

Fall 2005 22C:111

Homework6 Solution

Problem 1:

?- 1+1=2.

No

?- 1+1:=2.

Yes

?- X+1=2*Y+Z.

X = 2*_G161

Y = _G161

Z = 1 ;

No

?- X=1;X=2.

X = 1 ;

X = 2 ;

No

?- [X,Y|Xs]=[a,b,c,d].

X = a

Y = b

Xs = [c, d] ;

No

?- [X,[Y,Z],3]=[[Z,Y],X,Z].

X = [3, 3]

Y = 3

Z = 3 ;

No

?- member(b,[a,,b,c]).

ERROR: Syntax error: Operator expected

ERROR: member(b,[a,,

ERROR: ** here **

ERROR: b,c]) .

?- member(d,[a,b,c]).

No

?- member(X,[a,b,c]).

X = a ;

X = b ;

X = c ;

No

?- length(Xs,2),member(a,Xs),member(b,Xs) .

Xs = [a, b] ;

Xs = [b, a] ;

No

Problem 2:

(a)

?- member(X,[1,222,3,56,670]),X>100.

X = 222 ;

X = 670 ;

No

(b) ?- member(X, [1,222,3,56,670]), X>50, X<100.

X = 56 ;

No

(c)

?-append(_, [X|Xs], [a,a,b,c,c]), member(X, Xs).

X = a Xs = [a, b, c, c] ;

X = c Xs = [c] ;

No

Problem 3:

alike(a,aa). (1)

alike(aa,aaa). (2)

alike(X,X). (3)

alike(X,Y):-alike(Y,X). (4)

alike(X,Y):-alike(X,Z),alike(Z,Y). (5)

(a)

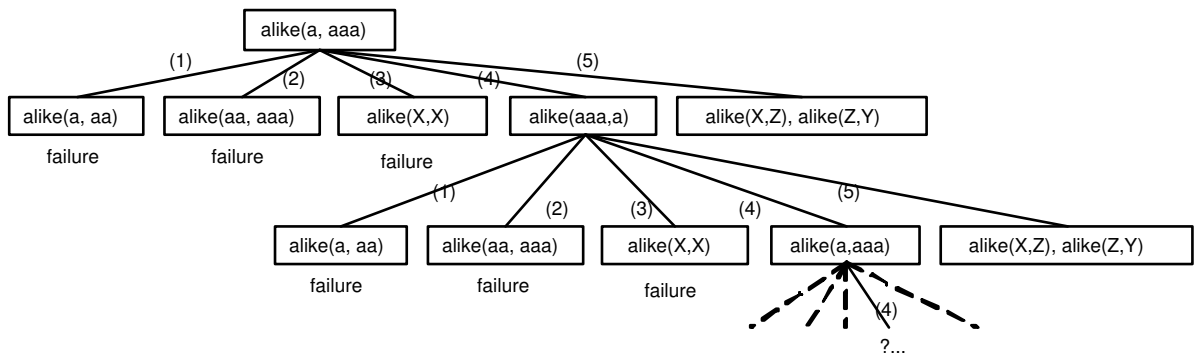
?- alike(a,aaa).

ERROR: Out of local stack Exception: (29,573)

alike(a, aaa) ? no debug

The response doesn't reflect "logical conclusions". According to logic, $(1)(2)(5) \Rightarrow \text{alike}(a, \text{aaa})$, But actually, clause (4) in the predicate definition prevents prolog to ever try clause (5) in this case. When trying to resolve $\text{alike}(a, \text{aaa})$ using clause (4), it tries to resolve $\text{alike}(\text{aaa}, a)$. When then trying to resolve $\text{alike}(\text{aaa}, a)$ using clause (4), it tries to resolve $\text{alike}(a, \text{aaa})$, therefore enter a loop.

Please see the following Prolog search tree for resolving the goal. Since the Prolog system is using depth-first search, the resolution has infinite depth, thus cause the out of stack error. (Refer to textbook Section 12.4.5 Prolog's Search Strategy.)



Prolog search tree for resolving goal $\text{alike}(a, \text{aaa})$

(b)

?- $\text{alike}(\text{aaa}, \text{aa})$.

Yes

According to logic, $(2)(4) \Rightarrow \text{alike}(\text{aaa}, \text{aa})$.

(c)

?- $\text{alike}(a, X)$.

$X = \text{aa}$;

$X = a$;

```
X = a ;
X = aa ;
X = a ;
X = a ;
X = aa ;
X = a ;
X = a ;
X = aa
(continuing...)
Yes
```

It doesn't reflect logical conditions. According to logic, a, aa, aaa are all possible values for X. However, Prolog system responds with only a, and aa repeatedly. The reason is similar to (a). The search tree has infinite depth in the branch along clause (4). Clause (5) will never be tried.

```
(d)
?- alike(X,Y).
X = a Y = aa ;
X = aa Y = aaa ;
X = _G157 Y = _G157 ;
X = aa Y = a ;
X = aaa Y = aa ;
X = _G157 Y = _G157 ;
X = a Y = aa ;
X = aa Y = aaa ;
```

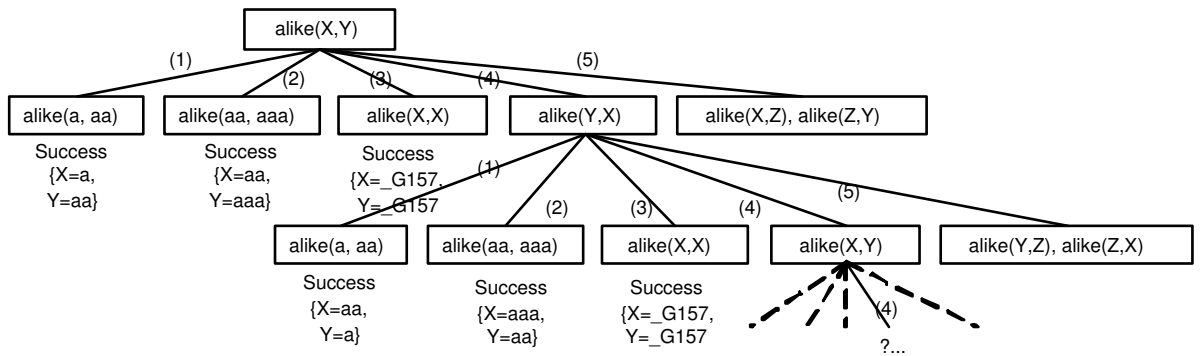
X = _G157 Y = _G157

(continuing...)

Yes

It doesn't reflect logical conditions. According to logic, X=a, Y=aa; X=aa, Y=a; X=a, Y=aaa; X=aaa, Y=a; X=aa, Y=aaa; X=aaa, Y=aa ; and X=Y, are all possible values for alike(X,Y) to be true. However, the system's responses missed the cases when X=aaa, Y=a, etc. This happens for the same reason as in (a) and (c).

Please see the following Prolog search tree for resolving the goal.



Prolog search tree for resolving goal alike(X,Y)