
Algorithm 1: Guarded Saturation

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1 Function GSat:
   Input : Guarded TGDs  $\Sigma$ 
   Output: Atomic rewriting of  $\Sigma$ 

2  $\mathcal{W} = \text{VNF}(\text{HNF}(\Sigma))$  // working set
3  $\mathcal{F} = \mathcal{N} = \emptyset$  // full and non-full set
4 while  $\mathcal{W} \neq \emptyset$  do
5   Let  $\sigma$  be a rule in  $\mathcal{W}$ 
6   if  $\sigma$  is full then
7      $\mathcal{F} = \mathcal{F} \cup \{\sigma\}$ 
8      $\mathcal{E} = \{\text{EVOLVE}(\tau, \sigma) \mid \tau \in \mathcal{N}\}$ 
9   else
10     $\mathcal{N} = \mathcal{N} \cup \{\sigma\}$ 
11     $\mathcal{E} = \{\text{EVOLVE}(\sigma, \tau) \mid \tau \in \mathcal{F}\}$ 
12  end
13   $\mathcal{W} = \mathcal{W} \cup \mathcal{E} \setminus (\mathcal{F} \cup \mathcal{N} \cup \{\sigma\})$ 
14 end
15 return  $\mathcal{F}$ 

16
17 Function EVOLVE:
   Input : Non-full  $\sigma = \beta(\vec{x}) \rightarrow \exists \vec{y} \eta$  and full  $\sigma' = \beta' \rightarrow \eta'$ 
   Output: Derived rules of  $\sigma, \sigma'$ 

18 Rename  $\sigma'$  s.t.  $\text{Vars}(\sigma) \cap \text{Vars}(\sigma') = \emptyset$ 
19 Let  $G'$  be a guard of  $\sigma'$ 
20  $\mathcal{E} = \emptyset$ 
21 foreach  $H \in \eta$  do
22   if there is an mgu  $\theta$  of  $G'$  and  $H$  with  $\theta|_{\vec{y}} = \text{id}_{\vec{y}}$  and  $\vec{x}\theta \cap \vec{y} = \emptyset$  then
23      $\sigma = \sigma\theta$ 
24      $\sigma' = \sigma'\theta$ 
25      $S' = (B'_1, \dots, B'_n)$  s.t.  $B'_i \in \beta'$  and  $B'_i \cap \vec{y} \neq \emptyset$  and  $G' = B'_1$ 
26     for  $2 \leq i \leq n$  do
27       // get matches for  $B'_i = R(w_1, \dots, w_m)$  by selecting atoms with matching
28       // predicates and positions of existentials
29        $S_i = \{R(v_1, \dots, v_m) \in \eta \mid \forall 1 \leq j \leq m. v_j \in \vec{y} \vee w_j \in \vec{y} \implies v_j = w_j\}$ 
30     end
31     foreach  $S \in (\{H\} \times S_2 \times \dots \times S_n)$  do
32       Let  $\theta^*$  be the mgu of  $S$  and  $S'$ 
33       // Note:  $\text{evc}$  is satisfied by construction
34        $\beta'' = (\beta \cup (\beta' \setminus \{B'_1, \dots, B'_n\}))\theta^*$ 
35        $\eta'' = (\eta \cup \eta')\theta^*$ 
36        $\mathcal{E} = \mathcal{E} \cup \text{VNF}(\text{HNF}(\beta'' \rightarrow \exists \vec{y} \eta''))$ 
37     end
38   end
39 end
40 return  $\mathcal{E}$ 
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