Chapter one

Experts System

AL- Mustansirya University

Course: Intelligent Applications College of Education

Department of Computer Science Fourth Class

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1.1 Expert System

An expert system is a computer program that represents and reasons with knowledge of some specialist subject with a view to solving problems or giving advice.

1.2 Tasks for Expert Systems

1. The interpretation of data Such as sonar data or geophysical measurements.

2. Diagnosis of malfunctions Such as equipment faults or human diseases.

3. Structural analysis or configuration of complex objects Such as chemical compounds or computer systems

4. Planning sequences of actions Such as might be performed by robots

5. Predicting the future Such as weather, share prices, exchange rates.

1.3 Search Control Methods

All expert systems are search intensive. Many techniques have been employed to make these intensive searches more efficient. Branch and bound, pruning, depth-first search, and breadth-first search are some of the search techniques that have been explored. Because of the intensity of the search process, it is important that good search control strategies be used in the expert systems inference process.

1. Forward Chaining

It is a strategy of an expert system to answer the question, **"What can happen next?"** Here, the Inference Engine follows the chain of conditions and derivations and finally deduces the outcome. It considers all the facts and rules, and sorts them before concluding to a solution.

This strategy is followed for working on conclusion, result, or effect. For example, prediction of share market status as an effect of changes in interest rates.
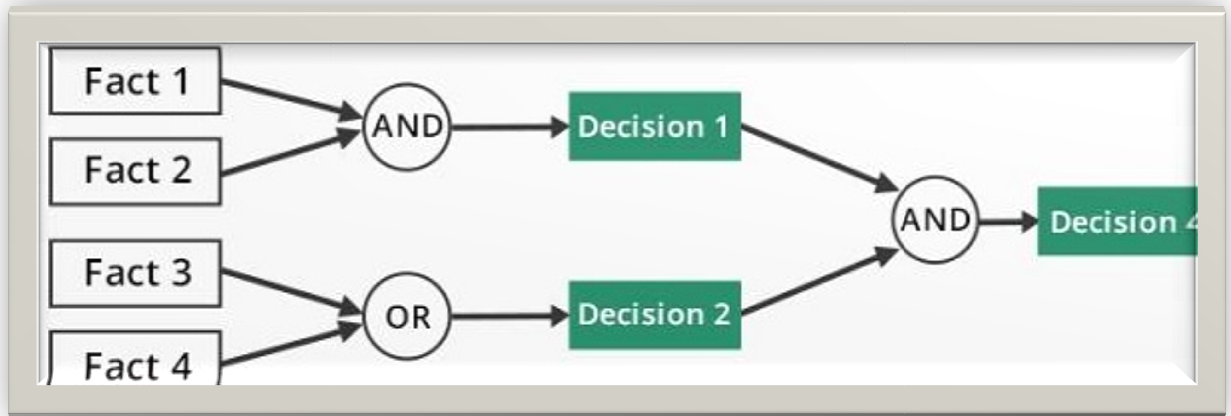

2.Backward Chaining

With this strategy, an expert system finds out the answer to the question, **"Why this happened?"**On the basis of what has already happened, the Inference Engine tries to find out which conditions could have happened in the past for this result. This strategy is followed for finding out cause or reason. For example, diagnosis of blood cancer in humans.
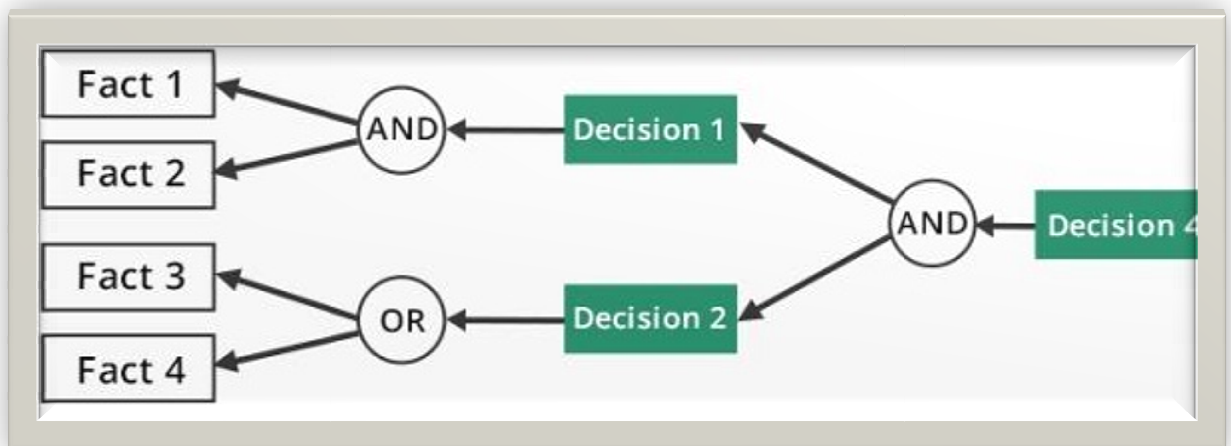
1.4 **Architecture of Expert Systems**

The process of building expert systems is often called knowledge engineering. The knowledge engineer is involved with all components of an expert system:
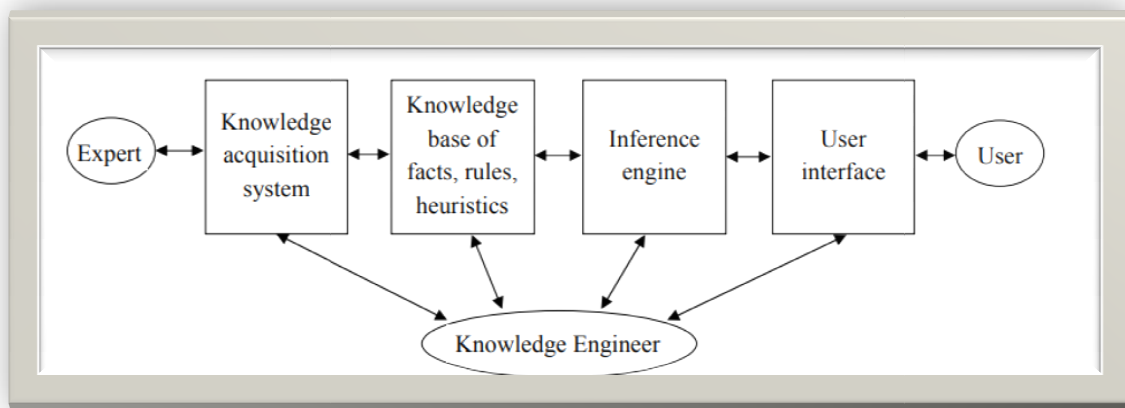
1.Knowledge Acquisition The knowledge acquisition component allows the expert to enter their knowledge or expertise into the expert system, and to refine it later as and when required.

2.Knowledge Base

The knowledge base is a collection of rules or other information structures derived from the human expert. Rules are typically structured as If/Then statements of the form:

IF <antecedent> THEN <consequent>

Knowledge base contains the domain knowledge which is used by the inference engine to draw conclusions.

3.The inference engine

The inference engine is the generic control mechanism that applies the axiomatic knowledge to the task-specific data to arrive at some conclusion. When a user supplies facts or relevant information of query to the expert system he receives advice or expertise in response. That is given the facts it uses the inference engine which in turn uses the knowledge base to infer the solution.

4.USER INTERFACE

This is a mechanism to support communication between and the system. The user interface may be a simple text-oriented display or a sophisticated, high resolution display. It is determined at the time of designing the system. Nowadays graphical user interfaces are very common for their user-friendliness.

1.5CHARACTERISTICS OF EXPERT SYSTEMS

- **High performance:** They should perform at the level of a human expert.
- **Adequate response time:** They should have the ability to respond in a reasonable amount of time. Time is crucial especially for real time systems.
- **Reliability:** They must be reliable and should not crash.
- **Understandable:** They should not be a black box instead it should be able explain the steps of the reasoning process.

1.6 ADVANTAGES OF EXPERT SYSTEMS

- **Availability:** Expert systems are available easily due to mass production software.
- **Cheaper:** The cost of providing expertise is not expensive.
- **Reduced danger:** They can be used in any risky environments where humans cannot work with.

- **Permanence:** The knowledge will last long indefinitely.
- **Multiple expertise:** It can be designed to have knowledge of many experts.
  - **Explanation:** They are capable of explaining in detail the reasoning that led to a conclusion.
  - **Fast response:** They can respond at great speed due to the inherent advantages of computers over humans.
  - **Unemotional and response at all times:** Unlike humans, they do not get tense, fatigue or panic and work steadily during emergency situations.

1.7 Expert Systems Limitations

- Limitations of the technology
- Difficult knowledge acquisition
- ES are difficult to maintain
- High development costs

Refrences

- **https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems.htm**.

- **http://intelligence.worldofcomputing.net/ai-branches/expert-systems.html#.We4pDo8jTIV**