

To compare the effectiveness of the heuristic rules for selecting the set to be added to cover a point having no covering set, a randomly generated problem with 25 points and 100 sets was generated.



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50 iterations of subgradient optimization were performed, and after each iteration, the heuristic algorithm was applied 3 times:

- the least-cost set covering the point was added
- the reduced costs of the 4 least-cost sets were computed, and the set having the smallest reduced cost was added.
- like the second rule, but with zero used as the multiplier of any point already covered.

Best solution found

Random SCP (seed= 29155467)

Total cost = 44

Greatest Lower Bound = 42.81

Gap = 2.694 %

of points with
multiple covers: 11

sets in the solution: 8

| Set | Cost | # pts covered |
|-----|------|---------------|
| 1 | 3 | 6 |
| 2 | 3 | 3 |
| 3 | 4 | 8 |
| 4 | 4 | 3 |
| 6 | 5 | 6 |
| 7 | 5 | 3 |
| 18 | 9 | 3 |
| 22 | 11 | 5 |

| Pt | # times covered | multiplier |
|----|-----------------|------------|
| 2 | 2 | 0.0000 |
| 6 | 2 | 0.0000 |
| 7 | 2 | 0.0000 |
| 14 | 2 | 0.0000 |
| 15 | 2 | 0.0000 |
| 17 | 2 | 0.2410 |
| 19 | 2 | 0.0000 |
| 20 | 3 | 0.0000 |
| 23 | 2 | 0.0000 |
| 24 | 2 | 0.8565 |
| 25 | 2 | 0.0000 |

Analysis of the Results

LUB= 44

sets in best cover: 8

(sets are 1 2 3 4 6 7 18 22)

sets eliminated by penalty: 87

| Heuristic set selection rule for add | Option | Frequency | Mean | 1st found |
|-----------------------------------------|--------|-----------|-------|-----------|
| | | UB=LUB | error | LUB |
| original cost | (1) | 14 | 3.50 | 13 |
| reduced cost | (4,1) | 28 | 2.12 | 6 |
| recomputed reduced cost | (4,2) | 24 | 1.90 | 13 |

Frequency of <

| | | |
|----|---|---|
| 0 | 6 | 1 |
| 20 | 0 | 8 |
| 13 | 8 | 0 |

Frequency of =

| | | |
|----|----|----|
| 0 | 24 | 36 |
| 24 | 0 | 34 |
| 36 | 34 | 0 |

i.e., the second rule outperformed the first in 20 instances, and the third in 8 instances!