1 Clustering problem

The Clustering problem is NP-hard [1]. It is defined as follows: There is a finite set X of objects ($|X| = N$), a distance $d(x, y) \in \mathbb{Z}_0^+$ for each pair $x, y \in X$, and two positive integers K and B. Is there a partition of X into disjoint sets $X_1, X_2, \cdots, X_K$ such that, for all pairs $x, y \in X_i$, $d(x, y) \leq B$, where $1 \leq i \leq K$?

2 Experiments

There were 10 randomly generated problem instances for each problem. Details of the generating procedure, as well as configurations, are described in the GitHub repository.[1]. Problems' specification are depicted in relevant tables.

3 Results

Table 1 presents the experiment results of the Clustering problem. DLV achieved the best results in all problems. WMaxSAT was the second losing against Clingo in the first two problems only. Similarly, cmodels outperformed Clingo for larger problems but lost completly againts WMaxSAT. Eventually, smodel performed very poorly compared to other solvers.

Note that in Table 1, 2, 3, 4, and 5, TL denotes the time limit that was 240 s in every experiment. The best results are marked in bold.

Table 1: The Clustering problems' specification and the results. *Dec.* denotes a *decision*.

Problem	N	K	B	Dec.	Clingo	DLV	smodels	cmodels	WMaxSAT
p1	992	5	45	Yes	5.81 s	**1.49** s	TL	7.12 s	5.04 s
p2	992	5	44	No	5.86 s	**1.70** s	TL	8.31 s	5.23 s
p3	1271	5	49	Yes	11.25 s	**2.32** s	58.28 s	9.50 s	6.42 s
p4	1271	5	48	No	11.29 s	**2.40** s	TL	10.93 s	6.74 s
p5	1401	5	43	Yes	15.23 s	**2.92** s	TL	16.01 s	9.18 s
p6	1401	5	42	No	15.36 s	**3.25** s	TL	17.88 s	9.67 s
p7	1887	4	55	Yes	31.37 s	**4.83** s	170.16 s	19.58 s	9.30 s
p8	1887	4	54	No	31.43 s	**4.91** s	TL	21.09 s	9.68 s
p9	2223	4	57	Yes	51.63 s	**6.73** s	225.95 s	25.21 s	11.56 s
p10	2223	4	56	No	51.79 s	**6.91** s	TL	27.26 s	12.19 s

References

[1] Peter Brucker. On the complexity of clustering problems. In *Optimization and Operations Research: Proceedings of a Workshop Held at the University of Bonn, October 2–8, 1977*, pages 45–54. Springer, 1978.

[1] https://github.com/lazarow/ASP-via-WMaxSat

Table 2: The Longest Path Problem' results.

Problem	$\|V\|$	$\|E\|$	Clingo	DLV	smodels	WMaxSAT
p1	30	120	88.87 s	50.70 s	48.31 s	**38.33** s
p2	30	120	47.55 s	TL	39.05 s	**0.98** s
p3	30	120	62.83 s	22.57 s	25.45 s	**0.58** s
p4	30	120	110.06 s	138.93 s	**45.10** s	TL
p5	30	120	58.22 s	TL	**39.13** s	110.95 s
p6	30	110	49.28 s	TL	22.36 s	**11.58** s
p7	30	110	48.96 s	**4.85** s	28.90 s	25.60 s
p8	30	110	56.92 s	TL	24.60 s	**10.68** s
p9	30	110	36.07 s	131.07 s	19.49 s	**2.99** s
p10	30	110	76.20 s	TL	56.98 s	**1.44** s

Table 3: The Max Cut Problem' results.

Problem	$\|V\|$	$\|E\|$	Clingo	DLV	smodels	WMaxSAT
p1	70	130	52.06 s	2.77 s	TL	**2.61** s
p2	60	130	96.16 s	**1.62** s	TL	3.20 s
p3	40	160	TL	TL	TL	**4.55** s
p4	30	170	159.75 s	TL	67.00 s	**3.05** s
p5	30	190	TL	TL	101.91 s	**2.15** s
p6	40	180	197.72 s	77.71 s	TL	**1.83** s
p7	70	140	54.87 s	**0.49** s	TL	2.59 s
p8	30	150	85.58 s	TL	40.12 s	**2.99** s
p9	30	180	159.66 s	TL	49.97 s	**2.62** s
p10	75	150	TL	**2.31** s	TL	2.44 s

Table 4: The Minimum Cover problems' results.

Problem	Clingo	DLV	smodels	WMaxSAT
p1	55.37 s	**0.09** s	136.66 s	1.41 s
p2	125.04 s	**0.82** s	105.79 s	5.31 s
p3	14.55 s	**0.06** s	36.16 s	0.54 s
p4	39.84 s	**0.29** s	39.63 s	1.27 s
p5	20.80 s	**0.06** s	20.19 s	0.68 s
p6	79.50 s	**0.97** s	233.18 s	1.14 s
p7	146.15 s	**1.36** s	219.74 s	5.56 s
p8	TL	**0.22** s	153.91 s	0.89 s
p9	TL	**1.03** s	133.55 s	4.54 s
p10	TL	**1.10** s	219.84 s	5.43 s

Table 5: The Minimum Test Set problems' results.

Problem	Clingo	DLV	smodels	WMaxSAT
p1	90.06 s	6.80 s	TL	**6.74** s
p2	67.57 s	25.33 s	TL	**15.26** s
p3	60.13 s	**4.66** s	TL	6.76 s
p4	54.76 s	**5.01** s	TL	6.41 s
p5	84.53 s	40.62 s	TL	**16.20** s
p6	54.26 s	**8.30** s	TL	9.55 s
p7	65.53 s	**5.37** s	TL	6.51 s
p8	88.95 s	16.61 s	TL	**11.26** s
p9	75.27 s	18.12 s	TL	**11.15** s
p10	57.64 s	**5.08** s	TL	5.41 s