Experiment-7

Yash Patel
2019130047
Batch C
TE Comps

Aim:
To design and implement an expert system, incorporating the match algorithm and the rule language.

1. It should provide a fact base updating function.
2. It should provide a function that checks the rules' LHS and returns which rules were matched.
3. It should support firing RHS according to matches.

Theory:
Expert System:

- A naive implementation of an expert system might check each rule against known facts in a knowledge base, firing that rule if necessary, then moving on to the next rule (and looping back to the first rule when finished). For even moderate sized rules and facts knowledge-bases, this naive approach performs far too slowly. The Rete algorithm provides the basis for a more efficient implementation. A Rete-based expert system builds a network of nodes, where each node (except the root) corresponds to a pattern occurring in the left-hand-side (the condition part) of a rule. The path from the root node to a leaf node defines a complete rule left-hand-side. Each node has a memory of facts which satisfy that pattern. This structure is essentially a generalized trie. As new facts are asserted or modified, they propagate along the network, causing nodes to be annotated when that fact matches that pattern. When a fact or combination of facts causes all of the patterns for a given rule to be satisfied, a leaf node is reached and the corresponding rule is triggered.

Problem Statement:
Read the below passage carefully and answer the questions: Five cities all got more rain than usual this year. The five cities are: Last Stand, Mile City, New Town, Olliopolis, and Polberg. The cities are located in five different areas of the country: the mountains, the forest, the coast, the desert, and in a valley. The rainfall amounts were: 12 inches, 27 inches, 32 inches, 44 inches, and 65 inches.

- The city in the desert got the least rain; the city in the forest got the most rain.
    - New Town is in the mountains.
    - Last Stand got more rain than Olliopolis.
    - Mile City got more rain than Polberg, but less rain than New Town. • Olliopolis got 44 inches of rain.
- The city in the mountains got 32 inches of rain; the city on the coast got 27 inches of rain.
    1. Which city got the most rain?
    2. How much rain did Mile City get?
    3. Which city is in the desert ?
    4. Where is Olliopolis located?

Code:

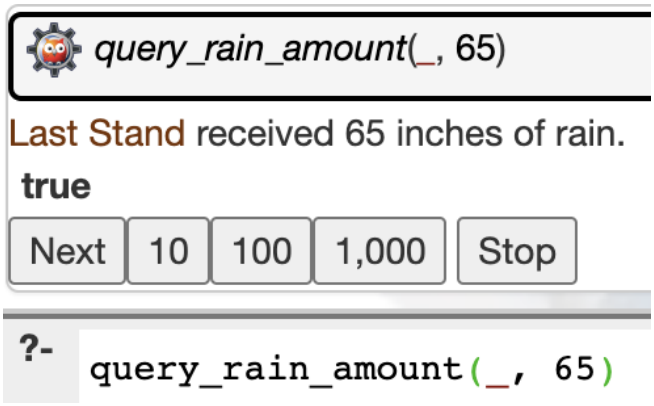
```
city(C) :-
% there are 5 cities
length(C, 5),

% city names
member(h('Last Stand', _, _), C),
member(h('Mile City', _, _), C),
member(h('New Town', _, _), C),
member(h('Olliopolis', _, _), C),
member(h('Polberg', _, _), C),

% city areas
member(h(_, mountains, _), C),
member(h(_, forest, _), C),
member(h(_, coast, _), C),
member(h(_, desert, _), C),
member(h(_, valley, _), C),

% rainfall amounts
```

```
member(h(_, _, 12), C),
member(h(_, _, 27), C),
member(h(_, _, 32), C),
member(h(_, _, 44), C),
member(h(_, _, 65), C),

% Hints
% The city in the desert got the least rain;
% the city in the forest got the most rain.
member(h(_, desert, 12), C),
member(h(_, forest, 65), C),

% New Town is in the mountains.
member(h('New Town', mountains, _), C),

% Last Stand got more rain than Olliopolis.
member(h('Last Stand', _, A), C),
member(h('Olliopolis', _, B), C),
A > B,

% Mile City got more rain than Polberg, but less rain than New Town.
member(h('Mile City', _, D), C),
member(h('Polberg', _, E), C),
D > E,
member(h('New Town', _, F), C),
F > D,

% Olliopolis got 44 inches of rain.
member(h('Olliopolis', _, 44), C),

% The city in the mountains got 32 inches of rain; the
% city on the coast got 27 inches of rain.
member(h(_, mountains, 32), C),
member(h(_, coast, 27), C).

query_rain_amount(City_Name, Rainfall_Amount) :-
```

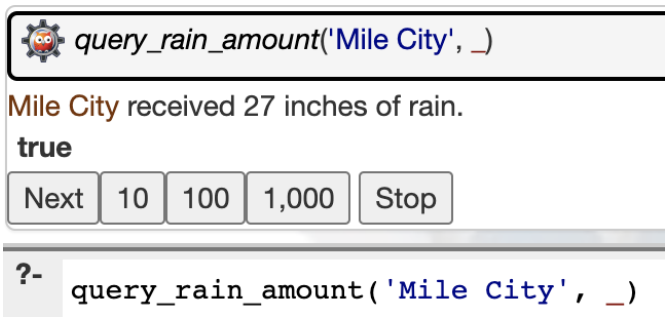
```
city(C),
member(h(City_Name, _, Rainfall_Amount), C),
write(City_Name), write(" received "),
write(Rainfall_Amount), write(" inches of rain."),
nl.


query_city_region(City_Name, Region) :-
city(C),
member(h(City_Name, Region, _), C),
write(City_Name), write(" is located in the "),
write(Region), nl.
```

Output:

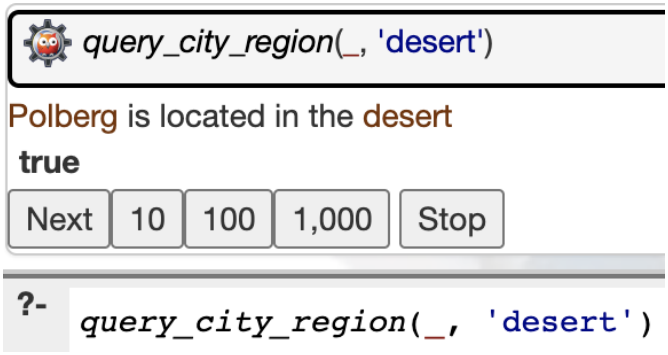
1. Which city got the most rain?



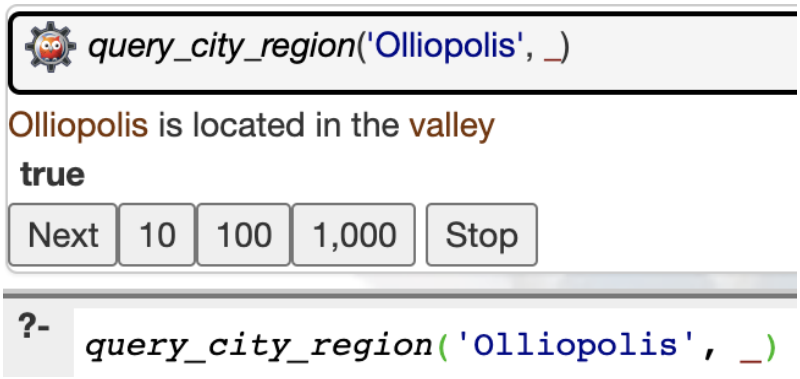
2. How much rain did Mile City get?



3. Which city is in the desert?



4. What is Olliopolis?



Conclusion:
I learned about expert systems as a result of this exercise. It is an interactive computer-based decision-making system that solves difficult decision-making problems by combining facts and heuristics. The data in the supplied question pertains to the amount of rainfall in a city and the region in which the city is located. All of the names of cities and areas listed in the problem statement were first stored in the above code, followed by the facts. Then, using the query in the preceding code, we can obtain the city name from the rainfall quantity and vice versa, as well as the region from the city name and vice versa. Once the facts have been saved, Prolog makes it easier to find answers to these queries by leveraging these facts to find the solution.

Github: https://github.com/yash19pro/AI-ML-Lab