PROLOG

References:

- Clocksin and Mellisch, chapters 1-4
- Sethi, chapter 11

Example with Cut

```
% ----- allListsHave -----

% allListsHave ( List, Key ) returns true iff every element
% of List that is a a list, contains Key.

% broken version:

broken( [First|Rest], Key ) :-
    is_list(First),
    member(Key, First),
    broken( Rest, Key ).

broken( [_|Rest], Key ) :-
    broken( Rest, Key ).

broken( [], _ ).


% Working version (with cut):

allListsHave( [First|Rest], Key ) :-
    is_list(First), !,      % A cut here fixes the prob.
    member(Key, First),
    allListsHave( Rest, Key ).

allListsHave( [_|Rest], Key ) :-
    allListsHave( Rest, Key ).

allListsHave( [], _ ).
```

Trace without cut

```
| ?- broken( [[a,b], p, [c,d,e]], a).
   (0) Call: broken([[a,b],p,[c,d,e]],a) ?
   (1) Call: is_list([a,b]) ?
   (1) Exit: is_list([a,b]) ?
   (2) Call: member(a,[a,b]) ?
   (2) Exit: member(a,[a,b]) ?
   (3) Call: broken([p,[c,d,e]],a) ?
   (4) Call: is_list(p) ?
   (4) Fail: is_list(p) ?
   (5) Call: broken([[c,d,e]],a) ?
   (6) Call: is_list([c,d,e]) ?
   (6) Exit: is_list([c,d,e]) ?
   (7) Call: member(a,[c,d,e]) ?
                 ...

   (7) Fail: member(a,[c,d,e]) ?
   (6) Redo: is_list([c,d,e]) ?
   (6) Fail: is_list([c,d,e]) ?
   (11) Call: broken([],a) ?
   (11) Exit: broken([],a) ?
   (5) Exit: broken([[c,d,e]],a) ?
   (3) Exit: broken([p,[c,d,e]],a) ?
   (0) Exit: broken([[a,b],p,[c,d,e]],a) ?

yes
[trace]
```

Trace with cut

```
| ?- allListsHave( [[a,b], p, [c,d,e]], a).
   (0) Call: allListsHave([[a,b],p,[c,d,e]],a) ?
   (1) Call: is_list([a,b]) ?
   (1) Exit: is_list([a,b]) ?
   (2) Call: member(a,[a,b]) ?
   (2) Exit: member(a,[a,b]) ?
   (3) Call: allListsHave([p,[c,d,e]],a) ?
   (4) Call: is_list(p) ?
   (4) Fail: is_list(p) ?
   (5) Call: allListsHave([[c,d,e]],a) ?
   (6) Call: is_list([c,d,e]) ?
   (6) Exit: is_list([c,d,e]) ?
   (7) Call: member(a,[c,d,e]) ?
                ...

   (8) Fail: member(a,[d,e]) ?
   (7) Fail: member(a,[c,d,e]) ?
   (5) Fail: allListsHave([[c,d,e]],a) ?
   (3) Fail: allListsHave([p,[c,d,e]],a) ?
   (2) Redo: member(a,[a,b]) ?
   (11) Call: member(a,[b]) ?
   (12) Call: member(a,[]) ?
   (12) Fail: member(a,[]) ?
   (11) Fail: member(a,[b]) ?
   (2) Fail: member(a,[a,b]) ?
   (0) Fail: allListsHave([[a,b],p,[c,d,e]],a) ?

no
[trace]
```