Exercise 8.1  We consider the connection between default logics and autoepistemic logic. Let \( \delta = \frac{\varphi}{\psi_1, \ldots, \psi_n} \chi \) be a default rule. We define the translation function for default rules as follows:

\[
\text{trans}(\delta) = (L \varphi \land \neg L \neg \psi_1 \land \cdots \land \neg L \neg \psi_n) \rightarrow \chi.
\]

Let \( T = (W, D) \) be a default theory. We define the translation function for default theories as follows:

\[
\text{trans}(T) = W \cup \{\text{trans}(\delta) \mid \delta \in D\}.
\]

Consider \( T_{DT} = (W, D) \) with \( W = \emptyset \) and \( D = \{ p : \text{true} \} \).

(a) Compute the extensions of \( T_{DT} \).
(b) Compute the expansions of \( T_{AE} = \text{trans}(T_{DT}) \).
(c) Explain the difference.

Exercise 8.2  Define \( \varphi[p_1/\psi_1, \ldots, p_n/\pi_n] \), the simultaneous substitution of the predicates in \( p_i \) by the predicate expressions \( \psi_i \) in \( \varphi \).

Exercise 8.3  Consider the circumscription schema for \textit{isBlock} and the given formula

\[
isBlock(a) \land isBlock(b).
\]

Explain what happens when …

(a) …the predicate expression \( \psi(X) \equiv X = a \) is used.
(b) …the predicate expression \( \psi(X) \equiv (X = a \lor X = b \lor X = c) \) is used.\(^1\)
(c) …\textit{isBlock}(c) is added to the given knowledge.

\(^1\)An earlier version of the exercise sheet had \( \land \) instead of \( \lor \), unfortunately.