1 Explanation Generation

Algorithm 1: EXPLAINCSP($\mathcal{C}, f$)

1   $E \leftarrow \langle \rangle$;
2   $\mathcal{I}_{end} \leftarrow$ OPTIMALPROPAGATE($\mathcal{C}$);
3   $I \leftarrow \emptyset$;
4   **while** $I \neq \mathcal{I}_{end}$ **do**
5      $X \leftarrow$ BESTSTEP($\mathcal{C}, f, I, \mathcal{I}_{end}$);
6      $I_{best} \leftarrow I \cap X$;
7      $\mathcal{C}_{best} \leftarrow \mathcal{C} \cap X$;
8      $N_{best} \leftarrow \{\mathcal{I}_{end} \setminus I\} \cap$ OPTIMALPROPAGATE(X);
9   add $\{I_{best} \wedge \mathcal{C}_{best} \implies N_{best}\}$ to E;
10     $I \leftarrow I \cup N_{best}$;
11   **end**
12   **return** E;

Algorithm 2: BESTSTEP–OUS($\mathcal{C}, f, I, \mathcal{I}_{end}$)

1   $X_{best} \leftarrow \{\mathcal{C} \wedge I \wedge \overline{\mathcal{I}_{end}}\}$;
2   **for** $l \in \{\mathcal{I}_{end} \setminus I\}$ **do**
3      $X \leftarrow$ OUS($\mathcal{C} \wedge I \wedge \neg l, \; f$);
4   **if** $f(X) < f(X_{best})$ **then**
5        $X_{best} \leftarrow X$;
6   **end**
7   **end**
8   **return** X_{best}

Algorithm 3: BESTSTEP–C-OUS($\mathcal{C}, f, I, I_{end}$)

1   $\mathcal{G} \leftarrow \mathcal{C} \cup I_{end} \cup \overline{\mathcal{I}_{end}}$;
2   set p such that exactly one of $\overline{\mathcal{I}_{end}}$ in the hitting set *and* none of $\{I_{end} \setminus I\}$ *and* none of $\bar{I}$ can be in the hitting set;
3   **return** C-OUS($\mathcal{G}, f, p$);

2 OUS Algorithm

Algorithm 4: OUS-INC$(\mathcal{F}, f)$

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1 **SSOfF** $\leftarrow \emptyset$
2 **for** $S \in \textbf{SSs}$ **do**
3 $\quad$ $S_{\mathcal{F}} \leftarrow S \cap \mathcal{F}$
4 $\quad$ **if** $\neg \exists S' \in \textbf{SSOfF} : S_{\mathcal{F}} \subseteq S'$ **then**
5 $\quad\quad$ $S_{\mathcal{F}} \leftarrow \text{GROW}(S_{\mathcal{F}}, \mathcal{F})$
6 $\quad\quad$ $\mathcal{H} \leftarrow \mathcal{H} \cup \{\mathcal{F} \setminus S_{\mathcal{F}}\}$
7 $\quad\quad$ **SSOfF** $\leftarrow$ **SSOfF** $\cup \{S_{\mathcal{F}}\}$
8 $\quad$ **end**
9 **end**
10 **while** *true* **do**
11 $\quad$ $\mathcal{F}' \leftarrow \text{OPTHITTINGSET}(\mathcal{H}, f)$
12 $\quad$ **if** $\neg \text{SAT}(\mathcal{F}')$ **then**
13 $\quad\quad$ **return** $\mathcal{F}'$
14 $\quad$ **end**
15 $\quad$ $\mathcal{F}'' \leftarrow \text{GROW}(\mathcal{F}', \mathcal{F})$
16 $\quad$ $\mathcal{H} \leftarrow \mathcal{H} \cup \{\mathcal{F} \setminus \mathcal{F}''\}$
17 $\quad$ **SSs** $\leftarrow$ **SSs** $\cup \{(\mathcal{F}'', M)\}$
18 **end**

Algorithm 5: Postponing hitting set optimization for OUS (to be inserted before of)

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1 **while** *true* **do**
2 $\quad$ **while** $|\mathcal{H}| > 0$ **do**
3 $\quad\quad$ $\mathcal{F}' \leftarrow \mathcal{F}' + min_f$ element of last MCS in $\mathcal{H}$;
4 $\quad\quad$ **if** $\neg \text{SAT}(\mathcal{F}')$ **then**
5 $\quad\quad\quad$ **break**
6 $\quad\quad$ **end**
7 $\quad\quad$ $\mathcal{H} \leftarrow \mathcal{H} \cup \{\mathcal{F} \setminus \text{GROW}(\mathcal{F}', \mathcal{F})\}$;
8 $\quad$ **end**
9 $\quad$ $\mathcal{F}' \leftarrow \text{GREEDYHITTINGSET}(\mathcal{H}, f)$;
10 $\quad$ **if** $\neg \text{SAT}(\mathcal{F}')$ **then**
11 $\quad\quad$ **break**
12 $\quad$ **end**
13 $\quad$ $\mathcal{H} \leftarrow \mathcal{H} \cup \{\mathcal{F} \setminus \text{GROW}(\mathcal{F}', \mathcal{F})\}$;
14 **end**

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3 cOUS

Algorithm 6: C-OUS$(\mathcal{F}, f, p)$

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1 **while** *true* **do**
2 $\mathcal{F}' \leftarrow \textsc{CondOptHittingSet}(\mathcal{H}, f, p)$
3   **if** $\neg\textsc{sat}(\mathcal{F}')$ **then**
4   **return** $\mathcal{F}'$
5   **end**
6 $\mathcal{F}'' \leftarrow \textsc{Grow}(\mathcal{F}', \mathcal{F})$
7 $\mathcal{H} \leftarrow \mathcal{H} \cup \{\mathcal{F} \setminus \mathcal{F}''\}$
8 **end**