Core Boosting in SAT-Based Multi-Objective Optimization—Additional Results

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This document contains additional details and empirical data related to our paper "Core Boosting in SAT-Based Multi-Objective Optimization" published at CPAIOR'24. Table 1 shows a summary of the benchmark families and where the instances were obtained from. In Figure 1 we provide more details on the time spent core boosting by showing how much percentage of the overall solving time was spent core boosting for how many instances.

Adding to the comparison of core boosting and preprocessing with MaxPre in the main paper, Figure 2 shows per-instance runtime comparisons of all three algorithms respectively employing either core boosting or MaxPre. Furthermore, in Table 2 we extend on Table 2 from the main paper by also including variants combining MaxPre preprocessing and core boosting. The two additional variants differ on the order in which core boosting and MaxPre are applied.

Similar to the plot shown for P-Minimal in the main paper (Figure 5 left), Figure 3 relates the impact on solver performance to the reduction in search space for BiOptSat (left) and LowerBound (right). Note that the number of clauses in the objective encodings—as shown in the main paper Figure 5 (right)—is independent of the algorithm. Finally, Figure 4 shows per-instance runtimes for P-Minimal with core boosting, comparing whether the SAT solver is reset after core boosting or not.

References

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Table 1. Overview of the benchmark domains.

Domain	# Inst.	Unit coefficients	# Obj.	Obtained From
set-cover-sc	80	no	2–5	[3] and randomly generated
set-cover-ep	80	no	2–5	[3] and randomly generated
packup	80	yes	2–5	[2]
shiftdesign	20	yes	3	MaxSAT Lib*
lidr	20	yes	2	[3]
ftp	20	no	2	[1]
spot5	20	no	2	MaxSAT Lib*

*https://www.cs.toronto.edu/maxsat-lib

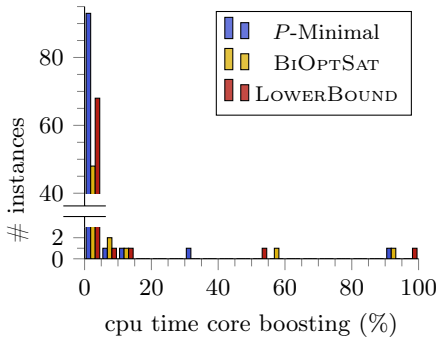

Fig. 1. Percentage of cpu time spent performing core boosting on non-trivial instances.

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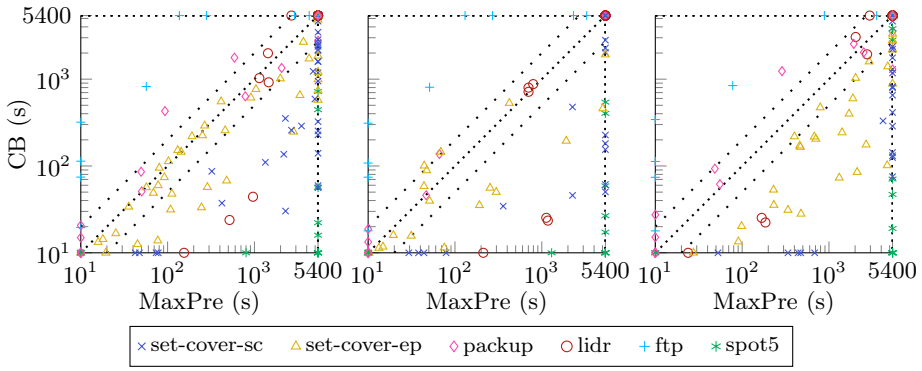

Fig. 2. Per-instance runtime comparison of core boosting and MaxPre preprocessing for P-Minimal (left), BiOptSat (middle), and LowerBound (right).

Table 2. Change in number of solved instances ($\Delta\#$) through core boosting (CB) and preprocessing with MaxPre and combinations thereof.

Algorithm	Prepro.	set-cover-sc $\Delta\#$	set-cover-ep $\Delta\#$	packup $\Delta\#$	lidr $\Delta\#$	ftp $\Delta\#$	spot5 $\Delta\#$
P-Minimal	CB	**+20**	+5	**±0**	−1	−1	**+11**
	MaxPre	+1	−1	−1	**±0**	**+3**	+1
	MaxPre + CB	**+20**	**+7**	−1	−1	+1	**+11**
	CB + MaxPre	+19	**+7**	**±0**	−1	+1	**+11**
BiOptSat	CB	**+8**	**+1**	**±0**	**±0**	−2	**+11**
	MaxPre	±0	±0	**±0**	**±0**	**+2**	+1
	MaxPre + CB	**+8**	**+1**	**±0**	**±0**	±0	**+11**
	CB + MaxPre	**+8**	**+1**	**±0**	**±0**	−2	**+11**
LowerBound	CB	**+16**	**+6**	**+1**	±0	−1	**+11**
	MaxPre	+1	±0	−1	**+1**	**+1**	±0
	MaxPre + CB	**+16**	**+6**	±0	−1	**+1**	**+11**
	CB + MaxPre	**+16**	**+6**	±0	−2	**+1**	**+11**

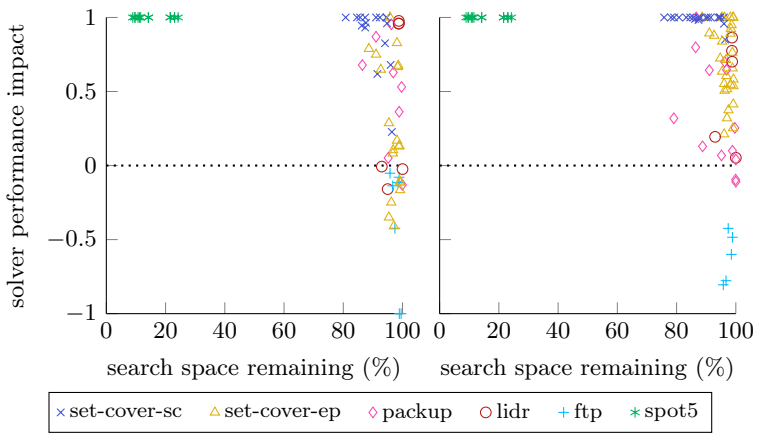

Fig. 3. Relating the impact of core boosting on solver performance with recution of search space achieved (left: BiOptSat, right: LowerBound).

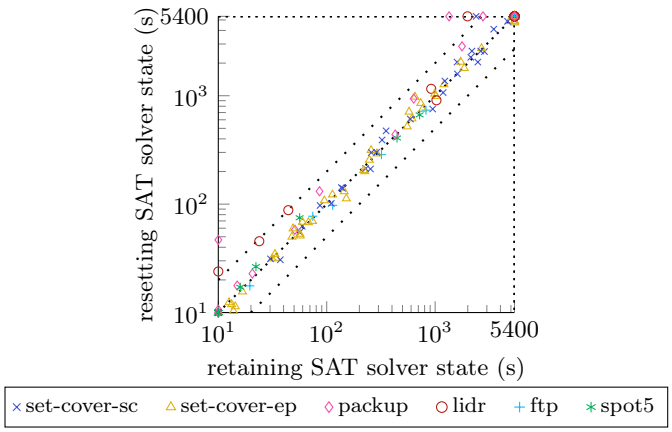

Fig. 4. Impact of resetting/retaining the SAT solver state between core boosting and *P*-Minimal.