Tik-79.144 **Syksy 1998**
Logic in Computer Science: Foundations
Exercise 11
Solutions

1. a)
```
| ?- reverse([a,b,c],Xs).
 + 1  1  Call: reverse([a,b,c],_83) ?
 + 2  2  Call: reverse([a,b,c],[],_83) ?
 + 3  3  Call: reverse([b,c],[a],_83) ?
 + 4  4  Call: reverse([c],[b,a],_83) ?
 + 5  5  Call: reverse([],[c,b,a],_83) ?
 + 5  5  Exit: reverse([],[c,b,a],[c,b,a]) ?
 + 4  4  Exit: reverse([c],[b,a],[c,b,a]) ?
 + 3  3  Exit: reverse([b,c],[a],[c,b,a]) ?
 + 2  2  Exit: reverse([a,b,c],[],[c,b,a]) ?
 + 1  1  Exit: reverse([a,b,c],[c,b,a]) ?

Xs = [c,b,a] ?

yes
```

b)
```
| ?- reverse([a,b,c],[c,b]).
 + 1  1  Call: reverse([a,b,c],[c,b]) ?
 + 2  2  Call: reverse([a,b,c],[],[c,b]) ?
 + 3  3  Call: reverse([b,c],[a],[c,b]) ?
 + 4  4  Call: reverse([c],[b,a],[c,b]) ?
 + 5  5  Call: reverse([],[c,b,a],[c,b]) ?
 + 5  5  Fail: reverse([],[c,b,a],[c,b]) ?
 + 4  4  Fail: reverse([c],[b,a],[c,b]) ?
 + 3  3  Fail: reverse([b,c],[a],[c,b]) ?
 + 2  2  Fail: reverse([a,b,c],[],[c,b]) ?
 + 1  1  Fail: reverse([a,b,c],[c,b]) ?

no
```

2. a)
```
qmove(X1,Y1,X2,Y2) :- diff(X1,X2,_), equal(Y1,Y2).
qmove(X1,Y1,X2,Y2) :- diff(Y1,Y2,_), equal(X1,X2).
qmove(X1,Y1,X2,Y2) :- diff(X1,X2,N), diff(Y1,Y2,N).

equal(1,1).
equal(X,Y) :- succ(A,X), succ(B,Y), equal(A,B).
```

```
diff(X,Y,N) :- add(X,N,Y).
diff(X,Y,N) :- add(Y,N,X).

add(X,1,Y) :- succ(X,Y).
add(X,Y,Z) :- succ(A,Y), succ(B,Z), add(X,A,B).

succ(1,2).
succ(2,3).
succ(3,4).
succ(4,5).
succ(5,6).
succ(6,7).
succ(7,8).
```

b)
```
nqmove(X1,Y1,X2,Y2) :- diff(X1,X2,N), diff(Y1,Y2,M),
                       diff(N,M,_).
```

c)
```
nocc(X,Y,[]) :- equal(X,Y).
nocc(X,Y,[]) :- diff(X,Y,_).
nocc(X1,Y1,[pos(X2,Y2)|L]) :- nqmove(X1,Y1,X2,Y2),
                              nocc(X1,Y1,L).

noccupied(X,8,[]) :- nocc(X,8,[]).
noccupied(X1,Y1,[pos(X2,Y2)|L]) :- succ(Y1,Y2),
  noccupied(X2,Y2,L), nocc(X1,Y1,[pos(X2,Y2)|L]).

solution([pos(X,1)|L]) :- noccupied(X,1,L).
```