387	30	380	32.00000	27.49725	14.1%	117 7703s
1175471	53659	cutoff	26		32.00000	27.51078	14.0%	117 7709s
1176283	53561	cutoff	30		32.00000	27.53048	14.0%	117 7715s
1177160	53477	cutoff	36		32.00000	27.54646	13.9%	117 7721s
1177964	53354	29.77733	35	299	32.00000	27.56436	13.9%	117 7726s
1178804	53270	cutoff	30		32.00000	27.58233	13.8%	117 7732s
1179681	53178	cutoff	47		32.00000	27.59894	13.8%	117 7738s
1180400	53097	cutoff	27		32.00000	27.61250	13.7%	117 7745s
1180879	52975	30.13946	40	351	32.00000	27.61658	13.7%	117 7751s
1181673	52862	30.72041	34	194	32.00000	27.63671	13.6%	117 7757s
1182547	52744	29.73075	31	387	32.00000	27.65765	13.6%	117 7763s
1183353	52658	cutoff	29		32.00000	27.67658	13.5%	117 7769s
1184221	52551	30.78648	26	391	32.00000	27.69394	13.5%	117 7774s
1184994	52444	cutoff	30		32.00000	27.71015	13.4%	117 7780s
1185884	52339	cutoff	33		32.00000	27.72636	13.4%	117 7786s
1186709	52205	30.41044	41	246	32.00000	27.74245	13.3%	117 7793s
1187493	52053	30.34134	38	274	32.00000	27.75824	13.3%	117 7798s
1188227	51874	29.59604	29	449	32.00000	27.77161	13.2%	117 7805s
1189040	51727	cutoff	35		32.00000	27.78987	13.2%	117 7811s
1189871	51563	cutoff	37		32.00000	27.80978	13.1%	117 7817s
1190656	51412	cutoff	25		32.00000	27.82339	13.1%	117 7823s
1191361	51239	cutoff	31		32.00000	27.84442	13.0%	117 7829s
1192079	51056	30.41671	33	177	32.00000	27.86384	12.9%	117 7835s
1192821	50896	29.27497	34	349	32.00000	27.88167	12.9%	117 7842s
1193599	50715	cutoff	26		32.00000	27.90169	12.8%	117 7848s
1194406	50602	cutoff	31		32.00000	27.91864	12.8%	117 7854s
1195277	50441	30.77647	34	460	32.00000	27.93774	12.7%	117 7860s
1196111	50281	cutoff	33		32.00000	27.95676	12.6%	117 7866s
1196924	50096	29.99076	39	276	32.00000	27.97819	12.6%	118 7872s
1197759	49927	cutoff	40		32.00000	27.99454	12.5%	118 7878s
1198635	49774	infeasible	23		32.00000	28.01482	12.5%	118 7884s
1199306	49587	cutoff	27		32.00000	28.02987	12.4%	118 7890s
1200170	49408	29.61848	29	407	32.00000	28.04889	12.3%	118 7897s
1200982	49231	30.53378	30	399	32.00000	28.06661	12.3%	118 7903s
1201845	49050	29.92618	43	289	32.00000	28.08385	12.2%	118 7909s
1202602	48843	cutoff	31		32.00000	28.09928	12.2%	118 7915s
1203403	48683	30.80100	31	420	32.00000	28.12208	12.1%	118 7921s

```
 1204291 48476     cutoff   35        32.00000   28.13956  12.1%   118 7927s
 1205049 48254   30.82484   33  248   32.00000   28.15486  12.0%   118 7933s
 1205802 48036   30.86081   32  394   32.00000   28.17936  11.9%   118 7939s
 1206618 47878     cutoff   38        32.00000   28.20221  11.9%   118 7947s
 1207054 47706     cutoff   24        32.00000   28.21244  11.8%   118 7953s
 1207989 47500   29.84613   35  118   32.00000   28.23352  11.8%   118 7960s
 1208769 47286     cutoff   39        32.00000   28.25060  11.7%   118 7966s
 1209580 47029     cutoff   29        32.00000   28.27218  11.6%   118 7972s
 1210442 46824 infeasible   37        32.00000   28.29097  11.6%   118 7979s
 1211176 46610   30.67670   26  429   32.00000   28.30698  11.5%   118 7985s
 1212020 46376   29.93068   47  281   32.00000   28.32825  11.5%   118 7991s
 1212792 46110   30.47377   33  207   32.00000   28.34979  11.4%   118 7997s
 1213614 45860   30.91327   38  324   32.00000   28.36952  11.3%   118 8004s
 1214415 45617     cutoff   35        32.00000   28.39504  11.3%   118 8010s
 1215171 45357     cutoff   35        32.00000   28.41157  11.2%   118 8016s
 1215968 45058     cutoff   30        32.00000   28.43349  11.1%   118 8023s
 1216807 44799     cutoff   29        32.00000   28.45508  11.1%   118 8030s
 1217485 44505     cutoff   27        32.00000   28.47470  11.0%   118 8036s
 1218281 44199   30.93408   29  169   32.00000   28.49504  11.0%   118 8042s
 1219052 43914   29.67991   37  281   32.00000   28.51529  10.9%   118 8049s
 1219837 43643   30.87722   43  262   32.00000   28.53711  10.8%   118 8056s
 1220730 43359     cutoff   37        32.00000   28.55486  10.8%   118 8062s
 1221603 43040   30.81351   35  208   32.00000   28.57928  10.7%   118 8069s
 1222396 42772     cutoff   37        32.00000   28.59946  10.6%   118 8076s
 1223020 42443     cutoff   32        32.00000   28.62011  10.6%   118 8083s
 1223841 42136     cutoff   32        32.00000   28.63939  10.5%   118 8090s
 1224656 41813   29.03326   30  469   32.00000   28.66065  10.4%   118 8096s
 1225449 41509     cutoff   34        32.00000   28.68115  10.4%   118 8102s
 1226311 41168     cutoff   35        32.00000   28.70235  10.3%   118 8109s
 1227134 40981   29.73742   47  313   32.00000   28.72402  10.2%   118 8117s
 1227518 40619     cutoff   30        32.00000   28.73064  10.2%   118 8123s
 1228256 40276     cutoff   37        32.00000   28.75897  10.1%   118 8130s
 1229045 39882     cutoff   38        32.00000   28.77999  10.1%   118 8137s
 1229923 39494     cutoff   27        32.00000   28.80470  10.0%   118 8144s
 1230742 39140     cutoff   38        32.00000   28.82933  9.91%   118 8151s
 1231565 38701   30.19627   40  305   32.00000   28.85359  9.83%   118 8158s
 1232476 38299     cutoff   30        32.00000   28.87746  9.76%   118 8165s
 1233340 37929     cutoff   34        32.00000   28.90301  9.68%   118 8172s
 1234209 37580     cutoff   44        32.00000   28.92956  9.60%   118 8178s
 1234941 37205     cutoff   39        32.00000   28.95098  9.53%   118 8185s
 1235802 36796     cutoff   31        32.00000   28.97324  9.46%   118 8191s
 1236639 36679     cutoff   28        32.00000   28.99639  9.39%   119 8200s
 1236881 36399     cutoff   36        32.00000   28.99859  9.38%   119 8208s
 1237306 35946     cutoff   41        32.00000   29.01491  9.33%   119 8215s
 1238293 35492     cutoff   33        32.00000   29.04403  9.24%   119 8222s
 1239129 34974     cutoff   34        32.00000   29.07549  9.14%   119 8228s
 1240000 34520     cutoff   27        32.00000   29.10238  9.06%   119 8235s
 1240824 34016     cutoff   33        32.00000   29.12703  8.98%   119 8242s
 1241658 33500     cutoff   26        32.00000   29.15463  8.89%   119 8249s
 1242497 32966     cutoff   36        32.00000   29.18171  8.81%   119 8255s
 1243301 32414     cutoff   38        32.00000   29.20994  8.72%   119 8262s
 1244156 31890     cutoff   36        32.00000   29.23676  8.64%   119 8269s
 1245011 31305   30.91573   45  363   32.00000   29.26637  8.54%   119 8275s
 1245901 30793     cutoff   43        32.00000   29.29270  8.46%   119 8282s
 1246749 30188     cutoff   39        32.00000   29.31618  8.39%   119 8289s
 1247607 29670     cutoff   27        32.00000   29.35155  8.28%   119 8295s
 1248366 29055   30.13756   38  302   32.00000   29.37600  8.20%   119 8302s
 1249285 28464     cutoff   39        32.00000   29.40707  8.10%   119 8308s
 1250128 27812     cutoff   39        32.00000   29.44391  7.99%   119 8315s
 1251034 27181     cutoff   32        32.00000   29.47038  7.91%   119 8321s
 1251885 26611     cutoff   27        32.00000   29.50265  7.80%   119 8328s
 1252690 25919   29.98435   54  218   32.00000   29.53176  7.71%   119 8335s
 1253568 25238     cutoff   38        32.00000   29.56701  7.60%   119 8341s
 1254493 24481     cutoff   30        32.00000   29.60251  7.49%   119 8347s
 1255460 23783     cutoff   33        32.00000   29.63918  7.38%   119 8354s
 1256386 23118     cutoff   34        32.00000   29.66627  7.29%   119 8361s
 1257253 22422     cutoff   33        32.00000   29.70633  7.17%   119 8367s
 1258175 21655     cutoff   27        32.00000   29.74442  7.05%   119 8373s
 1259131 20934     cutoff   35        32.00000   29.77541  6.95%   119 8379s
 1260045 20101     cutoff   35        32.00000   29.81503  6.83%   119 8385s
 1261011 19201     cutoff   46        32.00000   29.85478  6.70%   119 8390s
 1262017 18379   30.24999   40  329   32.00000   29.90058  6.56%   119 8397s
 1262970 17548     cutoff   40        32.00000   29.94774  6.41%   119 8402s
 1263890 16792     cutoff   28        32.00000   29.98325  6.30%   119 8408s
 1264740 15839     cutoff   41        32.00000   30.01993  6.19%   119 8414s
 1265784 14923     cutoff   33        32.00000   30.06229  6.06%   119 8420s
 1266762 13997     cutoff   38        32.00000   30.11566  5.89%   119 8425s
 1267776 13064     cutoff   31        32.00000   30.17038  5.72%   119 8431s
 1268757 12418     cutoff   36        32.00000   30.21692  5.57%   119 8437s
 1269440 11370     cutoff   39        32.00000   30.24353  5.49%   119 8442s
 1270525 10234     cutoff   37        32.00000   30.30171  5.31%   119 8447s
 1271705  9015     cutoff   23        32.00000   30.37669  5.07%   119 8452s
 1272961  7830     cutoff   35        32.00000   30.43597  4.89%   119 8457s
 1274173  6551     cutoff   39        32.00000   30.50559  4.67%   118 8461s
 1275471  5344     cutoff   41        32.00000   30.58734  4.41%   118 8465s
 1278166  2261     cutoff   39        32.00000   30.73975  3.94%   118 8473s
 1279782   353     cutoff   38        32.00000   30.84185  3.62%   118 8477s

Cutting planes:
```

```
  Gomory: 15
  Cover: 12
  MIR: 25
  StrongCG: 7
  Flow cover: 246
  Inf proof: 63
  Zero half: 4
  RLT: 95

Explored 1282043 nodes (151442671 simplex iterations) in 8478.67 seconds (3462.58 work units)
Thread count was 8 (of 8 available processors)

Solution count 5: 32 32 33 ... 35

Optimal solution found (tolerance 1.00e-04)
Best objective 3.200000000000e+01, best bound 3.200000000000e+01, gap 0.0000%
```

In [36]:
```python
print("The number of cut edges is",m.objval)

# Retrieve the districts and their populations
districts = [ [i for i in G.nodes if x[i,j].x > 0.5] for j in range(k)]
district_counties = [ [ G.nodes[i]["NAME10"] for i in districts[j] ] for j in range(k)]
district_populations = [ sum(G.nodes[i]["TOTPOP"] for i in districts[j]) for j in range(k) ]

# Rrint district info
for j in range(k):
    print("District",j,"has population",district_populations[j],"and contains counties",district_counties[j])
```

```
The number of cut edges is 32.0
District 0 has population 712582 and contains counties ['Greeley', 'Phillips', 'Pawnee', 'Clay', 'Republic', 'S
eward', 'Ford', 'Marshall', 'Lincoln', 'Finney', 'Stanton', 'Sheridan', 'Ellis', 'Reno', 'Wabaunsee', 'Comanche
', 'Logan', 'Harper', 'Norton', 'Thomas', 'Hamilton', 'Osborne', 'Hodgeman', 'Trego', 'Cloud', 'Dickinson', 'La
ne', 'Cheyenne', 'Wallace', 'Kiowa', 'Haskell', 'Rice', 'Morton', 'Rush', 'Washington', 'McPherson', 'Ness', 'G
rant', 'Edwards', 'Morris', 'Rooks', 'Barber', 'Decatur', 'Sherman', 'Gray', 'Barton', 'Clark', 'Saline', 'King
man', 'Geary', 'Scott', 'Jewell', 'Wichita', 'Stevens', 'Graham', 'Kearny', 'Gove', 'Smith', 'Russell', 'Rawlin
s', 'Riley', 'Stafford', 'Ottawa', 'Meade', 'Mitchell', 'Ellsworth', 'Sumner', 'Pratt']
District 1 has population 712119 and contains counties ['Montgomery', 'Woodson', 'Chase', 'Cowley', 'Butler', '
Chautauqua', 'Harvey', 'Wilson', 'Elk', 'Sedgwick', 'Greenwood', 'Marion']
District 2 has population 714395 and contains counties ['Franklin', 'Jackson', 'Doniphan', 'Wyandotte', 'Lyon',
'Pottawatomie', 'Atchison', 'Brown', 'Jefferson', 'Nemaha', 'Osage', 'Leavenworth', 'Anderson', 'Shawnee', 'Cof
fey', 'Douglas']
District 3 has population 714022 and contains counties ['Bourbon', 'Cherokee', 'Crawford', 'Allen', 'Johnson',
'Labette', 'Linn', 'Neosho', 'Miami']
```

In [74]:
```python
# Draw it on a map
import geopandas as gpd
import networkx as nx
```

In [75]:
```python
# Read Kansas county shapefile from "KS_counties.shp"
filename = 'C:/Users/Mason/Downloads/KS_counties.shp'

# Read geopandas dataframe from file
df = gpd.read_file(filename )
```

In [76]:
```python
# Find column values
print(df.columns)
```

```
Index(['STATEFP20', 'COUNTYFP20', 'COUNTYNS20', 'GEOID20', 'NAME20',
       'NAMELSAD20', 'LSAD20', 'CLASSFP20', 'MTFCC20', 'CSAFP20', 'CBSAFP20',
       'METDIVFP20', 'FUNCSTAT20', 'ALAND20', 'AWATER20', 'INTPTLAT20',
       'INTPTLON20', 'geometry'],
      dtype='object')
```

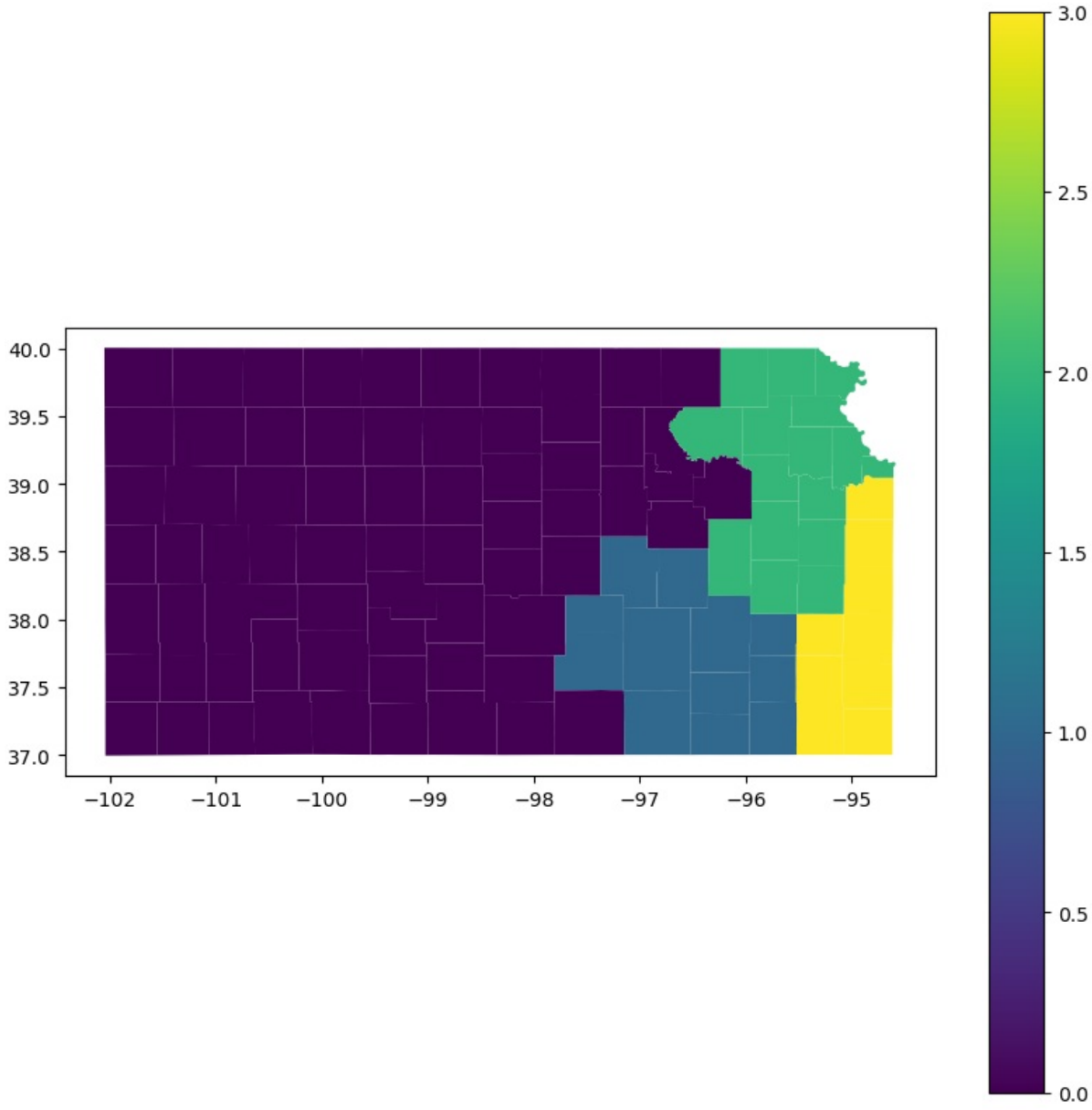
In [77]:
```python
# Creating a variable for optimized districts
district_info = {
    0: {
        'population': 712582,
        'counties': ['Greeley', 'Phillips', 'Pawnee', 'Clay', 'Republic', 'Seward', 'Ford', 'Marshall', 'Lincol
    },
    1: {
        'population': 712119,
        'counties': ['Montgomery', 'Woodson', 'Chase', 'Cowley', 'Butler', 'Chautauqua', 'Harvey', 'Wilson', 'E
    },
    2: {
        'population': 714395,
        'counties': ['Franklin', 'Jackson', 'Doniphan', 'Wyandotte', 'Lyon', 'Pottawatomie', 'Atchison', 'Brown
    },
    3: {
        'population': 714022,
        'counties': ['Bourbon', 'Cherokee', 'Crawford', 'Allen', 'Johnson', 'Labette', 'Linn', 'Neosho', 'Miami
    },
}

# Initialize assignment list with -1 for each row in GeoDataFrame
df['assignment'] = -1

# Iterate over district_info and assign districts to GeoDataFrame
for district, info in district_info.items():
```

```
    counties = info['counties']
    df.loc[df['NAME20'].isin(counties), 'assignment'] = district

# Plot the map
my_fig = df.plot(column='assignment', legend=True, figsize=(10, 10)).get_figure()
```



In [ ]: