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Gen :-
It is an element of chromosem.

(2) Fitness function :-
This function is utilished to verify a perticular chromosem will be selected for the next stage or not.

(3) mutation :-
This characteristic provides individual specification in the given chromosem.

Unit - 5
Expert System

⇒ It is a system that is designed to solve complex problems and provide decision making ability like human experts.
⇒ It performs by extracting the knowledge from the knowledge base using the reasoning and inferance rules.
⇒ It solves the complex problems by using facts and heuristic algorithms

Examples of expert Systems:-

(1) Dendral :-
This project was made in chemical engineering to detect the unknown organic molecules from various organic data by utilishing the knowledge base of mass spectra and chemical elements

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② MYCIN :-
This project helps in finding the bacteria causing infections like Bacteremia diseases.
It utilishes the data of blood clotting diseases and various antibiotices.

3 PXPERT :-
In this project the expert system determines the step and level of lung cancer along with the state of lung.
It utilishes the x-ray images of upper part of body.

④ CaDeT :- (Cancer Detection)
This project helps in diagonishing various kinds of cancer in early stages.

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Characteristics of expert system :-

① High Performance
The expert system provides high performance by solving complex problem with high accuracy.

② understandable :-
The expert system responds in such a way that it is easily understandable by the user.
It accepts the inputs by the human understandable language and replies the solution in the same language.

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(3) Reliable :-
the expert system provides a solution with high accuracy and efficient output

(4) Highly responsive :-
The expert system can able to provide the result for any complex query within a very short period of time.

Benefits of expert system :-
(1) It improves the decision quality.
(2) It cuts the expenceses of consulting experts for Problem Solving.
(3) It provides fast and efficient solution in a narrow area of specialization.
(4) It offers consistent answer for repetative questions.
(5) It helps you to get fast and accurate answer.
(6) It gives the proper explanation of the decision making.
(7) Ability to solve complex issues.

Limitations of expert system :-
(1) Unable to make a creative response in a extraordinary situation.
(2) Errors in the knowledge base can lead to wrong decision.
(3) The maintenance cost the expert system is too expensive.
(4) As the expert system does not have any create power so it can not able to provide multiple examples for the same solutions.

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Applications of Expert System:-

① **Information management:-**
The expert system help in mapaging the various information according to the requirement.

② **Hospital and medical facility:-**
The expert system can able to connect to the doctores and the various medical facilities like blood bank, bad facility, etc for the patient.

③ **Help desk management:-**
The expert system helps in managing the office or solving the query of the users.

④ **Employee performance evaluation:-**
It helps the HR peoples to evaluate the employees performance yearly or quarterely to provide increment or other solutions.

⑤ **Loan analysis:-**
The expert system provides the indepth analysis of your loans and there starteers.

⑥ **Financial decision making:-**
The decision regarding finance can be provided by the expert system which shootes best for your income.

⑦ **Process monitoring and control:-**
The expert system can able to manage the process and control it if there is any deviation.

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⑧ Stock market ~~trading~~ trading :-
The Expert system helps in analysing the market trend and your investment in stock market

⑨ Airline scheduling :-
→ the expert system controles the airline ~~flights~~ for its proper movement and delivery.

Representing the domain knowledge
① The expert system is build around the knowledge base.
② The knowledge base provides the domain knowledge of various fields. So to incorporate the expert system in the knowledge base it is using some methods.

① Transferring the knowledge from the human expert to the computer is very difficult.
So it tries to transfer the representations of the experts.
② It utilishes if-then-else condition or creating rule base for efficient expert system.

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Development of expert system :-
The expert system is created by the knowledge of experts who is specialized in different fields according to the requirement of the expert system it gathered and filtered the required knowledge.

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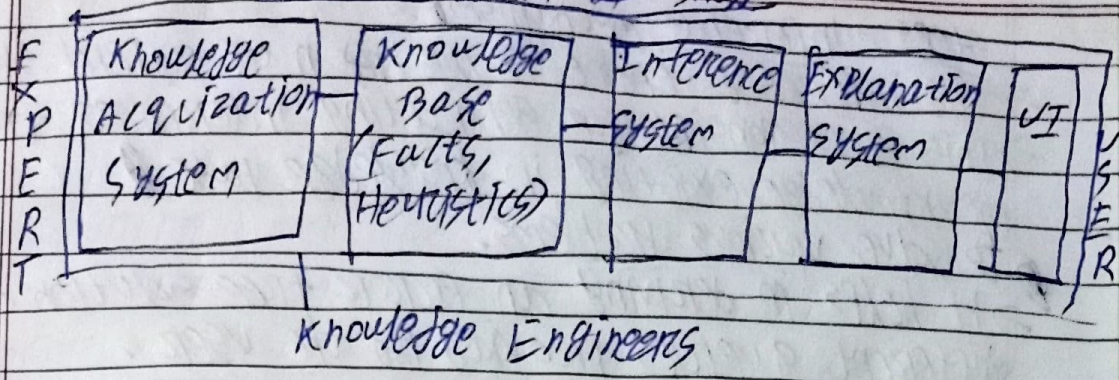
Expert System shell



Step 1 :- Knowledge acquization system :-

It is the fundamental step which helps to collect the experts knowledge required to solve the problem and to create knowledge base.

Step 2 :- Knowledge Base :-

→ It is the heart of expert system as it stores the facts and heuristic knowledges about the application domain.

→ It is like a database which stores the information of particular domain.

→ Knowledge base can be treated as a collection of objects and its attributes.

→ There are two kinds of knowledge :-

① **Factual Knowledge :-**

→ This knowledge which is based on facts and accepted by the knowledge engineers comes under factual knowledge.

② **Heuristic knowledge :-**

→ The knowledge is based on experience and the ability to guess evaluation and practice.

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Steps :- Inference mechanism :-

→ The inference engine is the brain of expert system.
→ This is responsible for generating inferences from the knowledge existing in knowledge base to solve various problems.
→ It helps in deriving an error free solution of different queries provided by the user.
→ There are 2 types of inference engine :-

(i) Deterministic Inference Engine :-

→ The conclusion drawn from this type of inference engine is assumed to be true as it is based on the facts.

(ii) Probabilistic Inference Engine :-

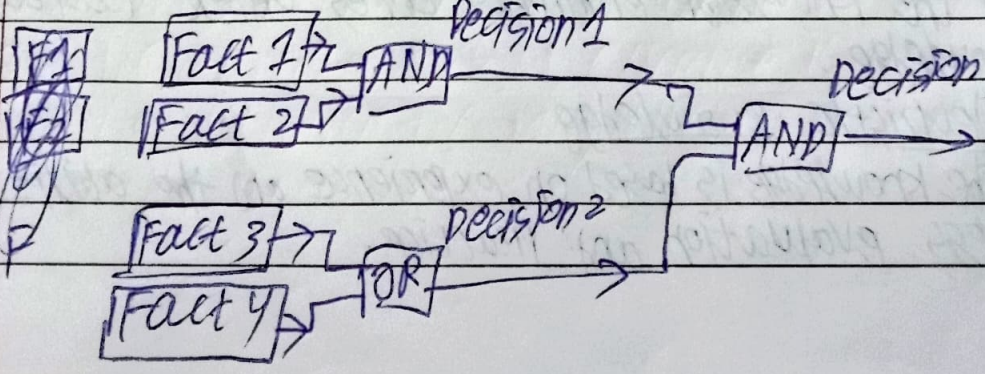
→ this type of inference engine contains uncertainty in the result as it is based on heuristic data.

Chaining :-

The inference engine uses two different modes to deliver the solution

(1) Forward Chaining :-

→ This is a data driven reasoning approach where the system starts with the available facts and applies rules to inform/get a new fact or conclusion.
→ It generally predicts the future by using the current data.



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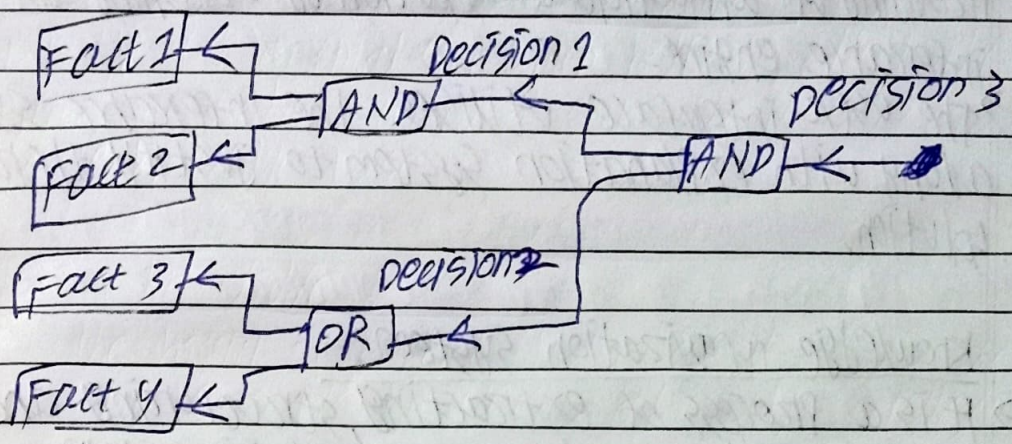
② Backward chaining :-

⇒ This is a role driven reasoning approach where the system starts with a goal and works backward to determine wheather the facts utilished are true or heuristics.

⇒ It is utilished for verification of inputs.

For ex :- A Patient is affected by malleria or stomach pain, etc. So we need to find the reasons or inputs for that disease.



Step 4 :- Explanation System :-

⇒ This is an effective tool of expert system as the user can able to understand the reason behind the inference system.

⇒ So It carries two different steps :-

① Explain its reasoning

In many domains of expert system the user is not accepting the inference outputs.

So the reasoning process helps in providing the exact reason of convience the user.

For ex :- A doctor is prescribing medicines after a proper diagnosis.

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④ Acquire new knowledge after modification
since the expert system driven new knowledge from the existing knowledge base, so the accuracy of new knowledge from the raw data is verified by the expert system.

Step 5 :- User Interface (UI) :-
→ with the help of user interface the expert system interacts with user taking the queries as input and providing an appropriate solution by utilishing the inferance engine.
→ the user interface utilises the Inferance system along with explanation system to justify there solution.

Knowledge acquization system :-
→ It is a process of extracting, structuring and organizing the knowledge from various types of experts to build a proper expert system.
→ There are 3 major areas to knowledge acquization that requires the consideration of expert system projects.
① The domain must be evaluated to determine the type of knowledge in the domain suitable to expert system.
② The source of expertise must be identified and evaluated to ensure the knowledge is correct.
③ If the major sources of expertise is from a specific field, then the participants need to be identified properly.

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Knowledge acquization techniques:-
We have 5 different methods or knowledge acquization from experts:-

① Diagram based technique.
→ In this technique the use of concept map, event diagram and process map is utilished.
→ This technique captures the questions using wh words

② matrix based technique :-
→ This technique involves various grids which suggests the solution of individual questions provided by various experts

③ Hirarchy generation technique:-
In this technique it creates the tree of solutions for a particular problem.

④ Protocol analysis technique:-
In this technique the expert system utilishes a proper protocol for finding the goal, decision from the expert

⑤ Protocol generation technique:-
In this technique they are creating the interviews like structured or semi-structured or unstructured way.

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How the components of expert system works:-
For ex:- A medical expert system designed to diagonise Phenomia

Step 1:- input
A patient reports syntums like fever, cough and fatigue through the user interface.

Step 2:- Processing
The inference engine analyses the syntums using the rules from the knowledge base.

Step 3:- output
The system suggests a possible diagonish of Phenomia through the user interface.

Step 4:- Explanation
The explanation module provides the detailed explanation like the presence of fever, cough and chest X-ray issues.

Step 5:- Updation:-
The knowledge acquization model adds new data like recent Phenomia treatment to keep the system up-to-date.

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Types of expert system in AI:-

Depending on the structure and application the expert system is categories into 5 types:-

① Rule based expert system:-

→ It is the common expert system where it release on if-then rule to process the information and make the decisions.

→ These rules are created by the domain experts. and used as the system reasoning mechanism.

② Frame based expert system:-

→ In this technique of expert system similar type of objects are created using one frame.
So the questions from user will be converted to the corresponding frame for getting the solution.

③ Fuzzy logic system:-

The situations involving uncertaintity and impreciseness is dealed with fuzzy logic system where the fuzzy control system uses its mechanism to handel the data.
For example fuzzy AC or fuzzy washine machine are the appliences where expert system is utilished.

④ Neural network based expert system:-

This system learns from the pattern of data and improve the decision making.
The example like image processing or speech recognization are the application of this type of system.

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Neuro-fuzzy expert system:-

In this hybrid approach the inputs are imprecized data and it follows particular patterns for decision making.
Some examples are financial forecasting, automated control system, etc.

Unit-5

5 marks
1. Discuss the examples of expert system.
2. Discuss the advantages and limitations of expert system.
3. Explain various applications of expert system.
4. Diagramatically show the internal structure of expert system shell.
5. Discuss the different components of knowledge base
6. Explain the types of inference engine
7. Explain knowledge acquization and its technique
8. Describe various types of expert system in AI

Unit 4

1. Discuss the two components of NLP
2. Describe the advantages and limitations of NLP
3. Discuss the 5 stages of NLP
4. Explain grammare in Phrashing
5. Describe the Phrashing techniques with ex.
6. Explain the various types of spelling errors
7. Discuss the spell checking technique
8. Discuss learning in AI.
9. Explain 3 different AI learning model.