Heart Disease Classification System

1. Introduction:

Heart disease is a broad term that encompasses a wide range of heart problems. It is also referred to as cardiovascular disease, which refers to heart and blood vessel disease. Every year, many people die as a result of various types of heart disease. Smoking, high blood pressure, high cholesterol, an unhealthy diet, a lack of exercise, and obesity can all increase the risk of certain heart diseases. Coronary artery disease (narrow or blocked coronary arteries) is the most common type of heart disease, and it can cause chest pain, heart attacks, or stroke. Aside from that, there are various types of heart disease such as heart attack, angina, and so on.

2. Problem Domain:

As we all know that, the heart is the most important organ in our bodies. A man cannot survive in the absence of blood circulation. Many people die each year as a result of heart disease. Heart disease treatment is also very expensive.

There are, however, numerous types of heart disease. As a result, determining which types of heart disease exist is difficult. A proper treatment can help the infected patient avoid long-term complications. Heart disease classification is required for this.

3. Proposed System:

The proposed system was created with the help of rules and facts as we all know an expert system contains rules and facts. Prolog makes use of built-in backward chaining. The rules are used to present information. So it can easily classify the heart disease.

For example:

- The patient has angina if he is sweating, squeezing and feeling pressure, fullness.
- If patient has chest pain, weakness, feeling discomfort in the neck and jaw then he probably goes to heart attack.

4. Objective of the Proposed System:

The system's goal is to create an expert system that can classify heart disease based on various symptoms. As a result, long-term treatment will be avoided, and costs will be reduced. The system has also created a knowledge base with details information about heart disease.

5. System Design:

The concept behind a rules-based expert system is to represent a domain expert's knowledge in the form of rules. It includes domain knowledge, a user interface, an inference engine, and knowledge acquisition. The following figure show the system design of our proposed method.

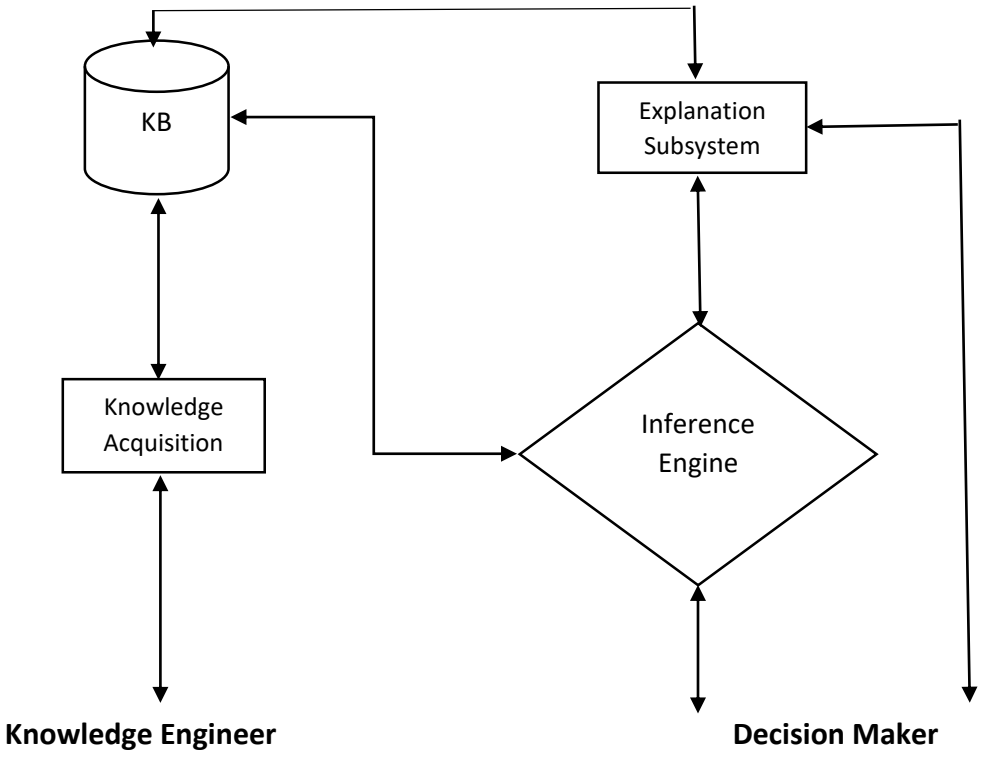

Figure 1: Knowledge Based Expert System Structure

6. Symptom of Heart Disease:

There are various types of symptom in heart disease which are showed in Table 1.

ID	Symptoms
1	Chest pain
2	Sweating
3	Feeling weak
4	Squeezing
5	Pressure
6	Fullness
7	Burning
8	Discomfort in the neck
9	Discomfort in the jaw
10	Shortness of breath
11	Pain in both shoulders
12	Light-headed
13	Fatigue and weakness
14	Swelling in the legs, ankles and feet
15	Irregular heartbeat
16	Lack of appetite
17	Slow heartbeat
18	Racing heartbeat
19	Fluttering in the chest
20	Anxiety
21	Lightheadedness
22	dizziness

Table 1: Symptom of Heart Disease

Symptom of different heart disease are showed in Table 2.

ID	Disease	Symptoms
1	Angina	2,4,5,6,7,10,13
2	Heart Attack	1,3,8,9,10,11,12,15
3	Heart Failure	1,13,14,15,16,19
4	Heart Arrhythmia	3,17,18,19,20,21,22

Table 2: Symptom of Specific Disease

7. Knowledge Representation:

In this phase, I use a decision table to flesh out the knowledge representation. The decision table is shown in the below.

Symptoms / Disease	Angina	Heart Attack	Heart Failure	Heart Arrhythmia
Chest pain	NO	YES	YES	NO
Sweating	YES	NO	NO	NO
Feeling weak	NO	YES	NO	YES
Squeezing	YES	NO	NO	NO
Pressure	YES	NO	NO	NO
Fullness	YES	NO	NO	NO
Burning	YES	NO	NO	NO
Discomfort in the neck	NO	YES	NO	NO
Discomfort in the jaw	NO	YES	NO	NO
Shortness of breath	YES	YES	NO	NO
Pain in both shoulders	NO	YES	NO	NO
Light-headed	NO	YES	NO	NO
Fatigue and weakness	YES	NO	YES	NO
Swelling in the legs, ankles and feet	NO	NO	YES	NO

Irregular heartbeat	NO	YES	YES	NO
Lack of appetite	NO	NO	YES	NO
Slow heartbeat	NO	NO	NO	YES
Racing heartbeat	NO	NO	NO	YES
Fluttering in the chest	NO	NO	YES	YES
Anxiety	NO	NO	NO	YES
Lightheadedness	NO	NO	NO	YES
Dizziness	NO	NO	NO	YES

Table 3: Decision Table

8. Methodology:

In this phase, I try to illustrate the system in graphical ways. The following figure describe how the system work and reacts to different responses ask by the user.

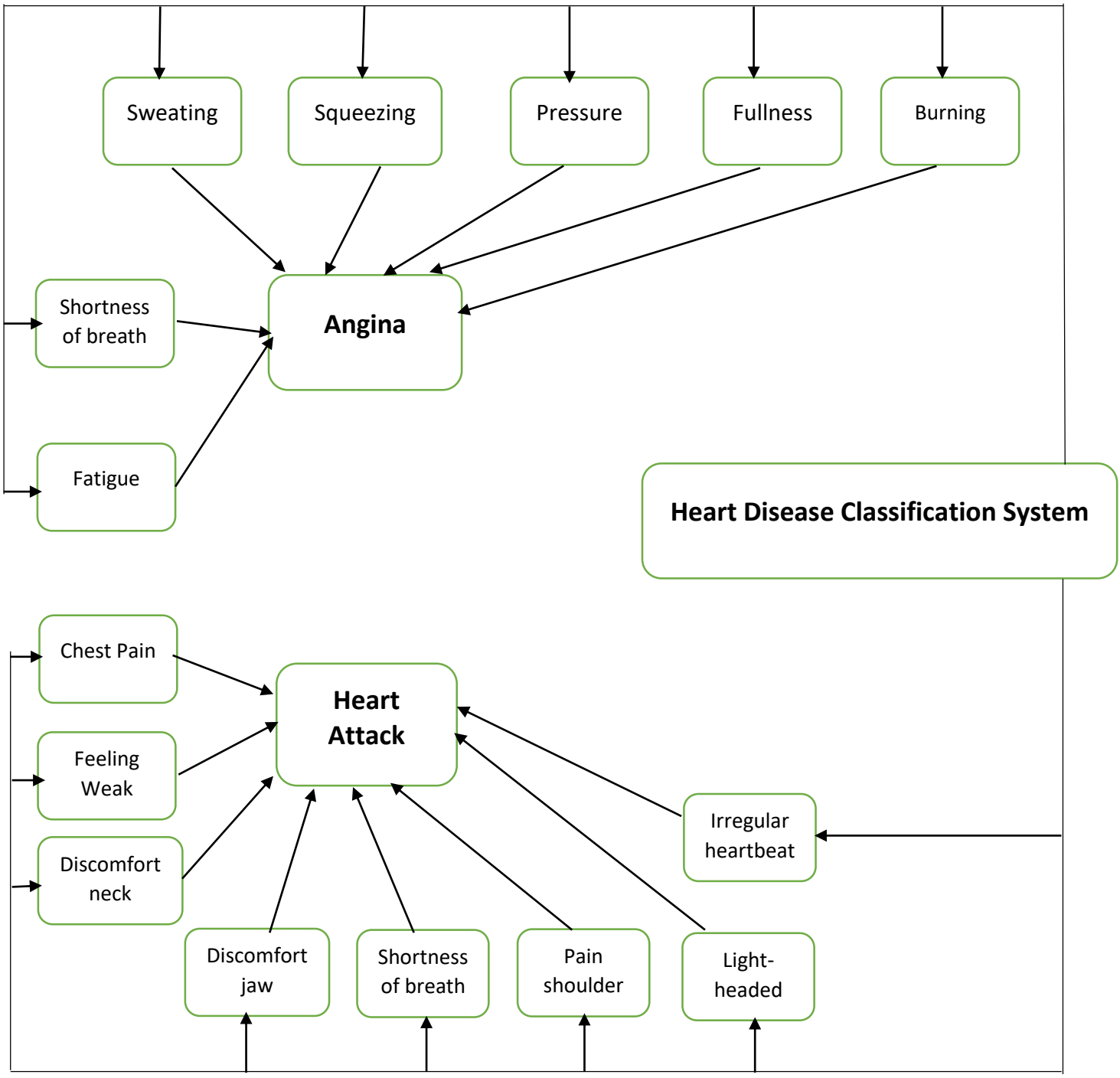

Figure 2: Heart Disease Classification System

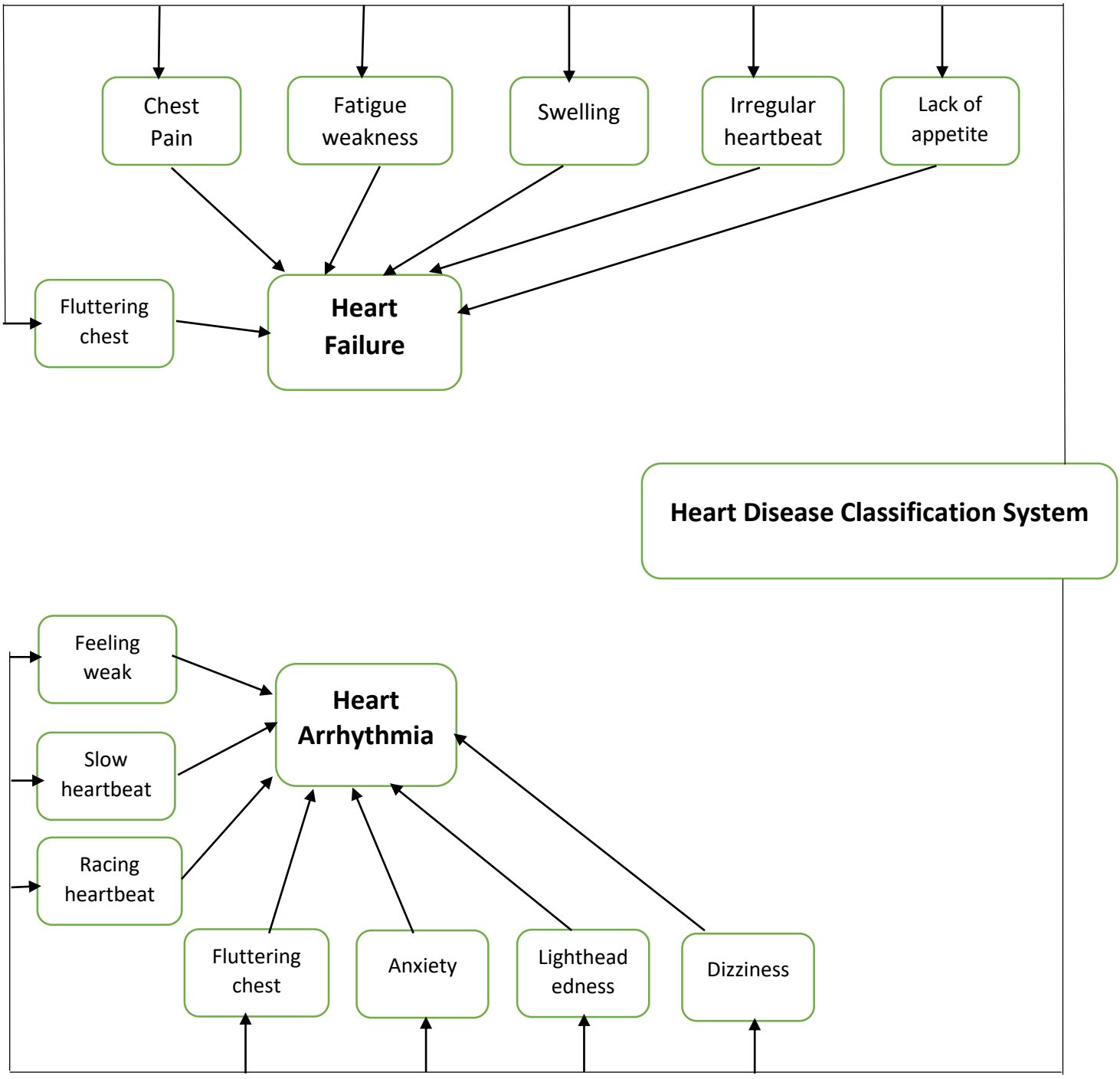

Figure 3: Heart Disease Classification System

9. Implementation:

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domains
    disease,indication = symbol
    Patient,name = string

predicates
    hypothesis(string,disease)
    symptom(name,indication)
    response(char)
    go

clauses
    go:-
        write("Enter your name "),
        readln(Patient),
        hypothesis(Patient,Disease),
        write(Patient, " may has ",Disease,"."),nl.

    symptom(Patient,sweating):-
        write("Are you sweating ? (y/n)"),
        response(Reply),
        reply='y'.

    symptom(Patient,squeezing):-
        write("Are you squeezing ? (y/n)"),
        response(Reply),
        reply='y'.

    symptom(Patient,pressure):-
        write("Are you feeling pressure ? (y/n)"),
        response(Reply),
        reply='y'.
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    symptom(Patient,fullness):-
        write("Are you feeling fullness ? (y/n)"),
        response(Reply),
        reply='y'.


    symptom(Patient,burning):-
        write("Are you feeling burning ? (y/n)"),
        response(Reply),
        reply='y'.

    symptom(Patient,breath_shortness):-
        write("Do you have any breat shortness ? (y/n)"),
        response(Reply),
        reply='y'.

    symptom(Patient,fatigue):-
        write("Do you have fatigue ? (y/n)"),
        response(Reply),
        reply='y'.

    symptom(Patient,weakness):-
        write("Are your feeling weakness ? (y/n)"),
        response(Reply),
        reply='y'.
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symptom(Patient,chest_pain):-
    write("Do you have chest pain ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,discomfort_in_neck):-
    write("Are you feeling discomfort in neck ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,discomfort_in_jaw):-
    write("Are your feeling discomfort in jaw ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,pain_in_shoulders):-
    write("Are your feeling pain in shoulders ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,light_headed):-
    write("Are you feeling light headed ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,irregular_heartbeat):-
    write("Do you have irregular heartbeat ? (y/n)"),
    response(Reply),
    reply='y'.
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symptom(Patient,swelling):-
    write("Are you swelling ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,lack_of_appetite):-
    write("Do you have lack of appetite ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,chest_fluttering):-
    write("Do you have chest fluttering ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,slow_heartbeat):-
    write("Do you have slow heartbeat ? (y/n)"),
    response(Reply),
    reply='y'.

symptom(Patient,racing_heartbeat):-
    write("Do you have racing heartbeat ? (y/n)"),
    response(Reply),
    reply='y'.
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    symptom(Patient,anxiety):-
        write("Do you have anxiety ? (y/n)"),
        response(Reply),
        reply='y'.

    symptom(Patient,dizziness):-
        write("Do you have dizziness ? (y/n)"),
        response(Reply),
        reply='y'.

    symptom(Patient,lightheadedness):-
        write("Do you have lightheadedness? (y/n)"),
        response(Reply),
        reply='y'.


hypothesis(Patient,angina):-
    symptom(Patient,sweating),
    symptom(Patient,squeezing),
    symptom(Patient,pressure),
    symptom(Patient,fullness),
    symptom(Patient,burning),
    symptom(Patient,breath_shortness),
    symptom(Patient,fatigue),
    symptom(Patient,weakness).

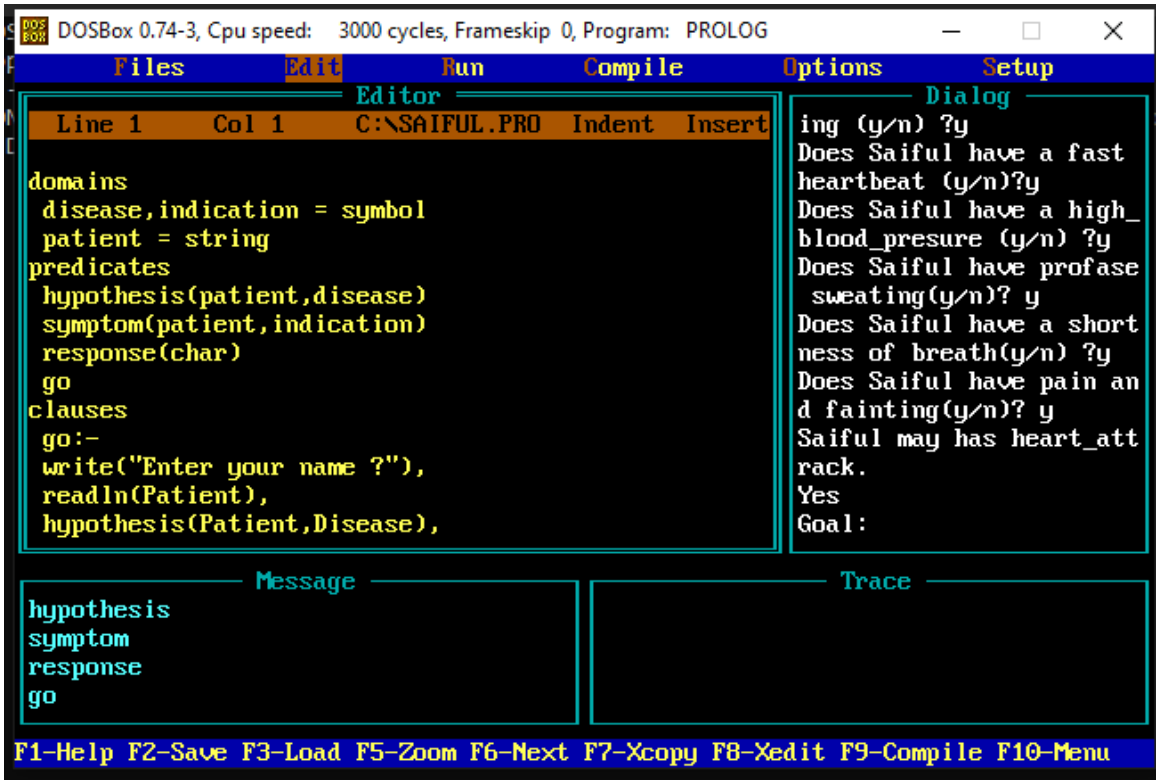
hypothesis(Patient,heart_attack):-
    symptom(Patient,chest_pain),
    symptom(Patient,weakness),
    symptom(Patient,discomfort_in_neck),
    symptom(Patient,discomfort_in_jaw),
    symptom(Patient,breath_shortness),
    symptom(Patient,pain_in_shoulders),
    symptom(Patient,light_headed),
    symptom(Patient,irregular_heartbeat).

hypothesis(Patient,heart_failure):-
    symptom(Patient,chest_pain),
    symptom(Patient,weakness),
    symptom(Patient,swelling),
    symptom(Patient,lack_of_appetite),
    symptom(Patient,chest_fluttering),
    symptom(Patient,irregular_heartbeat).

hypothesis(Patient,heart_arrhythmia):-
    symptom(Patient,weakness),
    symptom(Patient,slow_heartbeat),
    symptom(Patient,racing_heartbeat),
    symptom(Patient,anxiety),
    symptom(Patient,chest_fluttering),
    symptom(Patient,dizziness),
    symptom(Patient,lightheadedness).

response(Reply):-
    readchar(Reply),
    write(Reply),nl.
```

10.Snapshot of Output:



11.Conclusion:

Finally, a knowledge based expert system model for heart disease classification is developed. It is not replacement of human doctor but it can help doctor to find out types of heart disease.

12.Reference:

1. Tsao CW, Aday AW, Almarzooq ZI, Beaton AZ, Bittencourt MS, Boehme AK, et al. Heart Disease and Stroke Statistics—2022 Update: A Report From the American Heart Association. Circulation. 2022;145(8):e153–e639.

2. Fryar CD, Chen T-C, Li X. Prevalence of uncontrolled risk factors for cardiovascular disease: United States, 1999–2010 [PDF-494K]. NCHS data brief, no. 103. Hyattsville, MD: National Center for Health Statistics; 2012. Accessed May 9, 2019.