Problem 7.1

Consider the language \( L(\mathcal{R}, \mathcal{F}, \mathcal{V}) \), with \( \mathcal{R} = \{ p/0, q/0 \} \).

Given the set of formulas \( S = \{ p \leftarrow \neg q, q \leftarrow \neg p \} \)

1. Compute \( C_{\text{CWA}}(S) \).
2. Compute the completion \( C_C(S) \).

Problem 7.2

Give a logic program \( \mathcal{P} \) and its completion \( C_C(\mathcal{P}) \) such that the following holds:

\[
\{ \neg A \mid \neg A \in C(\mathcal{P}) \} \neq \{ \neg A \mid \neg A \in C_C(\mathcal{P}) \}
\]

(Justify your answer.)

Problem 7.3

Find non-stratifiable programs \( K_1 \) and \( K_2 \) such that

- \( C_C(K_1) \) is satisfiable, and
- \( C_C(K_2) \) is unsatisfiable.

Problem 7.4

Consider the language \( L(\mathcal{R}, \mathcal{F}, \mathcal{V}) \) with \( \mathcal{R} = \{ p/1 \} \) and \( \mathcal{F} = \{ a/0, b/0, c/0 \} \).

Let \( G \) be the formula \( p(a) \land (p(b) \lor p(c)) \).

- Determine \( \text{Circ}(G, p) \).
- Find two instantiation \( G_1 \) and \( G_2 \) of \( \text{Circ}(G, p) \) such that

\[
\{ G, G_1, G_2 \} \models (\forall X)(p(X) \rightarrow X \approx a \lor X \approx b) \lor (\forall X)(p(X) \rightarrow X \approx a \lor X \approx c).
\]

Hint: Combine the ideas from Exercise 1 (slides 23-24) and Exercise 2 (slides 26-27) from the lecture.