
Algorithm 1 Matrix-based Weakened JOIN-Safeness Verification

Input: Arc List E , Safe Vector, LoopSafe Vector, C -attribute Vector CV **Out-**

put: Boolean: $WeakJoinSafe$

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1:  $WeakJoinSafe \leftarrow \emptyset$ 
2:  $V_{in}(v) \leftarrow u \in V | (u, v) \in E$ 
3:  $V_{out}(v) \leftarrow u \in V | (v, w) \in E$ 
4:  $Joins \leftarrow v \in V | |V_{in}(v)| > 1 \wedge v \notin V_{source}$ 
5:  $Splits \leftarrow v \in V | |V_{out}(v)| > 1 \wedge v \notin V_{target}$ 
6: for all  $doj \in Joins$ 
7:    $ValidSources \leftarrow \{s \in Splits | Paths(s, j) \neq \emptyset\}$ 
8:    $ValidPathVertices \leftarrow \bigcup_{s \in ValidSources} \bigcup_{p \in Paths(s, j)} \{v | v \in p\}$ 
9:    $ValidPathArcs \leftarrow \bigcup_{s \in ValidSources} \bigcup_{p \in Paths(s, j)} \{(p_i, p_{i+1}) | i \in [0, |p| - 2]\}$ 
10: end for
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