KNOWLEDGE BASE SYSTEMS

CONTENTS

1. Introduction
2. Types of Knowledge
3. Components of KBS
4. Reasoning Techniques of KBS
5. Advantages of KBS
6. Limitation of KBS
7. Application of KBS

INTRODUCTION

- Knowledge-based systems were first developed by artificial intelligence researchers and the term knowledge base came in 1970.

- The tools of artificial intelligence (AI) can be divided into two broad types: knowledge -based systems (KBSs) and computational intelligence (CI). KBSs use explicit representations of knowledge in the form of words and symbols. This explicit representation makes the knowledge more easily read and understood by a human than the numerically derived implicit models in computational intelligence. Computational Intelligence (CI) usually refers to the ability of a computer to learn a specific task from data or experimental observation.

Types of Knowledge

1. Meta Knowledge – It's a knowledge about knowledge and how to gain them. Eg tagging, bibliography

2. Heuristic Knowledge – Representing knowledge of some expert in a field or subject. Eg intuitive judgements

3. Procedural Knowledge – Gives information/ knowledge about how to achieve something. It is a compiled or processed form of information. Eg sequence of steps to solve a problem is procedural knowledge

4. Declarative Knowledge – Its about statements that describe a particular object and its attributes , including some behavior in relation with it. It is a passive knowledge in the form of statements of facts about the world. For example, mark statement of a student is declarative knowledge.

5. Structural Knowledge – Describes what relationship exists between concepts/ objects i.e. how the ideas within the domain are interrelated with each other.

Components of KBS
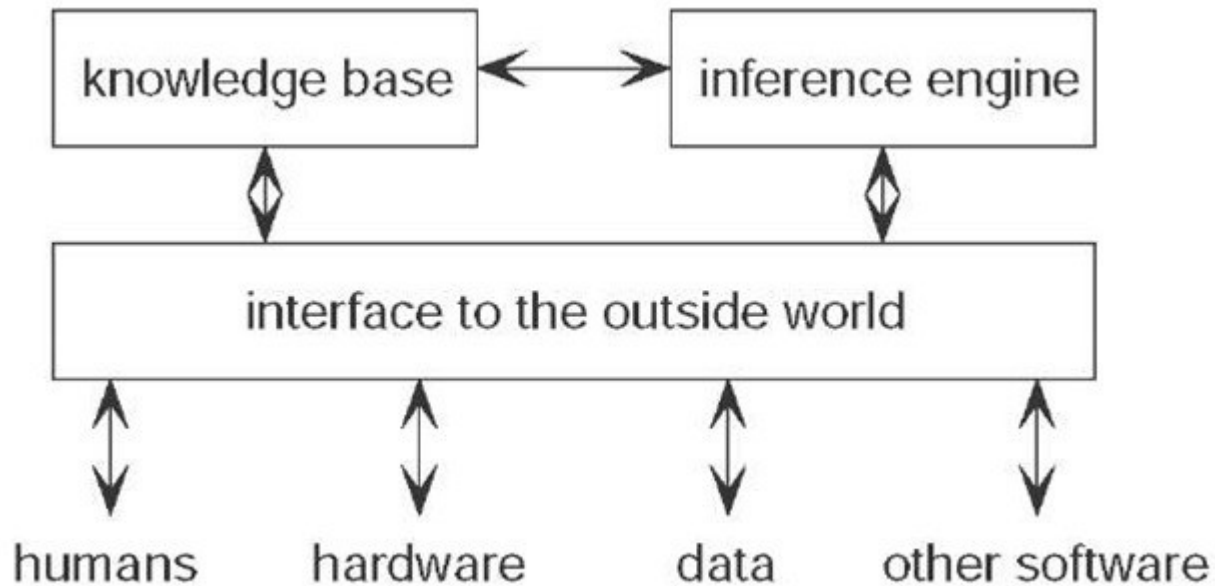
Reasoning Techniques of KBS

- Rule Based Reasoning
- Case Based Reasoning
- Model Based Reasoning

Rule Based Reasoning

- Rules are one of the most straightforward means of representing knowledge in a KBS. The simplest type of rule is called a production rule and takes the form:

- if <condition/cause> then <conclusion/effect>

- IF A,B, C THEN D (i.e., A ∧ B ∧ C ⇒D (

- A, B, C are the antecedents(or premises or conditions/situations)

- D is the consequent(or conclusion or action)

    Rules can be used to express a wide range of associations. E.g. If you are driving a car and an emergency vehicle approaches, then you should slow down and pull to the side of the road to allow the emergency vehicle to pass.

Inference chains

With pattern matching, rule-based systems use automated reasoning methods to progress logically from data to conclusions.

Process of problem-solving in KB systems is to create a series of inferences that form a "path" between the problem definition and its solution. Such a series of inferences is called an inference chain

CONTD....

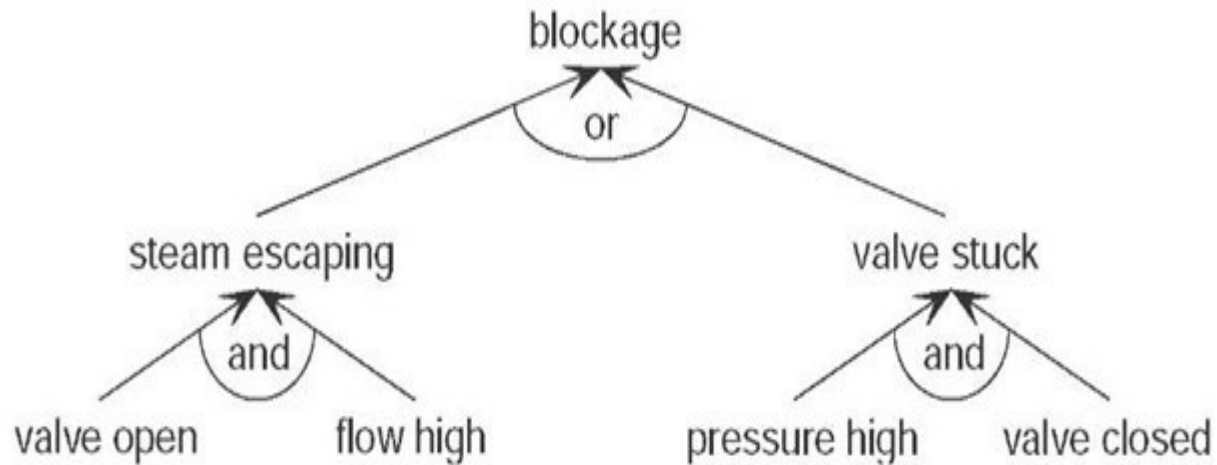Types of Inference Engines:

1.   Forward – chaining(Data-Driven)

2.   Backward-chaining(Goal-Driven)

          Mostly data driven inference engine is used to derive the knowledge in KBS.

EXAMPLE:-

 Boiler Monitoring System

EXAMPLE:
AN INFERENCE NETWORK OF A BOILER SYSTEM

Contd....

Rules of the example are used to link the system in the form :-

if <cause> then <effect>

- Eg. /* rule l */
- if valve is open and flow is high then steam is escaping
- /* fact l */ valve is open
- /* fact 2 */ flow is high
- The rules can be written in English language as well but these rules has uncertainity.

Advantages of KBS

1. Allow distribution of 'expertise'
2. Easy to update
3. Consistent answers
4. Availability
5. Preservation of expertise
6. Capable of ``working'' with incomplete information
7. Capable of explaining their solutions and their reasoning
8. Encourages organizations to clarify the logic of their decision-making

Limitation of KBS

1. Acquisition
2. Representation and manipulation of the large amount of data
3. High-tech image of the AI field.
4. Abstract nature of the knowledge.
5. Limitations of cognitive science and other scientific methods.

Application of KBS(Rule Based) - MYCIN

MYCIN was an early backward chaining expert system developed by

Edward Shortliffe that used artificial intelligence to identify bacteria causing

severe infections, such as bacteremia and meningitis, and to

recommend antibiotics, with the dosage adjusted for patient's body weight