Artificial Intelligence Lab Report

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Original Prolog Implementation

```prolog
% "," represents a "and" || "." represents a "end of a query or statement"||":-"
    represents "if" || "%" is ignored by prolog

% Facts
has_symptom(ali, fever).
has_symptom(ali, cough).
has_symptom(ali, headache).
has_symptom(ahmed, sore_throat).
has_symptom(ahmed, fever).
has_symptom(ahmed, fatigue).
has_symptom(saood, sneezing).
has_symptom(saood, runny_nose).
has_symptom(saood, itchy_eyes).
has_symptom(saad, nausea).
has_symptom(saad, vomiting).
has_symptom(saad, stomach_pain).

%Rules
has_disease(Person,flu):-
    has_symptom(Person,fever),
    has_symptom(Person,cough),
    has_symptom(Person,headache).

has_disease(Person,common_cold):-
    has_symptom(Person,sneezing),
    has_symptom(Person,runny_nose),
    has_symptom(Person,itchy_eyes).

has_disease(Person,strep_throat):-
    has_symptom(Person,sore_throat),
    has_symptom(Person,fever),
    has_symptom(Person,fatigue).

has_disease(Person,food_poisoning):-
    has_symptom(Person,nausea),
    has_symptom(Person,vomiting),
    has_symptom(Person,stomach_pain).
```

Listing 1: Original disease.pl code

Theoretical Background

Expert Systems in Prolog

An expert system is an AI application that emulates human decision-making through:

- **Knowledge Base**: Contains facts (e.g., symptoms) and rules (e.g., disease conditions)

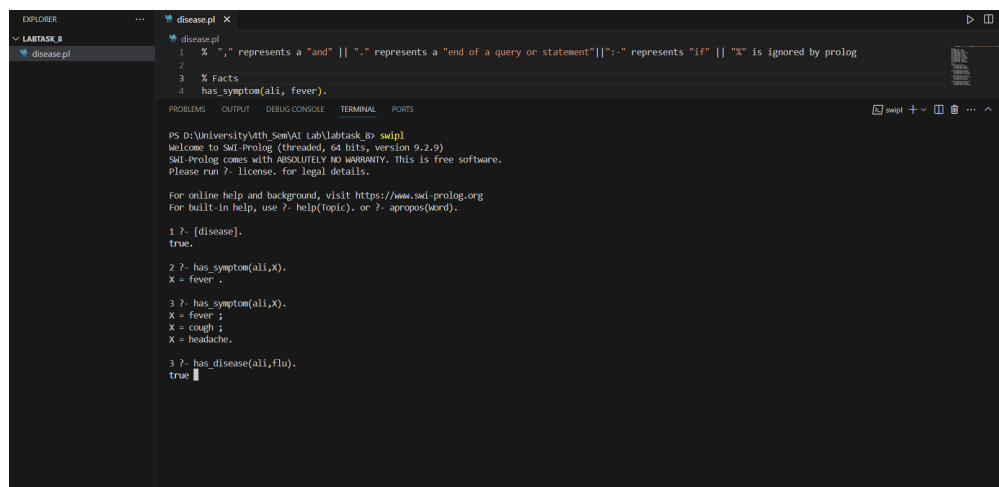- **Inference Engine**: Uses backward/forward chaining to derive conclusions

Key Prolog Concepts

Symbol	Meaning
:-	"If" (rule definition)
,	Logical "AND"
;	Logical "OR" (user prompt)
.	Terminates facts/rules
%	Comment (ignored)

Diagnosis Logic

The system uses Horn clauses to match symptoms:

$$\text{flu} \leftarrow \text{fever} \wedge \text{cough} \wedge \text{headache}$$

Figure 1: Execution results in Prolog terminal

→ Forward chaining
e.g   disease (Ali, Flu)
      will check   the   following

  ↳ symptom (Ali, fever)   ✓
           (Ali, cough)   ✓
           (Ali, headech)   ✓
    if all symptoms true
        then   Ali is having flue.

→ Backwark chaining
      disease (Ahmed, flu)
    will check the following
      Symptoms (Ahmed, fever) ✓
              (Ahmed, cough) ✗
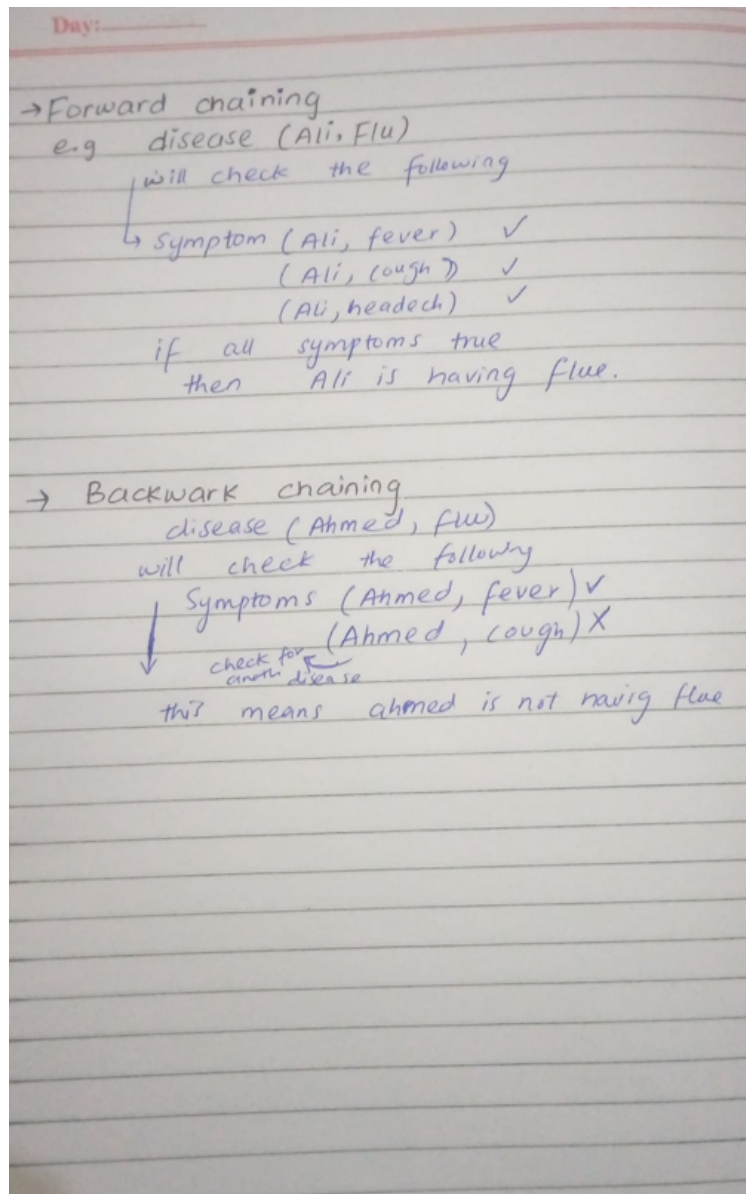   check for
    anoth disease
    this means ahmed is not having flue

Figure 2: System architecture diagram

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