Logic Programming: Prolog

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List Examples: Add and Delete

- Add(X,L1,L2)
  - Add(a,[],[a]).
  - Add(X,L1,[X|L1]).

- Del(X,[],[]).
- Del(X,[X],[]).
- Del(X,[X|Tail],Tail).
- Del(X,[Y|Tail],[Y|Tail1]) :- Del(X,Tail,Tail1).

Delete all instances of X

List Examples: Permutation

- permutation([],[]).
- permutation([X|L],P) :- permutation(L,L1), remove(X,P,L1).
- remove(X,[X],[]).
- remove(X,[X|L],L).
- remove(X,[Y|Tail],[Y|Tail1]) :- remove(X,Tail,Tail1).

List Examples: Permutation

- Permutation([],[]).
- Permutation([X|L],P) :- Permutation(L,L1), insert(X,L1,P).

- ?- Permutation([a,b,c,d],[d,c,a,b])

  [X|L] = [a|b,c,d], L1 = [d,c,b] P = [d,c,a,b]

  - Permutation([b,c,d],L1), insert(a,L1,[d,c,a,b])
  - Permutation([c,d],L'), insert(b,L',L1)

  - Depth first search
  - Draw derivation tree?

Arithmetic and Logical operators

- We have +, -, *, /, mod
- The “is” operator forces evaluation
- ?- X is 3/2.
  - Will be answered X = 1.5
- We have
  - X>Y, X<Y, X>=Y, X=<Y
  - X=:=Y
    - X and Y are equal
  - X =\= Y
    - X and Y are not equal

Prolog: Inputs and Outputs

- write()
  - To write the output we can use the write() predicate
- | ?- write(56).
- 56
- yes
- | ?- write('hello’).
- hello
- yes
- | ?- write('hello'),nl,write('world’).
- hello
- world

Prolog: Inputs and Outputs

- read()
  - The read() predicate is used to read from console
- | ?- write('Write a number: ‘), read(Number).

- area :- write('Write a number: '), read(Number), process(Number).
- process(0).
- process(Number) :-
  - A is Number * Number,
  - write(‘Area of '),write(Number),write(': '),write(A),nl,
  - area.

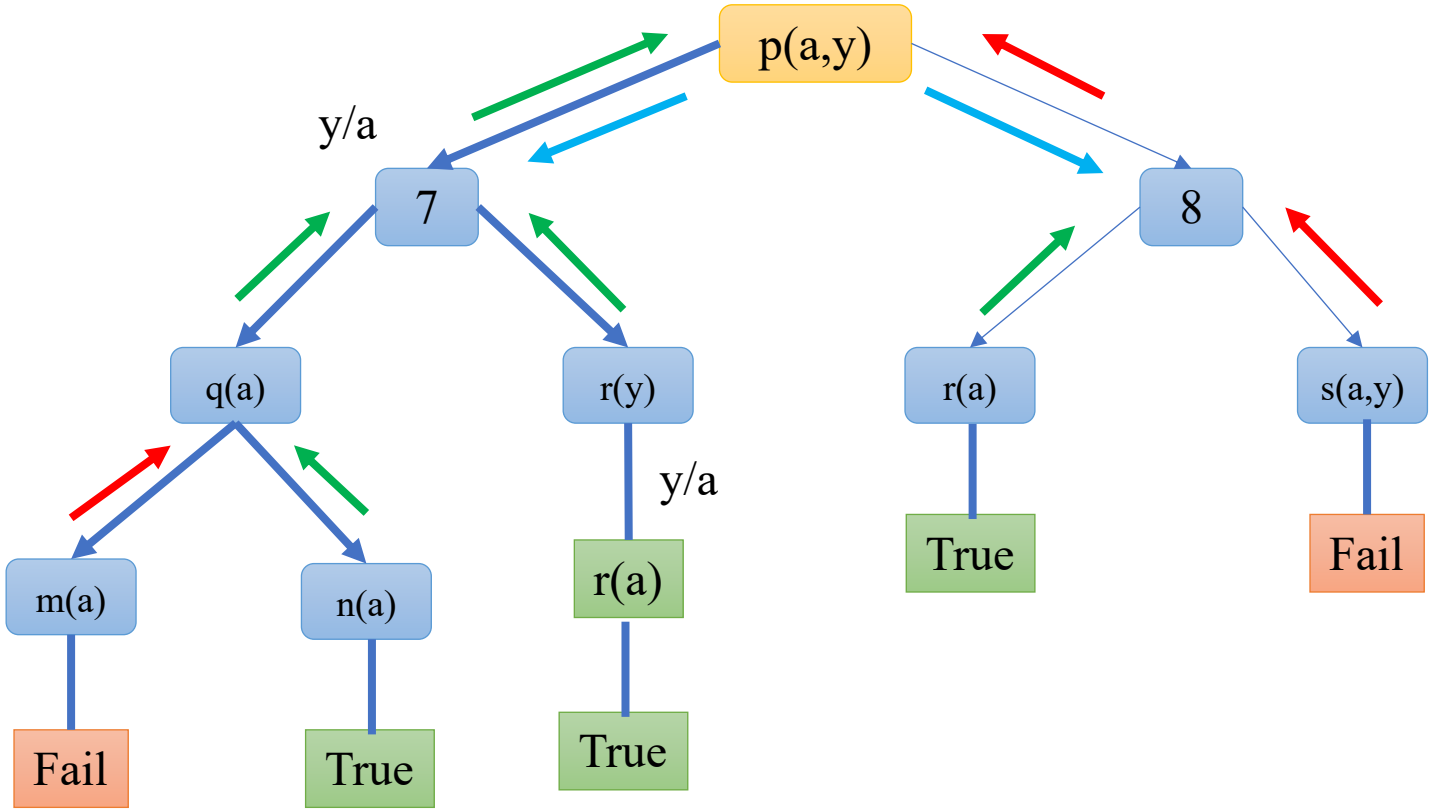
Examples

- GCD of two numbers
  - gcd(0,X,X).
  - gcd(X,0,X).
  - gcd(X,X,X).
  - gcd(X,Y,D) :- X>=Y, Y1 is X mod Y, gcd(Y1,Y,D).
  - gcd(X,Y,D) :- X<Y, Y1 is Y mod X, gcd(Y1,X,D).

- Length of a list
  - length([],0)
  - length([_|Tail], N) :- length(Tail, N1), N is N1+1

1. r(a)
2. s(b,c)
3. m(b)
4. n(a)
5. q(x) :- m(x)
6. q(x) :- n(x)
7. p(x,y) :- q(x), r(y)
8. p(x,y) :- r(x), s(x,y)

- ?- p(a,y)



y=a

Prolog: CUT

Cuts – for controlling backtracking

- C :- P, Q, R, !, S, T, U.
- C :- V
- A :- B, C, D.
- ?- A

- Backtracking within the goal list P, Q, R
- As soon as the cut is reached
  - All alternatives of P, Q, R are suppressed
  - The clause C :- V will also be discarded
  - Backtracking possible within S, T, U
  - No effect within A :- B, C, D, i.e.,
    - Backtracking within B, C, D remains active

Examples

- Finding the maximum of two numbers
  - If X>=Y, then Max=X, otherwise Max=Y

  - Max(X,Y,X) :- X>=Y, !.
  - Max(X,Y,Y).

  - If first one works Prolog will not try the second one

Examples

- Adding an element to a list without duplication
  - Try using CUT

Negation as Failure

- The different predicate
  - Different(X, X) :- !, fail.
  - Different(X,Y).

  - Different(X,X) :- fail.
  - Different(X,Y).

  - Different(X,X) :- fail.
  - Different(X,Y) :- X=\=Y.

Examples

- GCD of two numbers
  - gcd(0,X,X) :- !.
  - gcd(X,0,X) :- !.
  - gcd(X,X,X).
  - gcd(X,Y,D) :- X>=Y, Y1 is X mod Y, gcd(Y1,Y,D).
  - gcd(X,Y,D) :- X<Y, Y1 is Y mod X, gcd(Y1,X,D).

- Length of a list
  - length([],0)
  - length([_|Tail], N) :- length(Tail, N1), N is N1+1

Thank You