

Exercises: Rewriting

Exercise 1

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

$$\begin{aligned}\mathcal{T} &= \{B \sqsubseteq A, A \sqsubseteq \exists S, P \sqsubseteq R^-\} \\ \mathcal{A} &= \{R(a, b), S(c, d), P(c, a), B(b)\} \\ q(x) &= \exists y R(a, x) \wedge S(x, y)\end{aligned}$$

Correction

$$\begin{array}{llll} q_{\mathcal{T}}(x) = & \exists y R(a, x) \wedge S(x, y) & \vee & \exists y P(x, a) \wedge S(x, y) \\ & \vee & & P(x, a) \wedge A(x) \\ & \vee & & P(x, a) \wedge B(x) \\ & & & R(a, x) \wedge A(x) \\ & & & R(a, x) \wedge B(x) \end{array}$$

The certain answers of $q(x)$ over $\langle \mathcal{T}, \mathcal{A} \rangle$ are : b, c .

Exercise 2

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

$$\begin{aligned}\Sigma &= \{B(X) \rightarrow R(X, Y) \wedge P(Y, Z), \\ &\quad P(X, Y) \rightarrow S(X, Y) \wedge A(Y), \\ &\quad S(X, Y) \rightarrow R(X, Z) \wedge S(Z, Y)\} \\ D &= \{A(a), B(b), S(c, a)\} \\ q(x) &= \exists y z R(x, y) \wedge S(y, z) \wedge A(z)\end{aligned}$$

Correction

$$\begin{array}{llll} q_{\Sigma}(x) = & \exists y z R(x, y) \wedge S(y, z) \wedge A(z) & \vee & \exists y z R(x, y) \wedge P(y, z) \\ & \vee & & \exists z S(x, z) \wedge A(z) \\ & \vee & & \exists z P(x, z) \\ & & & B(x) \end{array}$$

The certain answers of $q(x)$ over $\langle \Sigma, D \rangle$ are : b, c .

Exercise 3

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

$$\begin{aligned}\Sigma &= \{A(X) \rightarrow R(X, Y) \wedge B(Y), \\ &\quad R(X, Y) \rightarrow P(Y, X), \\ &\quad B(X) \rightarrow R(X, Y) \wedge P(Y, Z), \\ &\quad S(X, Y) \rightarrow R(X, Z) \wedge P(Z, Y), \\ &\quad C(X) \rightarrow R(Y, X) \wedge P(X, Y)\} \\ D &= \{A(a), B(b), S(c, d), C(d)\} \\ q(x) &= \exists y R(x, y) \wedge P(y, x)\end{aligned}$$

Correction

$$\begin{array}{llll} q_{\Sigma}(x) = & \exists y R(x, y) \wedge P(y, x) & \vee & \exists y R(x, y) \\ & \vee & & S(x, x) & \vee & A(x) \\ & \vee & & B(x) & \vee & \exists y S(x, y) \end{array}$$

The certain answers of $q(x)$ over $\langle \Sigma, D \rangle$ are : a, b, c .

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 $\langle \Sigma', D \rangle$.

Correction

$$q_{\Sigma'}(x) = \exists y R(x, y) \wedge P(y, x) \vee S(x, x)$$

$q(x)$ has no certain answers over $\langle \Sigma', D \rangle$.