B Inference and Construction Times

Table 6 reports the time (in seconds) required for three main steps: bipartite graph construction, prediction using the GNN, and constraint construction using the prediction and the hyperparameters. It also shows the total time for each process. The results correspond to the `test` partitions of the MIS, MVC, and CA datasets, and are presented for both BackPaS and BackPaS-V0.

BackPaS refers to the full version of our method, which uses a bipartite graph with literals, a larger GNN with 8 Graph Transformer layers, and constructs constraints using the θ and α parameters. In contrast, BackPaS-V0 builds a variable-based bipartite graph, employs a smaller GNN with 2 GCN layers, and constructs constraints using the k_0, k_1, and Δ parameters.

The graph construction step accounts for the largest difference in runtime between the two methods. Constructing the literal-based bipartite graph in BackPaS is significantly slower, primarily due to the normalization of constraints. We believe this step could be substantially accelerated by reimplementing the normalization code (currently written in Python) in C++.

In terms of GNN prediction time, despite BackPaS having four times more layers than BackPaS-V0, the runtime is only about two to three times higher. Prediction remains the fastest among the three steps.

Regarding constraint construction, the time required for BackPaS (using θ and α) is comparable to BackPaS-V0 (using k_0, k_1, and Δ) in the CA and MIS datasets. However, in the MVC dataset, constraint construction in BackPaS takes approximately twice as long.

Table 6. Mean times (in seconds) for bipartite graph construction (**Graph time**), GNN prediction (**Prediction time**), and constraint construction (**Constraints time**) on the `test` partitions of the CA, MIS, and MVC benchmarks. Standard deviations are shown in parentheses. Results are reported for both BackPaS and BackPaS-V0, along with the total time for all steps combined.

Benchmark	Architecture	Graph time (s)	Prediction time (s)	Constraints time (s)	Total time (s)
CA	BackPaS	0.39 (0.06)	0.02 (0.04)	0.16 (0.06)	0.58 (0.08)
	BackPaS-V0	0.14 (0.05)	0.0 (0.04)	0.13 (0.06)	0.28 (0.08)
MIS	BackPaS	1.49 (0.09)	0.11 (0.68)	0.16 (0.06)	1.76 (0.77)
	BackPaS-V0	0.56 (0.08)	0.05 (0.41)	0.14 (0.05)	0.75 (0.47)
MVC	BackPaS	1.48 (0.06)	0.08 (0.44)	0.23 (0.06)	1.79 (0.48)
	BackPaS-V0	0.34 (0.09)	0.03 (0.02)	0.11 (0.04)	0.48 (0.1)