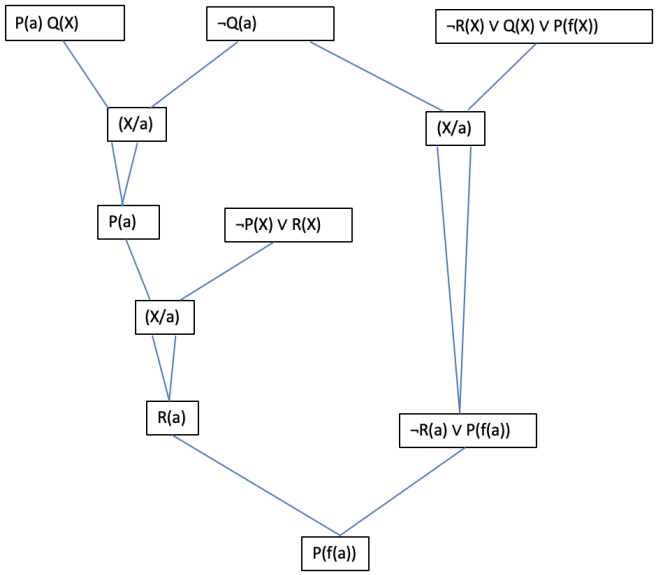
Introduction to Model-based AI Coursework 2

Miki Ivanovic

March 2019

1



2

There are two constants a and c and no function definitions within S, therefore we generate a ground instance S' of S

$$ground(S) = S' = \{G(c), B(a), G(a) \vee \neg G(c), \neg B(a) \vee \neg G(a)\}$$

S' is a finite set of ground instances which is clearly unsatisfiable, therefore by the Herbrand Theorem we have S is unsatisfiable $\Rightarrow$ S has no valid Herbrand interpretations.

3

Let

$$\begin{aligned} ground(S) = S' = \{&\neg P(a,a) \vee P(a,a), \neg P(a,b) \vee P(a,b), \neg P(b,a) \vee P(a,a), \\ &\neg P(b,b) \vee P(a,b), P(a,a) \vee P(b,a), P(a,b) \vee P(b,b), \\ &\neg P(a,b) \vee \neg P(a,a), \neg P(a,b) \vee \neg P(b,b)\} \end{aligned}$$

- Basic Davis Putnam

  Remove tautologies

  $$\begin{aligned} S'_1 = \{&\neg P(b,a) \vee P(a,a), \neg P(b,b) \vee P(a,b), P(a,a) \vee P(b,a), \\ &P(a,b) \vee P(b,b), \neg P(a,b) \vee \neg P(a,a), \neg P(a,b) \vee \neg P(b,b)\} \end{aligned}$$

  choose $P(a,a)$

  $$\begin{aligned} S'_2 = \{&\neg P(b,b) \vee P(a,b), P(a,b) \vee P(b,b), \neg P(a,b) \vee \neg P(b,b), \\ &\neg P(b,a) \vee \neg P(a,b), \neg P(b,a) \vee \neg P(a,b)\} \end{aligned}$$

  choose $P(a,b)$

  $$S'_3 = \{\neg P(b,b), \neg P(b,b) \vee \neg P(b,a), \neg P(b,a) \vee P(b,b), P(b,b) \vee \neg P(b,a)\}$$

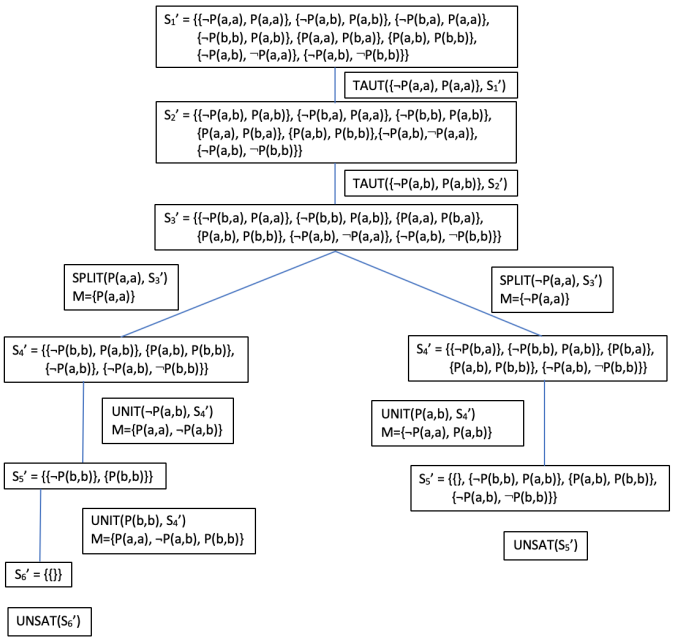
  choose $P(b,a)$

  $$S'_4 = \{\neg P(b,b), P(b,b)\}$$

  choose $P(b,b)$

  $$S'_5 = \{\{\}\}$$

- DLL



4

4.1

```
%static facts:
place(house)
place(car)

%initially we have
%       agent in house
%       camera in car
%       camera switched off

initially(agentLocation(house))
initially(cameraLocation(car))
initially(cameraStatus(off))

%describe agent taking picture
initiates(takePhoto,photoTaken(Place),T) :-
```

```
        time(T),
        holds(holdCamera, T),
        holds(agentLocation(Place,T).

%describe agent turning on camera
initiates(turnOn,cameraStatus(on),T) :-
        time(T),
        holds(holdCamera,T),
        holds(cameraStatus(off),T).

terminates(turnOn,cameraStatus(off),T) :-
        time(T),
        holds(holdCamera,T),
        holds(cameraStatus(off),T).

%describe picking up camera
initiate(pickUp,holdCamera,T) :-
        time(T),
        holds(not holdCamera,T),
        holds(agentLocation(Place1),T),
        holds(cameraLocation(Place2),T),
        Place1 == Place2.

%describe agent moving location
initiates(go(P1,P2),agentLocation(P2),T) :-
        place(P1),
        place(P2),
        P1 =/= P2,
        time(T).

terminates(go(P1,P2),agentLocation(P1),T) :-
        place(P1),
        place(P2),
        P1 =/= P2,
        time(T).

%describe putting down camera
initiate(putDown, not holdCamera,T) :-
```

```
        time(T),
        holdAt(holdCamera, T).

%describe agent turning off camera
initiates(turnOff,cameraStatus(off),T) :-
        time(T),
        holds(holdCamera,T),
        holds(cameraStatus(on),T).

terminates(turnOff,cameraStatus(on),T) :-
        time(T),
        holds(holdCamera,T),
        holds(cameraStatus(on),T).


%only one event can happen at a given time
ic :- happens(E1,T), happens(E2,T), time(T), E1 =/= E2.


abducible(happens(_,_)).


%Goal: take photo of house
holds(photoTaken(house),_)
```

4.2

$\Delta =$

```
{happens(go(house,car),1), happens(pickUp,2),
 happens(turnOn,3), happens(go(car,house),4),
 happens(takePhoto,5)}
```

4.3