

Exercise Sheet 7

Due: Sunday, 28. June 2009, 23:59:59 via SVN

For help, contact alp-staff@lists.iai.uni-bonn.de (staff only) or
alp-course@lists.iai.uni-bonn.de (staff and participants).

Please start working on the exercises early enough so that you can contact us in time in case of problems. Don't expect us to be available during weekend!

Task 1. *Cuts* (2 Points) – 10 minutes

a) Let a program be

```
p(1).  
p(2):-!.  
p(3).
```

Write all answers to the following queries:

```
1  ?- p(X).  
2  ?- p(X), p(Y).  
3  ?- p(X), !, p(Y).
```

b) Describe why it gives those answers for each case.

Tip: As an exercise for the oral examination at the end of the course do it with pen and paper only, not by running the program!

Task 2. *Declarative and Procedural Meaning and Cuts* (3 Points) – 10 minutes

Give the declarative and procedural meaning for the predicates p, q, r. Describe the cause for differences and similarities. Recall that the declarative meaning of cut is simply “true” (it always succeeds).

```
p:- a, b.  
p:- c.  
  
q:- a, !, b.  
q:- c.  
  
r:- c.  
r:- a, !, b.
```

Task 3. Sorting and Cuts (9 Points) – 20 minutes

Where are good places to use cuts to optimise the following sorting programs?
What would be changed by the cuts?

Which version (a, b, c, with or without cuts) would you recommend to use? Give the reason behind your decision. Write your preferred version and give it a comprehensive description.

```
a) sort([], []).
   sort([X], [X]).
   sort([H|T1], [H,S|T2]) :- sort(T1, [S|T2]), H < S.
   sort([H|T1], [S|T3])   :- sort(T1, [S|T2]), not(H < S), sort([H|T2], T3).

b) sort1([X|Xs], Ys) :- sort1(Xs, Zs), insert(X, Zs, Ys).
   sort1([], []).

   insert(X, [], [X]).
   insert(X, [Y|Ys], [Y|Zs]) :- X > Y, insert(X, Ys, Zs).
   insert(X, [Y|Ys], [X,Y|Ys]) :- X <= Y.

c) sort2([X|Xs], Ys) :-
    partition(Xs, X, Littles, Bigs),
    sort2(Littles, Ls),
    sort2(Bigs, Bs),
    append(Ls, [X|Bs], Ys).
   sort2([], []).

   partition([X|Xs], Y, [X|Ls], Bs) :- X <= Y, partition(Xs, Y, Ls, Bs).
   partition([X|Xs], Y, Ls, [X|Bs]) :- X > Y, partition(Xs, Y, Ls, Bs).
   partition([], Y, [], []).
```

Task 4. Sorting and Cuts (3 Points) – 10 minutes

Think about different modes of invocation and different “kinds” of input Lists that illustrate relevant test cases for the above programs.

Then use these inputs to compare the runtimes of the given programs and of your versions with cuts, as described in Task 2 of exercise sheet 6.