Foundations of Logic Programming
Tutorial 2 (on November 17th)

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Exercise 2.1:
Use the Martelli-Montanari algorithm step by step to unify the following pairs of terms with variables x, y, and z. For each step indicate which rule you have used.

a) $f(g(x), g(c), y)$ and $f(g(g(y)), x, a)$

b) $f(b, x, x, y)$ and $f(b, g(y), g(g(, z)), g(a))$

c) $f(x, g(z), g(z))$ and $f(h(y), y, g(h(x)))$

Give the corresponding *most general unifier* (mgu) or give the reason why the terms are not unifiable.

Exercise 2.2:
Consider the following program

```
p(X) :- q(X),r(X).
q(f(X)).
r(f(a)).
```

a) Give an SLD-derivation ξ for the query `?- p(X)` that uses the Prolog selection rule.

b) For each derivation step of ξ, give the resultant that is associated with this step (Sl. 3/18).

c) Give the resultants of every level i of ξ (Sl. 3/19).

Exercise 2.3:
Consider the query `?- fact(0,Y),fact(Y,s(0)).` together with the program

```
fact(0,s(0)).
fact(s(N),F) :- fact(N,G), mul(s(N),G,F).
```

a) Give an SLD-derivation using the Prolog selection rule (you don't have to show the multiplication in detail). Give the substitutions and the CAS.

b) Show that the Switching Lemma (Sl. 3/26) holds for the initial query (i.e., for $n = 0$).
Hint: Give a second SLD-derivation selecting the second atom at the beginning and using the Prolog selection rule afterwards. Show the correspondence of both derivations.

Exercise 2.4:
Give the SLD-tree for the query `?- p(X,Y).` and the following program. Use Prolog's selection and computation rule.

```
p(X,Y) :- q(X,Y), r(Y,X).
q(X,a) :- s(X).
q(X,c) :- s(X).
r(X,b) :- t(X).
s(a).
s(b).
s(c).
t(a).
t(c).
```