AI LAB 7

Title: Forward Chaining
Domain: Transport

Group members

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Problem Statement:

The winter season has arrived, and with it comes the challenge of driving in icy and snowy conditions. Drivers are encouraged to take caution on the roads, especially when there is a risk of black ice or other hazards. One of the most effective ways to stay safe while driving in these conditions is to have appropriate tires.
Winter tires have special treads that are designed to grip the road better in cold and snowy conditions. While all-season tires can provide some traction, winter tires are specifically designed to handle the challenges of winter driving.
However, not all drivers are aware of the benefits of winter tires or may not have them installed on their vehicles. This can lead to unsafe driving conditions, especially in areas with heavy snow and ice.
Studies have shown that using winter tires can significantly reduce the risk of accidents during winter weather, which is why many countries have laws mandating their use during certain times of the year. By using winter tires, drivers can improve their safety on the roads and avoid accidents caused by poor traction or skidding.

Rules:

1. If it is winter or there is a risk of black ice or other hazards on the roads, then drivers should take caution when driving.
2. If a driver wants to stay safe while driving in snowy or icy conditions, they should have appropriate tires installed on their vehicle.
3. If a driver has winter tires on their vehicle and is cautious, they are less likely to experience accidents caused by poor traction or skidding.
4. If a driver uses winter tires, they are following the law in many countries that mandate their use during certain times of the year.
5. If a driver doesn't have winter tires installed on their vehicle or is not cautious, they are at higher risk of experiencing accidents during winter weather conditions.

First-Order Logic:

1. $\forall x\ (Winter(x) \vee RoadHazard(x) \Rightarrow Caution(x))$

If for all x, x is a winter season and x has hazards on roads, then drivers should take caution when driving.

2. $\forall x\ (Snowy(x) \vee Icy(x) \Rightarrow TiresInstalled(x))$

If for all x, x is either snowy or icy, then drivers should have appropriate tires installed on their vehicles to stay safe while driving.

3. $\forall x\ (WinterTires(x) \wedge Caution(x) \Rightarrow \neg Accident(x))$

If for all x, x has winter tires on their vehicle, they are less likely to experience accidents caused by poor traction or skidding.

4. $\forall x\ (WinterTires(x) \Rightarrow Legal(x))$

If for all x, x uses winter tires, then they are following the law in many countries that mandate their use during certain times of the year.

5. $\forall x\ (\neg WinterTires(x) \vee \neg Caution(x) \Rightarrow Accident(x))$

If for all x, x does not have winter tires installed on their vehicle, they are at higher risk of experiencing accidents during winter weather conditions.

1. It’s snowing heavily, Adam forgot to buy winter tires, but he has to go pick up his mother-in-law at the airport. Will Adam face any accidents?

weather.pl

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weather.pl

```
:- dynamic has_to_pick_up_mother_in_law/1.
:- dynamic accident_possible/1.
:- dynamic driving_caution_taken/1.
:- dynamic tires_installed/2.
:- dynamic weather/2.
:- dynamic legal/1.
:- dynamic winter_tires/1.

% Define rules
add_pfc(weather(winter, risk(hazards_on_roads))).
add_pfc((caution_required(Driver) :- weather(winter, risk(hazards_on_roads)), not(driving_caution_taken(Driver)))).
add_pfc((safety_measure(Driver) :- (weather(winter, risk(hazards_on_roads)) ; (snowy(Weather) ; icy(Weather))), not(tires_installed(Driver,_)))).

add_pfc((winter_tires(Driver) :-  tires_installed(Driver, winter), weather(winter, risk(_)))).
add_pfc((legal(Driver) :- winter_tires(Driver))).
add_pfc((accident_possible(Driver) :- not(winter_tires(Driver)), weather(winter, risk(_)))).

% Define initial facts
add_pfc(has_to_pick_up_mother_in_law(adam)).
add_pfc(weather(snowy, heavy)).
add_pfc(tires_installed(adam, none)).

% Define additional rules based on initial facts
add_pfc((tires_installed(Driver, none) :- not(winter_tires(Driver)), (snowy(_) ; icy(_)))).

% Define additional rules based on initial rules and facts
add_pfc(driving_caution_taken(adam) :-  weather(snowy, _)).
add_pfc(winter_tires(adam) :- tires_installed(adam, winter)).
add_pfc(legal(adam) :- winter_tires(adam)).
add_pfc((accident_possible(adam) :- driving_caution_taken(adam), tires_installed(adam, none))).
add_pfc((accident_possible(adam) :- not(legal(adam)), driving_caution_taken(adam))).
add_pfc((accident_possible(adam) :- not(winter_tires(adam)), weather(snowy, _))).
```

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SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)

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For built-in help, use ?- help(Topic). or ?- apropos(Word).

?-
% c:/Users/aditi/OneDrive/Documents/Prolog/weather.pl compiled 0.00 sec, 16 clauses
?- accident_possible(adam).
true.

?-
```

2. It's snowing heavily and there is black ice present. Shania has just learned driving but she is a cautious driver with winter tires attached to her car. Will Shania face any accidents?

weather2.pl

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weather2.pl

```
:- dynamic accident_possible/1.
:- dynamic driving_caution_taken/1.
:- dynamic tires_installed/2.
:- dynamic weather/2.
:- dynamic legal/1.
:- dynamic winter_tires/1.

% Define rules
add_pfc(weather(winter, risk(hazards_on_roads))).
add_pfc((caution_required(Driver) :- weather(winter, risk(hazards_on_roads)), not(driving_caution_taken(Driver)))).
add_pfc((safety_measure(Driver) :- (weather(winter, risk(hazards_on_roads)) ; (snowy(Weather) ; icy(Weather))), not(tires_installed(Driver,_)))).

add_pfc((winter_tires(Driver) :- tires_installed(Driver, winter), weather(winter, risk()))).
add_pfc((legal(Driver) :- winter_tires(Driver))).
add_pfc((accident_possible(Driver) :- not(winter_tires(Driver)), weather(winter, risk()))).

% Define initial facts
add_pfc(weather(snowy, heavy)).
add_pfc(tires_installed(shania, winter)).

% Define additional rules based on initial facts
add_pfc((tires_installed(Driver, none) :- not(winter_tires(Driver)), (snowy() ; icy()))).

% Define additional rules based on initial rules and facts
add_pfc(driving_caution_taken(shania) :- weather(snowy, _)).
add_pfc(winter_tires(shania) :- tires_installed(shania, winter)).
add_pfc(legal(shania) :- winter_tires(shania)).
add_pfc((accident_possible(shania) :- driving_caution_taken(shania), tires_installed(shania, none))).
add_pfc((accident_possible(shania) :- not(legal(shania)), driving_caution_taken(shania))).
add_pfc((accident_possible(shania) :- not(winter_tires(shania)), weather(snowy, _))).
```

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SWI-Prolog (AMD64, Multi-threaded, version 9.0.4)

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?-
% c:/Users/aditi/OneDrive/Documents/Prolog/weather2.pl compiled 0.00 sec, 15 clauses
?- accident_possible(shania).
false.

?-
```