Administrative Issues

- HW5: May 4th
- Essay: May 1st
  ABET requirement:
  you must get a passing score (37.5), otherwise you will receive Incomplete (I) for this course
- Final Review: May 1st
- Final exam: open notes and open book
  Thursday, May 8th, 2-4:30pm, GACB 105

CSE 3302
Programming Languages

Logic Programming: Prolog (III)

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Spring 2008

Loops and Control:

fail and cut (!)

fail

- Loops:
  * Enforce backtrack even when an answer is found (using built-in predicate fail)
  * An alternative is to type ";" to indicate a continued search.

Example

- Print all solutions of appending.

```
printpieces(L) :- append(X,Y,L),
                  write(X),
                  write(Y),
                  nl,
                  fail.

?- printpieces([1,2]).
[][1,2]
[1][2]
[1,2][]
fail
```


Example

- num(0).
  num(X) :- num(Y), X is Y+1.

?- num(X).

- writenum(I,J) :- num(X),
  I =< X,
  X =< J,
  write(X),
  nl,
  fail.

?- writenum(1,10). (Will this work?)

cut

Cut (using built-in predicate !) branches in the search tree (to avoid infinite loop).

- "freezes" the choice made when "!" is encountered.
- If "!" is reached on backtracking, the search of the subtree at the parent node of the node containing "!" stops, and the search containues with the "grandparent" node.

Example

```
writenum(I,J) :- num(X),
                 I =< X,
                 X =< J,
                 write(X),
                 nl,
                 X = J, !,
                 fail.
?- writenum(1,10).
```


Where to cut exactly?

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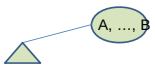
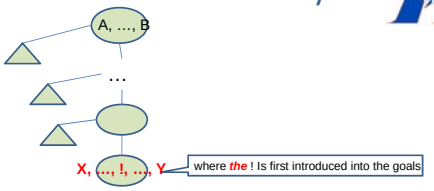
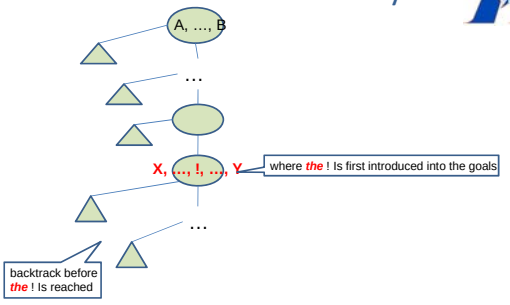


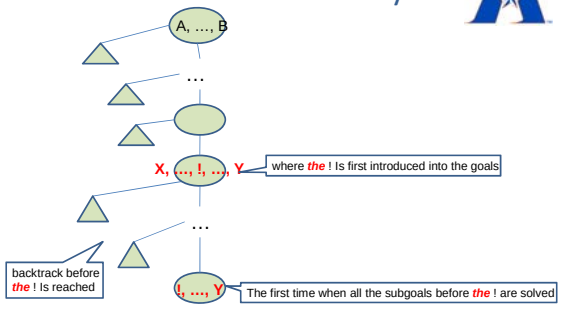
Where to cut exactly?



Where to cut exactly?



Where to cut exactly?



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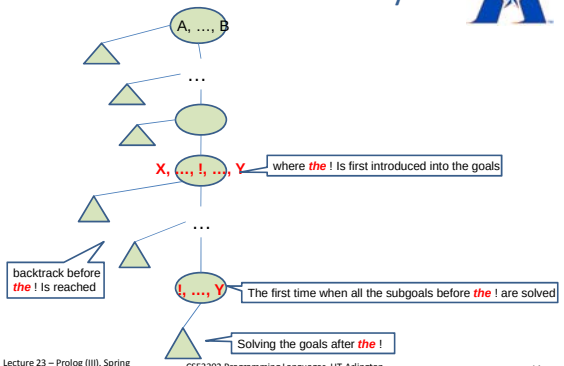

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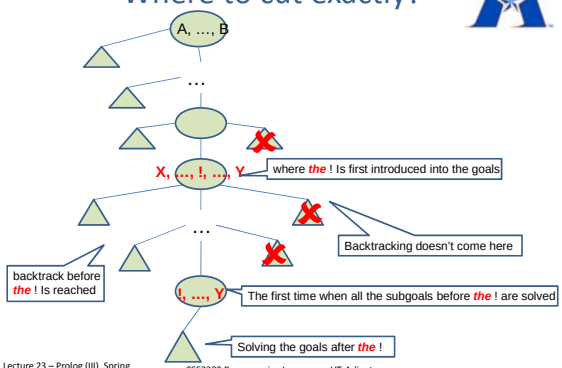
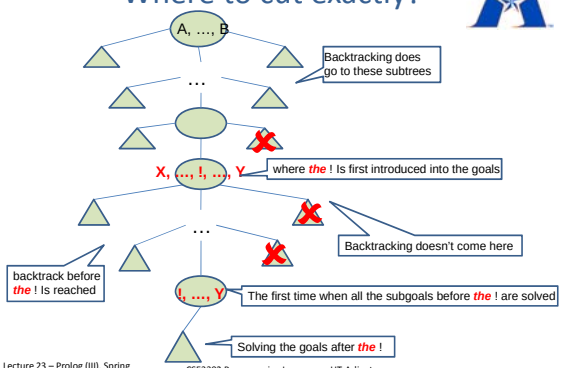


Where to cut exactly?



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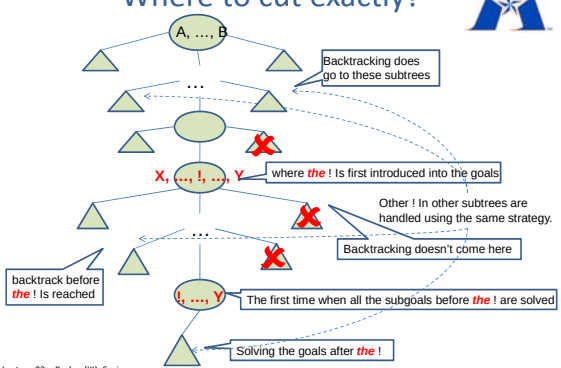


Where to cut?

- *The cut (!) goal always succeeds.*
- *All the choices made before ! are frozen.*
- *Along the path from the node where ! Is introduced into the goals till the node where ! is reached (all previous goals satisfied), all the silbings of these nodes are pruned.*

Exercise 1

- Duplicate the elements in a list, using the numbers of duplicates specified in another list.
- E.g.,
  ?- duplicate([1,5,3], [2,1,4], Result).

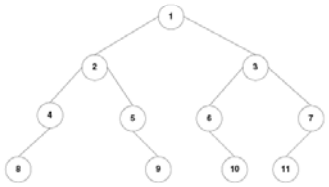
  Result = [1,1,5,3,3,3,3].

Exercise 1

```
duplicate_single(H, 0, []).

duplicate_single(H, N, [H|U]) :- N>0,
                                 M is N-1,
                                 duplicate_single(H,M,U).

duplicate_list([], _, []).

duplicate_list([H|T], [N|Ns], Result) :- duplicate_single(H,N,U),
                                         duplicate_list(T,Ns,V),
                                         append(U,V,Result).
```


Exercise 2

- An example with predicates containing predicates
- Binary Tree
  e.g.,
  tree(1,tree(2,tree(4,tree(8,void,void),void),tree(5,void,tree(9,void,void))),tree(3,tree(6,void,tree(10,void,void)),tree(7,tree(11,void,void),void))).



Exercise 2

- ordered (T): true if T is ordered
  (For each node n, all nodes in n's left subtree are smaller than n, and all nodes in n's right subtree are larger than n. Assuming no duplicates).

ordered(T) :- ordered(T, Min, Max).
ordered(tree(X, void, void), X, X).
ordered(tree(X, L, void), Min, X) :- ordered(L, Min, Max), X>Max.
ordered(tree(X, void, R), X, Max) :- ordered(R, Min, Max), X<Min.
ordered(tree(X, L, R), Min, Max) :- ordered(L, Min, Max1), ordered(R, Min2, Max), X>Max1, X<Min2.

Exercise 3

```
student(Amy).
student(Bob).
take(Amy, CSE3302).
take(Amy, CSE3303).
take(Amy, CSE3304).
take(Bob, CSE3301).
take(Bob, CSE3303).
credit(CSE3301, 3).
credit(CSE3302, 3).
credit(CSE3303, 4).
credit(CSE3304, 2).

?- student(X), take(X, Y), credit(Y,Z).
?- !, student(X), take(X, Y), credit(Y,Z).
?- student(X), take(X, Y), !, credit(Y,Z).
?- student(X), take(X, Y), credit(Y,Z), !.
```