1. Use the unification algorithm to determine if the following sets of atoms are unifiable, and if so to compute a most general unifier.

(a) \(\mathcal{S} = \{ q(X, Y, f(X, Y)), q(U, V, f(a, T)) \} \)

(b) \(\mathcal{S} = \{ p(X, f(h(X), a), b), p(U, U, Z) \} \)

(c) \(\mathcal{S} = \{ r(X, g(h(Y)), Y), r(U, U, b), r(T, g(h(a)), b) \} \)

2. Draw SLD trees and compute answer substitutions to explain each of the following

(a) ```
    concat([], X, X).
    concat([X|Y], Z, [X|T]) :- concat(Y, Z, T).
    reverse([], []).
    reverse([X|Y], Z) :- reverse(Y, T), concat(T, [X], Z).
``` : reverse([2, 3], X)?

    \(X = [3, 2]\)

    : reverse(X, [2, 3])?

    \(X = [3, 2]\)
    GLOBAL STACK OVERFLOW

(b) ```
    reverse(X, Y) :- rev2(X, [], Y).
    rev2([], L, L).
    rev2([X|Y], Z, T) :- rev2(Y, [X|Z], T).
``` : reverse([2, 3, 4], X)?

    \(X = [4, 3, 2]\)

    : reverse([X, Y, Z], [2, 3, 4])?

    \(X = 4\)
    \(Y = 3\)
    \(Z = 2\)
    What happens for the following queries?
    i. reverse([1, 2, 3, 4], [X|Y])?
    ii. reverse(X, [1, 2, 3])?
    iii. reverse(X, Y)?
3. Write a logic program for a predicate \texttt{member}(X,Y) that is true when \( Y \) is a list containing \( X \) as one of its members. What does your program do for each of the following queries?

(a) \texttt{member}(2,[4,a,2,X])?
(b) \texttt{member}(7,[4,a,2,X])?
(c) \texttt{member}(X,[4,a,2,3])?
(d) \texttt{member}(2, Y)\
(e) \texttt{member}(X,Y)?