Consider again the form-labeling problem of Example 2, relative to the set of constants \( \{f, \ell\} \) from the context, we refer to axioms or assertions without distinguishing them from their translations into FOL. This is required for technical reasons, such as the need to be able to explicitly refer to the variables in the axioms in order to have the possibility of linking such variables with those in probabilistic annotations. Note that this does not affect the expressiveness of our formalism, nor its tractability, since the translation to FOL (and back to \( \mathcal{EL}^{++} \)) can be done in polynomial time in the size of the ontology.

Informally, probabilistic ontologies consist of a finite set of first-order logic formulas that correspond to the translation of \( \mathcal{EL}^{++} \) axioms; each such formula is associated with a probabilistic annotation, as described next.

**Definition 1.** A probabilistic annotation \( \lambda \) relative to an MLN \( M \) defined over \( \mathcal{R}_{MLN}, \mathcal{V}_{MLN}, \) and \( \mathcal{D}_{MLN} \) is a (finite) set of pairs \( \langle A_i, x_i \rangle, \) where: (i) \( A_i \) is an atom over \( \mathcal{R}_{MLN}, \mathcal{V}_{MLN}, \) and \( \mathcal{D}_{MLN}; \) (ii) \( x_i \in \{0, 1\}; \) and (iii) for any two pairs \( \langle A, x \rangle, \langle B, y \rangle \in \lambda, \) there does not exist substitution \( \theta \) that unifies \( A \) and \( B. \) If \( |\lambda| = |X| \) and all \( \langle A, x_i \rangle \in \lambda \) are such that \( A \) is ground, then \( \lambda \) is called a (possible) world.

\(^1\)http://research.cs.wisc.edu/hazy/tuffy/