Exercises: Rewriting

Exercise 1
Rewrite the query \( q(x) \) with respect to \( \mathcal{T} \) to obtain the certain answers of \( q(x) \) over \( \langle \mathcal{T}, A \rangle \).

\[
\mathcal{T} = \{ B \sqsubseteq A, A \sqsubseteq \exists S, P \sqsubseteq R^- \}
\]
\[
A = \{ R(a,b), S(c,d), P(c,a), B(b) \}
\]
\[
q(x) = \exists y R(a,x) \land S(x,y)
\]

Exercise 2
Rewrite the query \( q(x) \) with respect to \( \Sigma \) to obtain the certain answers of \( q(x) \) over \( \langle \Sigma, D \rangle \).

\[
\Sigma = \{ B(X) \rightarrow R(X,Y) \land P(Y,Z), \]
\[
P(X,Y) \rightarrow S(X,Y) \land A(Y), \]
\[
S(X,Y) \rightarrow R(X,Z) \land S(Z,Y) \} \}
\]
\[
D = \{ A(a), B(b), S(c,a) \}
\]
\[
q(x) = \exists y z R(x,y) \land S(y,z) \land A(z)
\]

Exercise 3
1. Rewrite the query \( q(x) \) with respect to \( \Sigma \) to obtain the certain answers of \( q(x) \) over \( \langle \Sigma, D \rangle \).

\[
\Sigma = \{ A(X) \rightarrow R(X,Y) \land B(Y), \]
\[
R(X,Y) \rightarrow P(Y,X), \]
\[
B(X) \rightarrow R(X,Y) \land P(Y,Z), \]
\[
S(X,Y) \rightarrow R(X,Z) \land P(Z,Y), \]
\[
C(X) \rightarrow R(Y,X) \land P(X,Y) \} \}
\]
\[
D = \{ A(a), B(b), S(c,d), C(d) \}
\]
\[
q(x) = \exists y R(x,y) \land P(y,x)
\]

2. Rewrite the query \( q(x) \) with respect to \( \Sigma' = \Sigma \setminus \{ R(X,Y) \rightarrow P(Y,X) \} \) to obtain the certain answers of \( q(x) \) over \( \langle \Sigma', D \rangle \).