Experiment-7

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Batch C
TE Comps

Aim:
Using the match algorithm and the rule language, create and implement an expert system.

1. It should have a function for updating the fact base.
2. It should have a function that examines the LHS of the rules and returns the ones that were matched.
3. It should be able to fire RHS in accordance with 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. When new facts are asserted or updated, they propagate through the network, causing nodes to be annotated when they match a pattern. A leaf node is reached and the accompanying rule is triggered when a fact or combination of facts causes all of the patterns for a specific rule to be satisfied.

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:

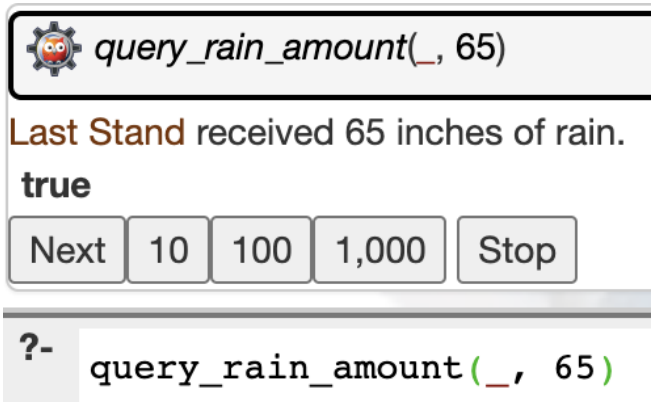
```
city(C) :-
% there are 5 cities
length(C, 5),

% 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).
```

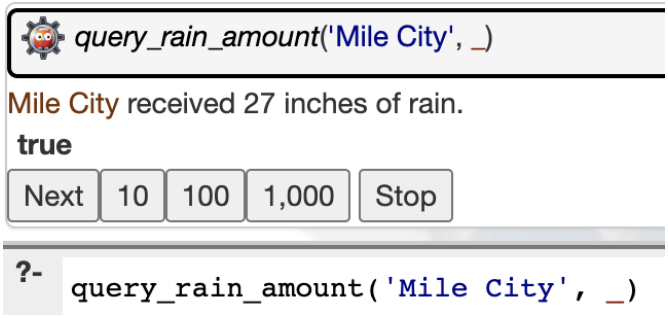
```
query_rain_amount(City_Name, Rainfall_Amount) :-
city(C),
member(h(City_Name, _, Rainfall_Amount), C),
write(City_Name), write(" received "),
write(Rainfall_Amount), write(" inches of rain."),
nl.


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:

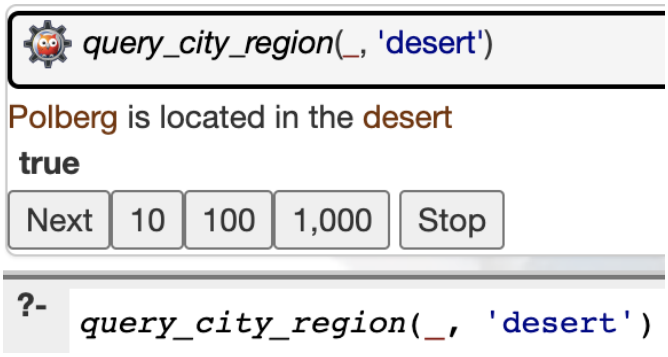
1. Which city got the most rain?



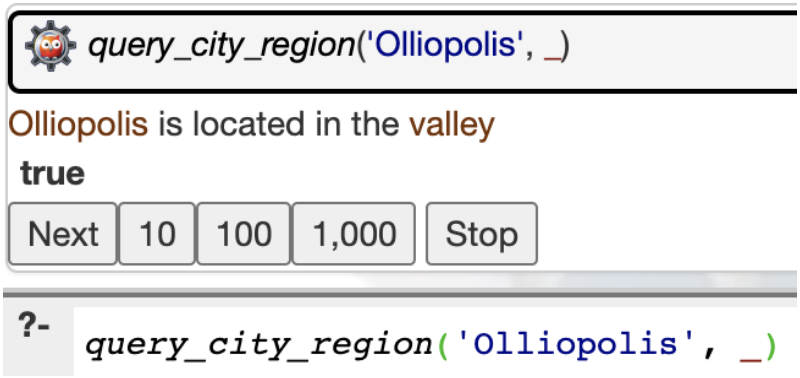
2. How much rain did Mile City get?



3. Which city is in the desert?



4. What is Olliopolis?



Conclusion:
As a result of this experiment, I learned about expert systems. It's an interactive computer-based decision-making system that combines facts and heuristics to tackle challenging decision-making challenges. The information in the provided question is about the amount of rain that falls in a city and the region in which it is located. The above code was used to save all of the names of cities and locations specified in the problem description, followed by the facts. The city name may then be obtained from the rainfall quantity and vice versa, as well as the region from the city name and vice versa, using the query in the preceding code. Prolog makes it easy to find answers to these inquiries once the facts have been saved by utilising these facts to locate the solution.

Github: https://github.com/mananshah5/AI-ML