Appendix A Probabilistic Reasoning

Listing 4: Table algorithm $\mathbb{PELP}(\text{depth}, \chi_t, \Pi_t, \Pi^A_t, W, Q, \langle \tau_1, \ldots, \tau_\ell \rangle)$ for nice TDs of the nested primal graph representation.

In: Nesting depth ≥ 0, bag χ_t, epistemic bag program Π_t, nested bag program Π^A_t, world view interpretation W, WVI (query) Q, and sequence $\langle \tau_1, \ldots, \tau_\ell \rangle$ of child tables of t. **Out:** Table τ_t.

if type$(t) = $ *leaf* **then** $\tau_t \leftarrow \{\langle \emptyset, 1, 1 \rangle\}$
else if type$(t) = $ *intr and* $a^e \in \chi_t$ *is introduced* **then**
  $\tau_t \leftarrow \{\langle J, c', q' \rangle \mid \langle I, c, q \rangle \in \tau_1, J \in \{I, I \cup \{a\}, I \cup \{\neg a\}\}, J \models_{\mathsf{p}} \Pi_t,$
  $\mathsf{P} = (\Pi^A_t)^J, c' = c \cdot \texttt{NestELP}(\text{depth}+1, \mathsf{P}, (W \cup J)_{|\mathsf{a}\text{-}ats(\mathsf{P})}), c' > 0\}$
  $\mathsf{P}' = (\Pi^A_t \sqcup Q)^J, q' = q \cdot \texttt{NestELP}(\text{depth}+1, \mathsf{P}', (W \cup J)_{|\mathsf{a}\text{-}ats(\mathsf{P}')}), q' > 0\}$
else if type$(t) = $ *rem and* $a^e \notin \chi_t$ *is removed* **then**
  $\tau_t \leftarrow \{\langle I', \sum_{\langle J, c', q' \rangle \in \tau_1 : I' \subseteq J} c', \sum_{\langle J, c', q' \rangle \in \tau_1 : I' \subseteq J} q' \rangle \mid \langle I, c, q \rangle \in \tau_1, I' = I \setminus \{a, \neg a\}\}$
else if type$(t) = $ *join* **then**
  $\tau_t \leftarrow \{\langle I, c_1 \cdot c_2, q_1 \cdot q_2 \rangle \mid \langle I, c_1, q_1 \rangle \in \tau_1, \langle I, c_2, q_2 \rangle \in \tau_2\}$

Listing 5: Algorithm $\texttt{NestELP}_{\mathbb{PELP}}(\text{depth}, \Pi, W, Q)$ for probabilistic world view acceptance via nested DP.

In: Nesting depth ≥ 0, epistemic logic program Π, WVI W over a set $X \subseteq \mathsf{a}\text{-}ats(\Pi)$ of atoms, and WVI (query) Q.
Out: The probability $\mathsf{prob}(\Pi \sqcup W, Q)$ of Q being compatible with a world view.

$A \leftarrow \mathsf{e}\text{-}ats(\Pi)$
if $A = \emptyset$ `/* No Epistemic Decisions left; Verify Decisions */` **then**
  if $\{a \in X \mid a \notin W, \neg a \notin W\} = \emptyset$ **then return** $|AS(\Pi)| = 1$ *and* $|AS(\Pi \cup \{\leftarrow W\})| = 0$ `/* ASP */`
  else return $WVS(\Pi \sqcup W) \neq \emptyset$ `/* Verify via Standard ELP Solver */`

$\mathcal{T} = (T, \chi) \leftarrow$ Decompose(G_Π) `/* Decompose via Heuristics */`
if width$(\mathcal{T}) \geq threshold_{hybrid}$ *or* depth $\geq threshold_{depth}$ `/* Standard ELP Solver */` **then**
  return $\mathsf{prob}(\Pi \sqcup W, Q)$

if width$(\mathcal{T}) \geq threshold_{abstr}$ `/* Abstract & Decompose via Heuristics */` **then**
  $A \leftarrow$ Choose-Abstraction(A, Π)
  $\mathcal{T} = (T, \chi) \leftarrow$ Decompose(G^A_Π)

for iterate t *in* post-order(T) `/* Dynamic Programming */` **do**
  Child-Tabs $\leftarrow \langle \tau_{t_1}, \ldots, \tau_{t_\ell} \rangle$ where children$(t) = \langle t_1, \ldots, t_\ell \rangle$
  $\tau_t \leftarrow \mathbb{PELP}(\text{depth}, \chi(t), \Pi_t, \Pi^A_t, W, Q, \text{Child-Tabs})$
return $\sum_{\langle I, c, q \rangle \in \tau_{\text{root}(T)}, c > 0} \frac{q}{c}$ `/* Return Total Probability */`