

CSc 372

Comparative Programming Languages

21 : Prolog — Execution

Department of Computer Science
University of Arizona

collberg@gmail.com

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Christian Collberg

Execution

Executing Prolog

- Now that we know about matching, we can take a closer look at how Prolog tries to satisfy goals.
- In general, to solve a goal

$$G = G_1, G_2, \dots, G_m,$$

Prolog will first try to solve the sub-goal G_1 .

- It solves a sub-goal G_1 it will look for a rule

$$H_i :- B_1, \dots, B_n$$

in the database, such that G_1 and H_i will match.

- Any variable substitutions resulting from the match will be stored in a variable θ .

Executing Prolog. . .

- A new goal will be constructed by replacing G_1 with B_1, \dots, B_n , yielding

$$G' = B_1, \dots, B_n, G_2, \dots, G_m.$$

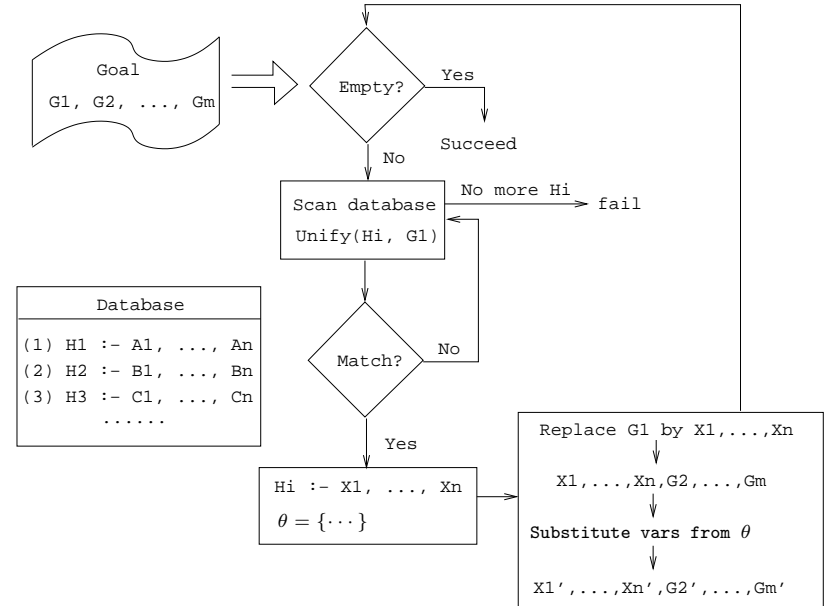
If $n = 0$ the new goal will be shorter and we'll be one step closer to a solution to G !

- Any new variable bindings from θ are applied to the new goal, yielding G'' .
- We recursively try to find a solution to G'' .

Executing Prolog...

```
FUNC Execute (G = G1, G2, ..., Gm; Result);
  IF Is_Empty(G) THEN Result := Yes
  ELSE
    Result := No;
    i := 1;
    WHILE Result=No & i ≤ NoOfClauses DO
      Clause := Hi :- B1, ..., Bn;
      IF Unify(G1, Clause, θ) THEN
        G' := B1, ..., Bn, G2, ..., Gm;
        G'' := substitute(G', θ);
        Execute(G'', Result);
      ENDIF;
      i := i + 1;
    ENDDO
  ENDIF
```

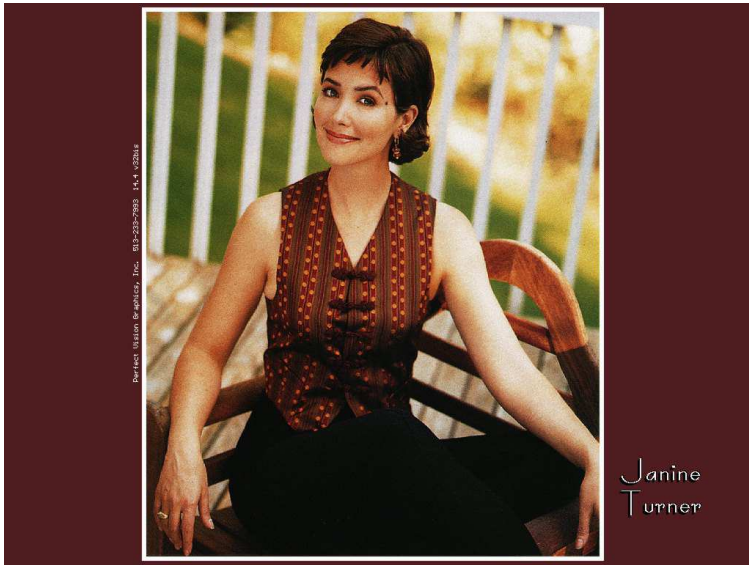
Example



Northern Exposure Example

```
% From the Northern Exposure FAQ
% friend(of, kind(name, regular)).
friend(maggie, person(eve, yes)).
friend(maggie, moose(morty, yes)).
friend(maggie, person(harry, no)).
friend(maggie, person(bruce, no)).
friend(maggie, person(glenn, no)).
friend(maggie, person(dave, no)).
friend(maggie, person(rick, no)).
friend(maggie, person(mike, yes)).
friend(maggie, person(joel, yes)).
```

Maggie (Janine Turner)



Northern Exposure Example...

```
cause_of_death(morty, copper_deficiency).
cause_of_death(harry, potato_salad).
cause_of_death(bruce, fishing_accident).
cause_of_death(glenn, missile).
cause_of_death(dave, hypothermia).
cause_of_death(rick, hit_by_satellite).
cause_of_death(mike, none_yet).
cause_of_death(joel, none_yet).
```

```
male(morty). male(harry). male(bruce).
male(glenn). male(dave). male(rick).
male(mike). male(joel). female(eve).
```

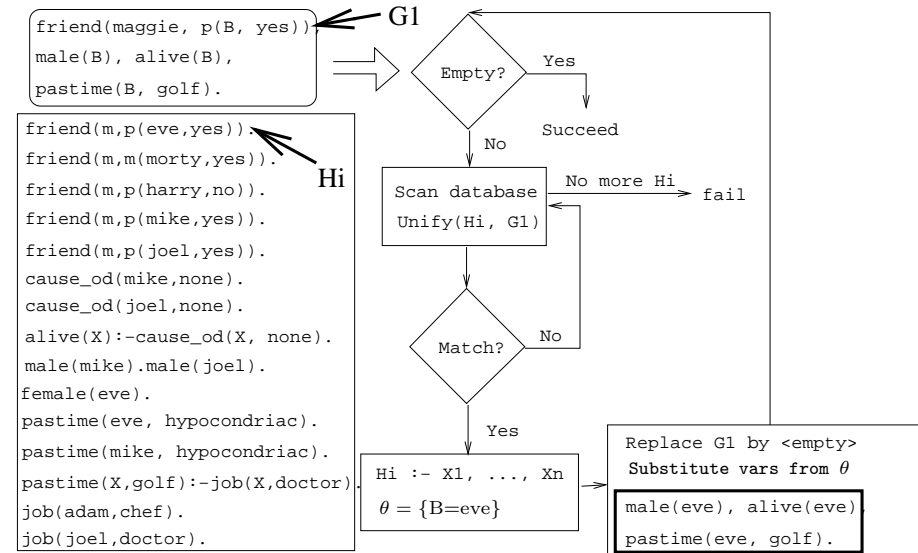
Northern Exposure Example...

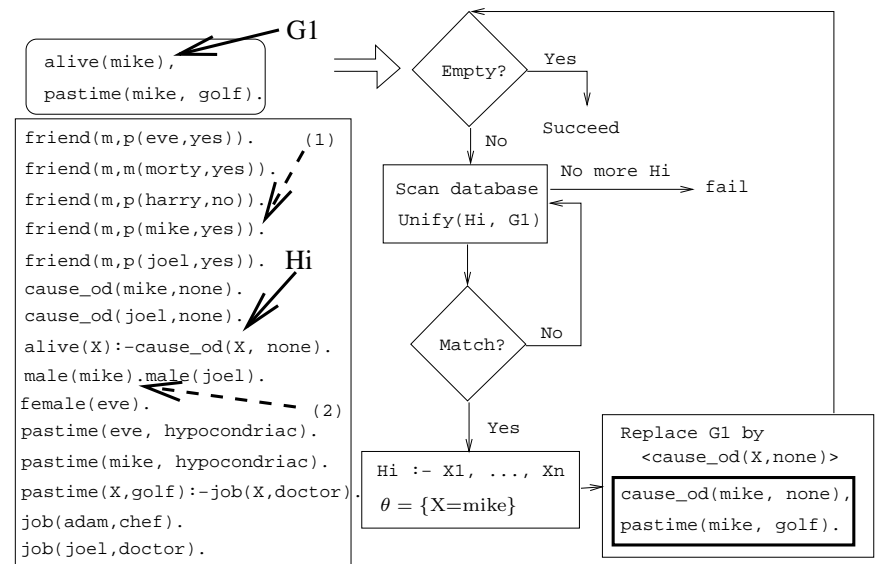
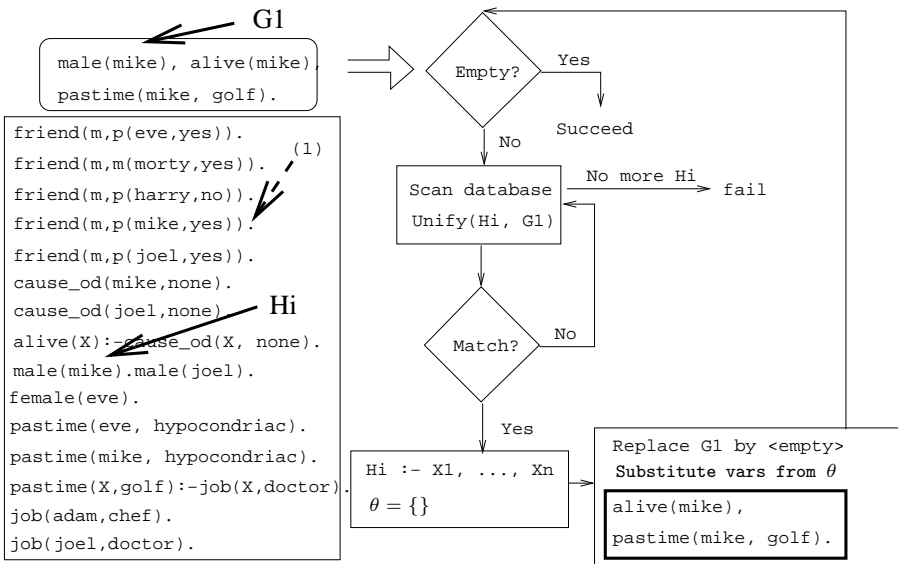
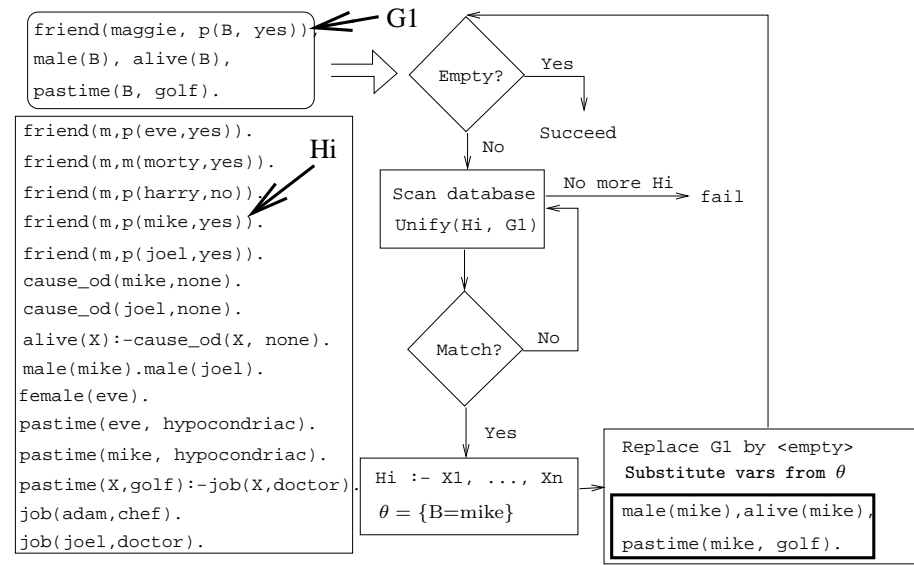
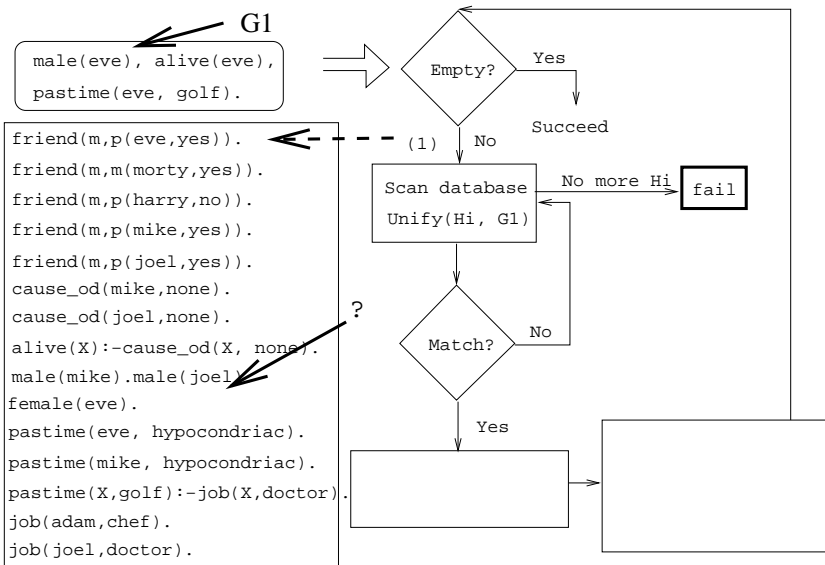
```
alive(X) :- cause_of_death(X, none_yet).
```

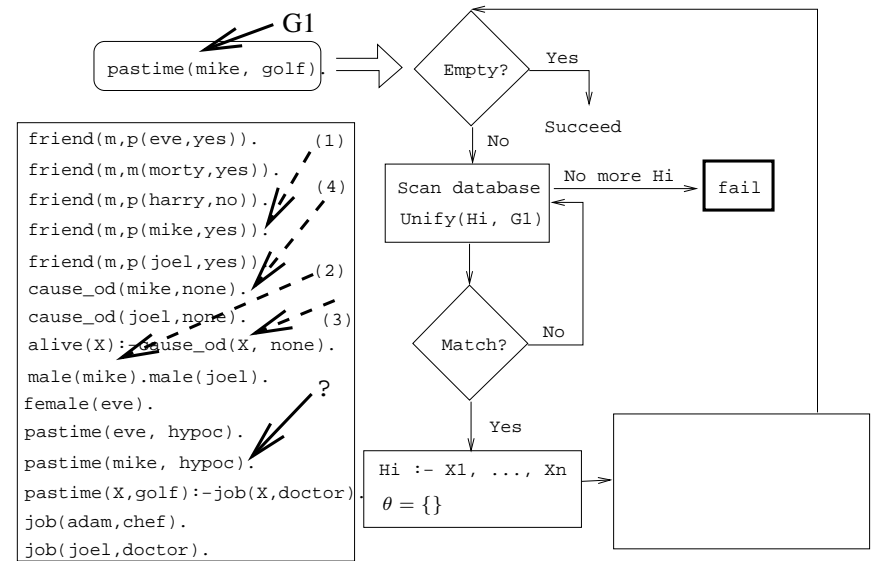
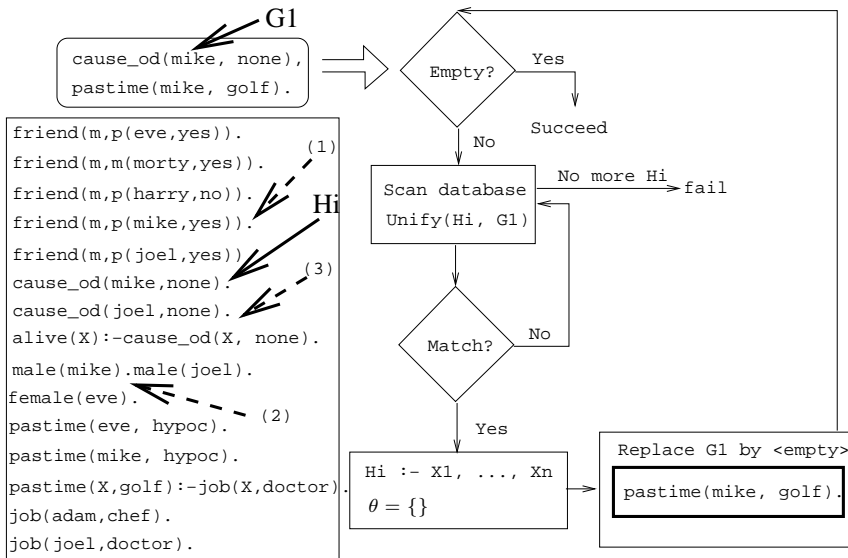
```
pastime(eve, hypochondria).
pastime(mike, hypochondria).
pastime(X, golf) :- job(X, doctor).
```

```
job(mike, lawyer). job(adam, chef).
job(maggie, pilot). job(joel, doctor).
```

```
?- friend(maggie, person(B, yes)),
   male(B),
   alive(B),
   pastime(B, golf).
```

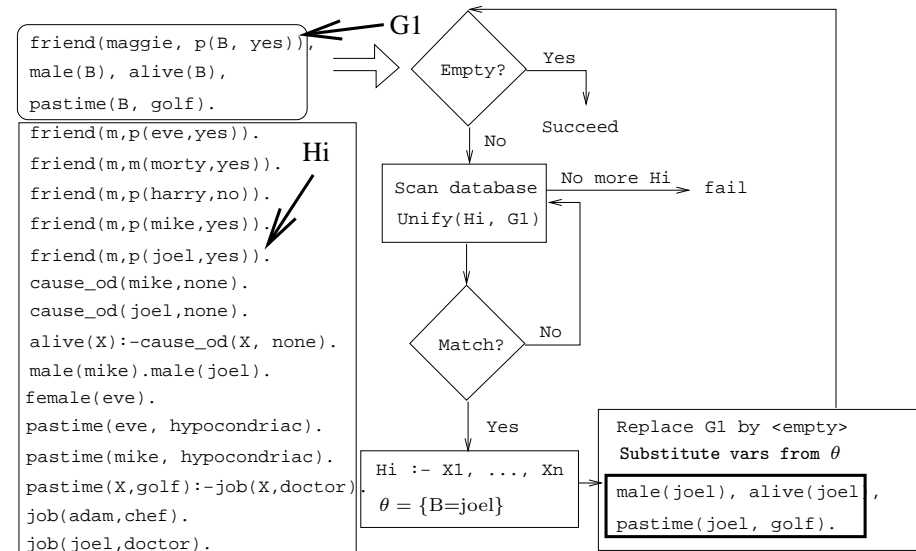


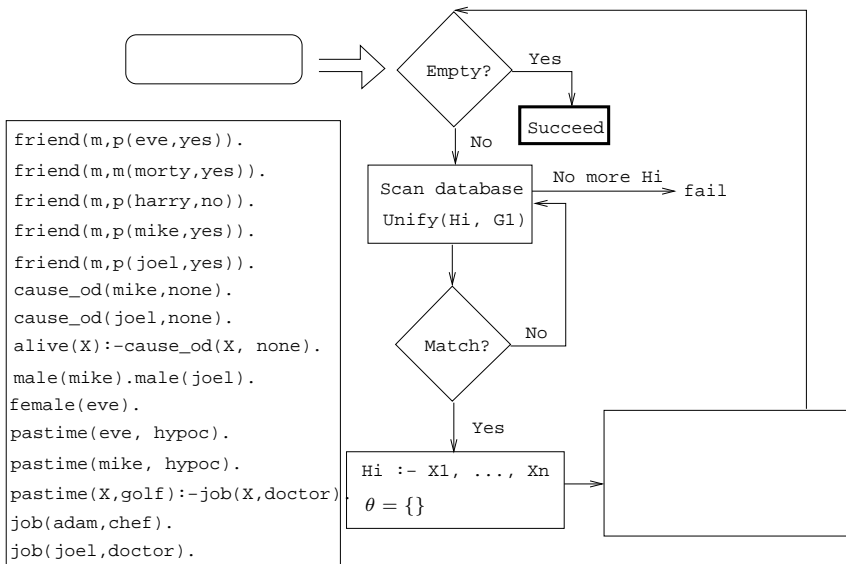
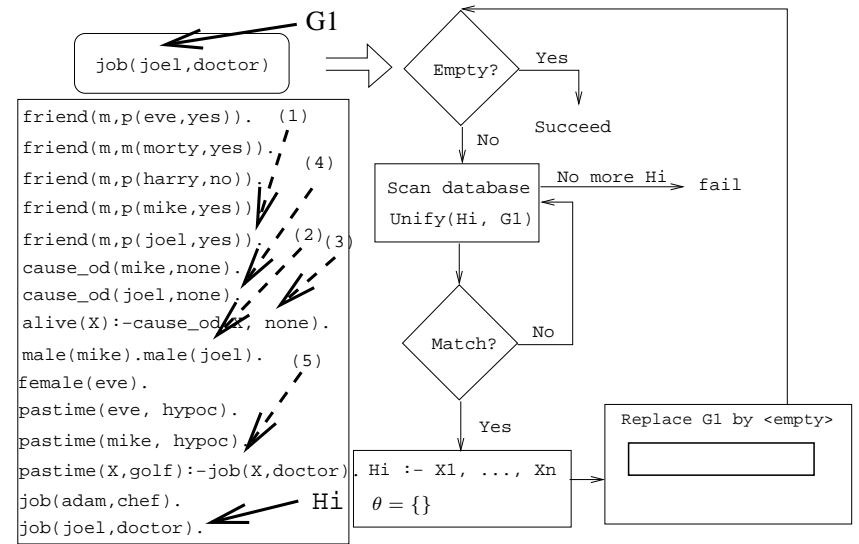
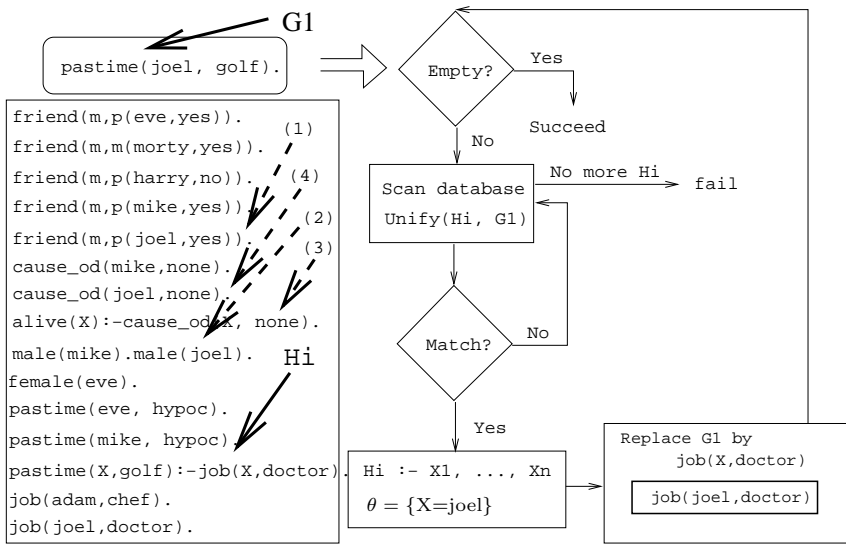




Northern Exposure Example...

- We skip a step here.
- `pastime(mike, golf)` unifies with `pastime(X, golf) :- job(X, doctor).`
- However, `job(mike, doctor)` fails, and we backtrack all the way up to the original query.





Readings and References

- Read [Clocksin-Mellish, Section 4.1](#).
- See <http://www.moosfest.org> for information about the annual Moosefest.
- See <http://members.lycos.co.uk/janineturner/engl/index.html> for pictures of Janine Turner, who plays Maggie.
- See <http://home.comcast.net/~mcnotes/mcnotes.html> for show transcripts.

Summary

- A term is either a
 - a constant (an atom or integer)
 - a variable
 - a structure
- Two terms *match* if
 - there exists a variable substitution θ which makes the terms identical.
- Once a variable becomes instantiated, it stays instantiated.
- Backtracking *undoes* variable instantiations.
- Prolog searches the database sequentially (from top to bottom) until a matching clause is found.