Cheat sheet for Knowledge Representation

Knowledge Representation (Vrije Universiteit Amsterdam)

Cheat sheet

Frequently occurring symbols

∈, ∉, ∑,⊑, ⊔, ⊓, ¬, ∃, ∀

There is a chance that you cannot copy-paste those symbols from the provided pdf. In that case use symbols that are alike the intended ones, and define their meaning. E.g. if use E instead of ∃ and mention briefly you use E as symbol for the existential quantifier.

Rules for rewriting a statement into CNF

1. $P \leftrightarrow Q \equiv (P \rightarrow Q) \land (Q \rightarrow P)$
2. $P \rightarrow Q \equiv \neg P \lor Q$
3. $\neg (\neg P) \equiv P$
4. $\neg (P \land Q) \equiv \neg P \lor \neg Q$
5. $\neg (P \lor Q) \equiv \neg P \land \neg Q$
6. $(P \land Q) \lor R \equiv (P \lor R) \land (Q \lor R)$

Rules for rewriting a DL concept into NNF

To reduce the number of tableau rules we can assume that all concepts in the input appear in *Negation Normal Form* (*NNF*).

$$
\begin{aligned}
\neg\top &\Rightarrow \bot \\
\neg\bot &\Rightarrow \top \\
\neg A &\Rightarrow \neg A \\
\neg(\neg C) &\Rightarrow C \\
\neg(C \sqcap D) &\Rightarrow \neg C \sqcup \neg D \\
\neg(C \sqcup D) &\Rightarrow \neg C \sqcap \neg D \\
\neg\exists r.C &\Rightarrow \forall r.\neg C \\
\neg\forall r.C &\Rightarrow \exists r.\neg C
\end{aligned}
$$

Tableau Rules for ABoxes and TBoxes

$\Rightarrow_\sqcap$ **IF** $(a : C \sqcap D) \in S$ **THEN** $S' := S \cup \{a : C, a : D\}$

$\Rightarrow_\sqcup$ **IF** $(a : C \sqcup D) \in S$ **THEN** $S' := S \cup \{a : C\}$ **or** $S' := S \cup \{a : D\}$

$\Rightarrow_\exists$ **IF** $(a : \exists r.C) \in S$ **THEN** $S' := S \cup \{(a, b) : r,\ b : C\}$
where b is a ‘fresh’ individual name in S

$\Rightarrow_\forall$ **IF** $(a : \forall r.C) \in S$ **and** $(a, b) : r \in S$ **THEN** $S' := S \cup \{b : C\}$

$\Rightarrow_\times$ **IF** $\{a : A, a : \neg A\} \subseteq S$ **or** $(a : \bot) \in S$ **THEN** mark the branch as CLOSED

$\Rightarrow_\equiv$ **IF** $(\top \equiv C) \in S$ **and** an individual a occurs in S
THEN $S' := S \cup \{a : C\}$