These questions use the following CLP(\( \mathcal{R} \)) rules:

\[
\begin{align*}
\text{member}(X, [X|Xs]). \\
\text{member}(X, [Y|Ys]) :- \text{member}(X, Ys).
\end{align*}
\]

\[
\begin{align*}
\text{member_cut}(X, [X|Xs]) :- !. \\
\text{member_cut}(X, [Y|Ys]) :- \text{member}(X, Ys).
\end{align*}
\]

\[
\begin{align*}
\text{length}([], 0). \\
\text{length}([_|Xs], N) :- N>0, \text{length}(Xs, N-1).
\end{align*}
\]

1. What are all the answers that CLP(\( \mathcal{R} \)) returns for the following goals? (If there are an infinite number give the first several; if there are none, say so.)

   - \( \text{member}(\text{squid}, [\text{clam}, \text{squid}, \text{tuna}]) \)
   - \( \text{member}(\text{squid}, X) \)
   - \( \text{member_cut}(\text{squid}, [\text{clam}, \text{squid}, \text{tuna}]) \)
   - \( \text{member_cut}(\text{squid}, X) \)
   - \( \text{member}(X, [a, b, c, d]), \text{member}(X, [c, d, e, f]) \)
   - \( \text{length}([A, B, C], N) \)
   - \( \text{length}([A, B, C|Cs], N) \)

2. Write a CLP(\( \mathcal{R} \)) rule to find the average of a list of numbers. Fail if the list is empty.

3. Write a CLP(\( \mathcal{R} \)) rule \( \text{range}(\text{Lo}, \text{Hi}, \text{List}) \) that succeeds if \( \text{List} \) consists of all the numbers between \( \text{Lo} \) and \( \text{Hi} \) inclusive. (Assume that \( \text{Lo} \) and \( \text{Hi} \) are integers.) If \( \text{Lo} \) is greater than \( \text{Hi} \), \( \text{List} \) should be empty.

4. Given your \( \text{range} \) rule from Question 3, what are all the results for the following goals?

   - \( \text{range}(2, 5, A) \)
   - \( \text{range}(5, 2, A) \)
   - \( \text{range}(A, B, [2, 3, 4, 5, 6]) \)
   - \( \text{range}(A, B, [2, 4, 6]) \)

5. Write another version of \( \text{range} \) that also takes a \text{Step} parameter: \( \text{range}(\text{Lo}, \text{Hi}, \text{Step}, \text{List}) \). \( \text{Lo}, \text{Hi}, \) and \text{Step} don't have to be integers for this version. For example, \( \text{range}(2.2, 3.0, 0.2, L) \) should succeed with \( L = [2.2, 2.4, 2.8, 3.0] \).

6. Is CLP(\( \mathcal{R} \)) statically typed? Is it type safe?

7. Compare the way parameters are passed in Haskell and CLP(\( \mathcal{R} \)).