Artificial Intelligence

UNIT - 1

Introduction

1. Define Artificial Intelligence?

Artificial Intelligence(AI) is the simulation of human intelligence by machines.

2. List Goals of AI?

- Replicate human intelligence
- Solve Knowledge-intensive tasks
- An intelligent connection of perception and action
- Creating some system which can exhibit intelligent behavior, learn new things by itself, demonstrate, explain, and can advise to its user.

3. List and Explain the AI Problems?

1.Data Quality and Bias:

AI systems heavily rely on data for training and decision-making.

2.Interpretability and Transparency:

Many AI algorithms, particularly deep learning models, are often considered "black boxes" because it's difficult to understand how they arrive at their decisions.

3.Ethical and Societal Implications:

AI systems can have significant societal impacts, raising ethical questions about privacy, fairness, and job displacement.

4.Robustness and Security:

AI systems are susceptible to adversarial attacks, where minor changes to input data can lead to incorrect or unintended outputs.

5.Resource Consumption and Environmental Impact:

Training large AI models requires substantial computational resources, leading to significant energy consumption and carbon emissions.

6.Human-AI Collaboration:

Designing effective human-AI collaboration systems where humans and AI work together seamlessly poses challenges in terms of interface design, trust-building, and understanding each other's capabilities and limitations

4. What is an AI Technique?

An AI technique refers to a method or approach used to develop artificial intelligence systems capable of performing specific tasks or solving particular problems.

5. List and explain various AI Techniques?

1.Machine Learning:

Machine learning is a subset of AI that focuses on developing algorithms capable of learning from data and making predictions or decisions without being explicitly programmed.

Techniques within machine learning include:

a.Supervised learning: Learning from labeled data to make predictions or

classifications.

b.Unsupervised learning: Discovering patterns and relationships in unlabeled data.

c.Reinforcement learning: Learning to make decisions through trial and error by interacting with an environment and receiving feedback.

2.Deep Learning:

Deep learning is a subfield of machine learning that employs neural networks with many layers (deep neural networks) to learn hierarchical representations of data.

3.Natural Language Processing (NLP):

NLP focuses on enabling computers to understand, interpret, and generate human language.

NLP techniques include:

- Text classification and sentiment analysis
- Named entity recognition
- Machine translation
- Text summarization
- Question answering

4.Computer Vision:

Computer vision involves developing algorithms to enable computers to interpret and understand visual information from images or videos. Computer vision techniques include:

- Object detection and recognition
- Image segmentation
- Image classification
- Facial recognition,
- Scene understanding

5.Evolutionary Algorithms:

Evolutionary algorithms are inspired by biological evolution and natural selection processes.

6.Knowledge Representation and Reasoning:

Knowledge representation techniques aim to capture & represent knowledge in a structured form that can be utilized by AI systems for reasoning and decision-making. Ex: rule-based systems, semantic networks, and ontologies.

6. Define Agent?

In AI, an "**agent**" is any entity that perceives its environment through sensors and acts upon that environment through actuators.

7. List the examples of agents ?

1. Intelligent personal assistants: These are agents that are designed to help users with various tasks, such as scheduling appointments, sending messages, and setting reminders. Examples of intelligent personal assistants include Siri, Alexa, and Google Assistant.

2. Autonomous robots: These are agents that are designed to operate autonomously in the physical world. They can perform tasks such as cleaning, sorting, and delivering goods. Examples of autonomous robots are Roomba vacuum cleaner , Amazon delivery robot.

3. Gaming agents: These are agents that are designed to play games, either against human opponents or other agents. Examples of gaming agents include chess-playing agents and poker-playing agents.

4. Fraud detection agents: These are agents that are designed to detect fraudulent behavior in financial transactions.

8. Define Rationality?

Rationality is nothing but status of being reasonable, sensible, and having good sense of judgment.

9. Define Turing Test?

The success of an intelligent behavior of a system can be measured with Turing Test.

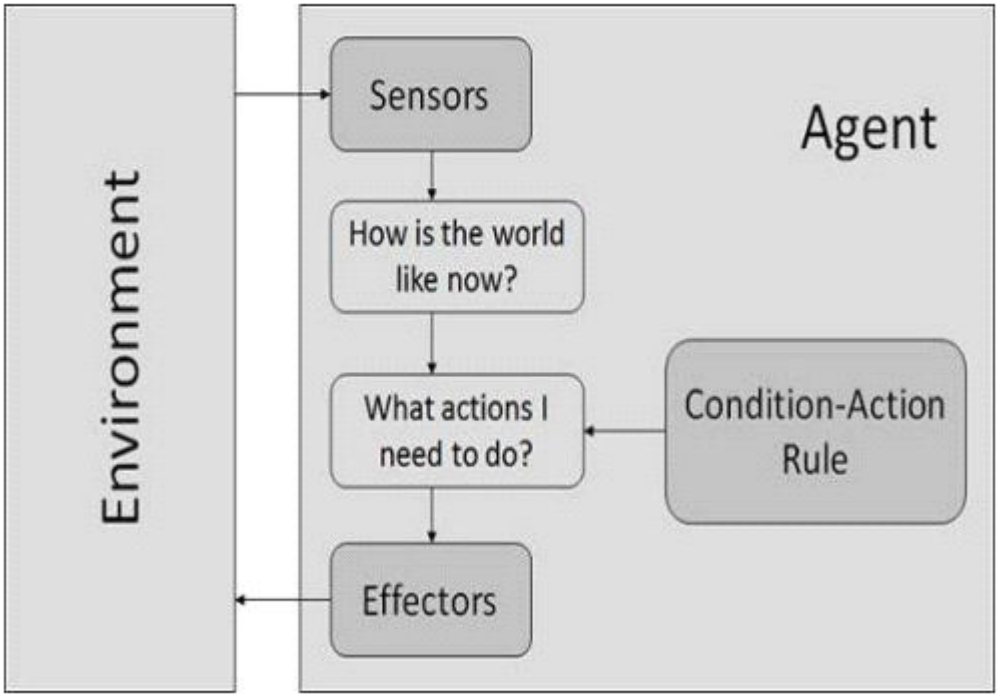
10. List Properties of Environments?

- **Discrete / Continuous —** If there are a limited number of distinct, clearly defined, states of the environment, the environment is discrete (For Ex,chess); otherwise it is continuous (For Ex, driving).
- **Observable / Partially Observable —** If it is possible to determine the complete state of the environment at each time point from the percepts it is observable; otherwise it is only partially observable.
- **Static / Dynamic —** If the environment does not change while an agent is acting, then it is static; otherwise it is dynamic.
- **Single agent / Multiple agents —** The environment may contain other agents which may be of the same or different kind as that of the agent.
- **Accessible / Inaccessible —** If the agent's sensory apparatus can have access to the complete state of the environment, then the environment is accessible to that agent.
- **Episodic / Non-episodic —** In an episodic environment, each episode consists of the agent perceiving and then acting.

11. Explain the types of agents ?

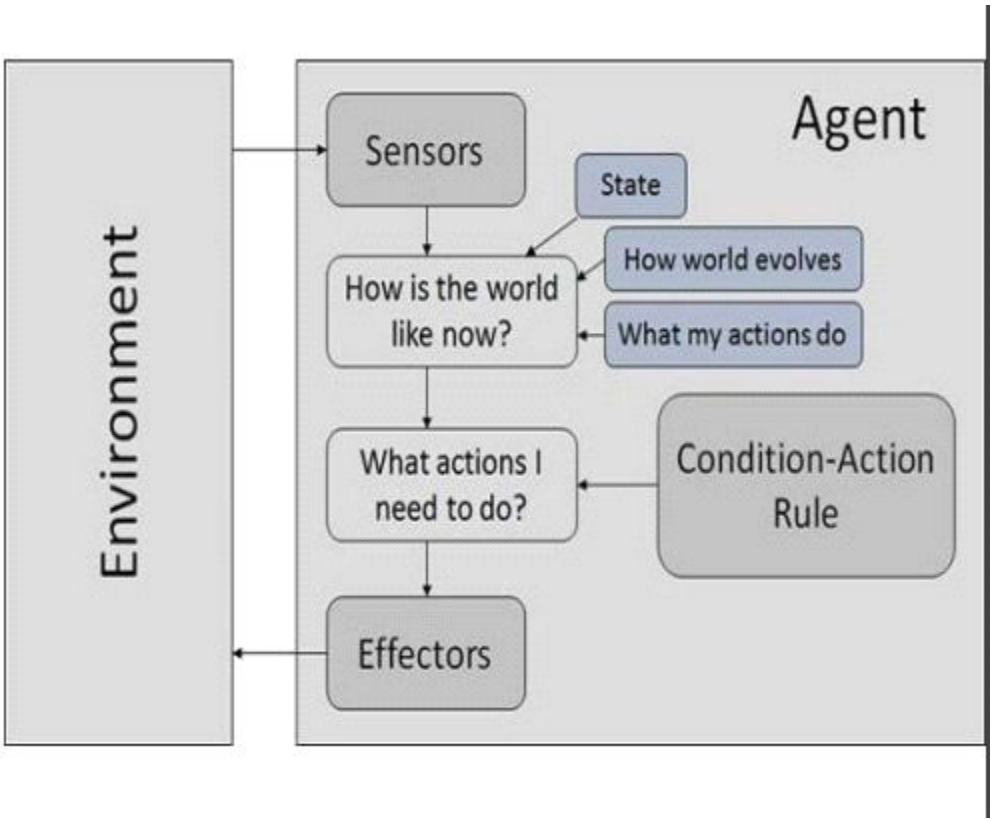
1. Simple Reflex Agents

- They choose actions only based on the current percept.
- They are rational only if a correct decision is made only on the basis of current precept.
- Their environment is completely observable.



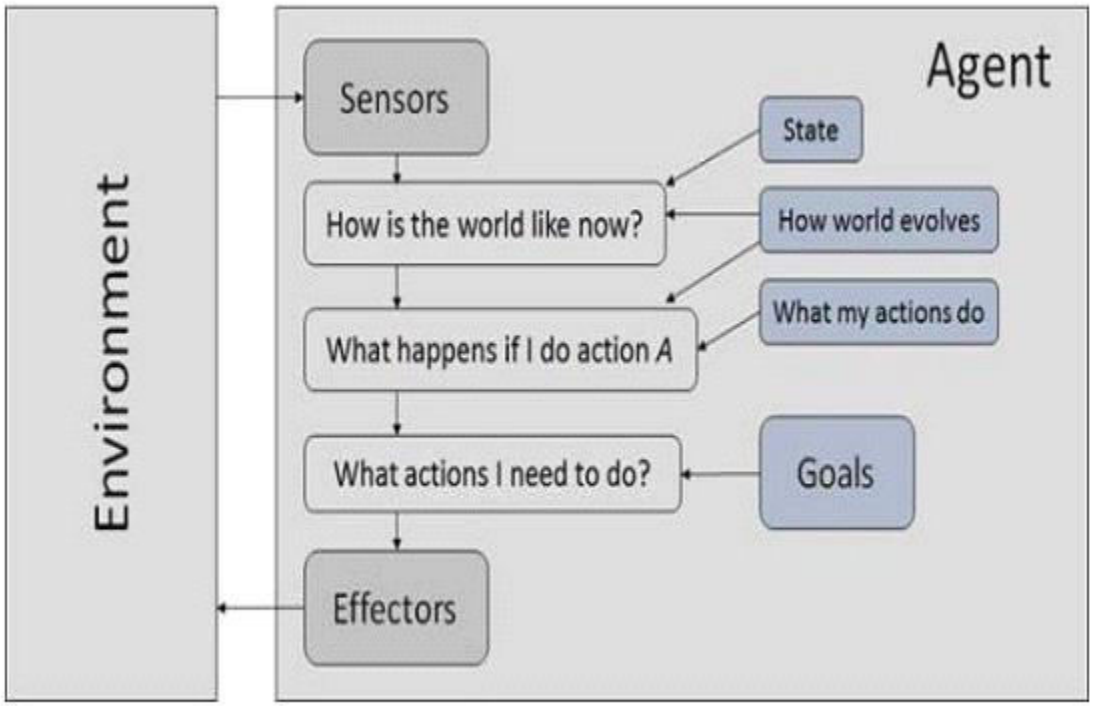
2. Model Based Reflex Agents

- They use a model of the world to choose their actions. They maintain an internal state.
- Model – knowledge about “how the things happen in the world”.
- Internal State – It is a representation of unobserved aspects of current state depending on percept history.



3. Goal Based Agents

- They choose their actions in order to achieve goals.
- Goal-based approach is more flexible than reflex agent since the knowledge supporting a decision is explicitly modeled, thereby allowing for modifications.
- **Goal –** It is the description of desirable situations.

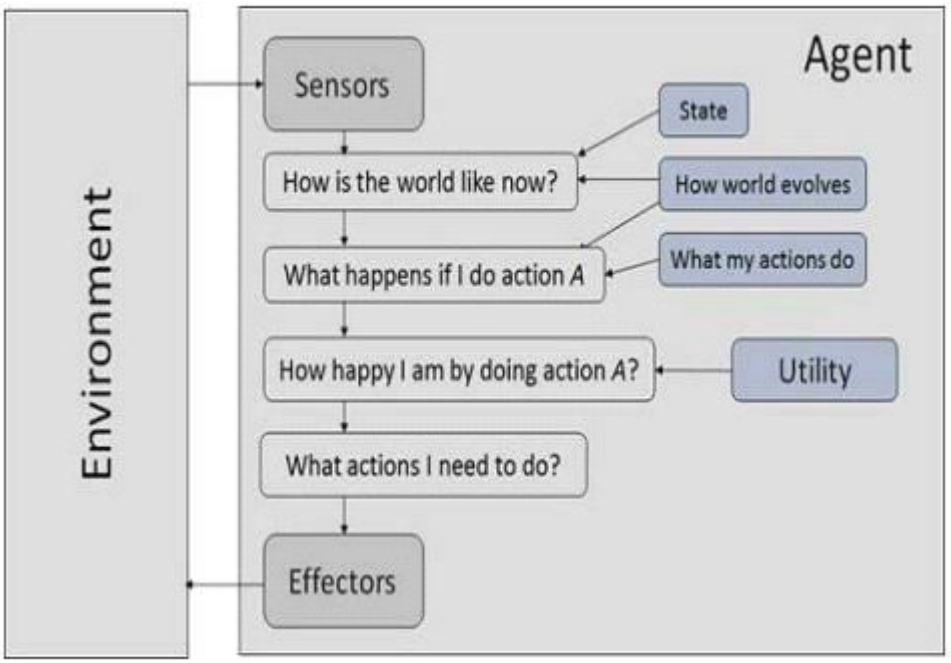


4. Utility Based Agents

They choose actions based on a preference (utility) for each state.

Goals are inadequate when —

- There are conflicting goals, out of which only few can be achieved.
- Goals have some uncertainty of being achieved and you need to weigh likelihood of success against the importance of a goal.



12. Define problem solving agent ? List types of problems in AI

A problem-solving agent is a goal-driven agent and focuses on satisfying the goal.

Types of problem in AI

1. **Ignorable:** In which solution steps can be ignored.
2. **Recoverable:** In which solution steps can be undo.
3. **Irrecoverable:** Solution steps cannot be undo.

UNIT - 2

Searching & Reduction

1. Define Searching, Problem Reduction, Problem Reduction Technique ?

Searching is the process of navigating from a starting state to a goal state by transitioning through intermediate states.

Problem Reduction in artificial intelligence refers to the process of breaking down complex problems into smaller, more manageable subproblems, in order to find a solution.

Problem Reduction Search is an algorithm design technique that takes a complex problem and reduces it to a simpler one.

2. List search technique ?

3. Explain Blind Search/Uninformed search Techniques ?

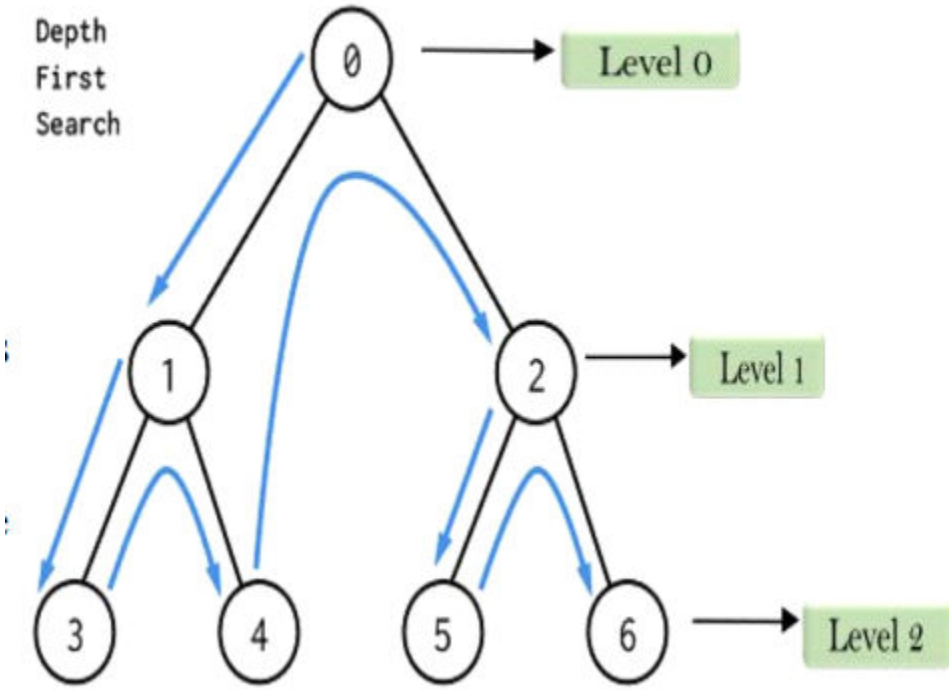
1. Depth First Search -

Depth-first search (DFS) is an algorithm for traversing or searching tree or graph data structures.

- The algorithm starts at the root node (selecting some arbitrary node as the root node in the case of a graph) and explores as far as possible along each branch

before backtracking.

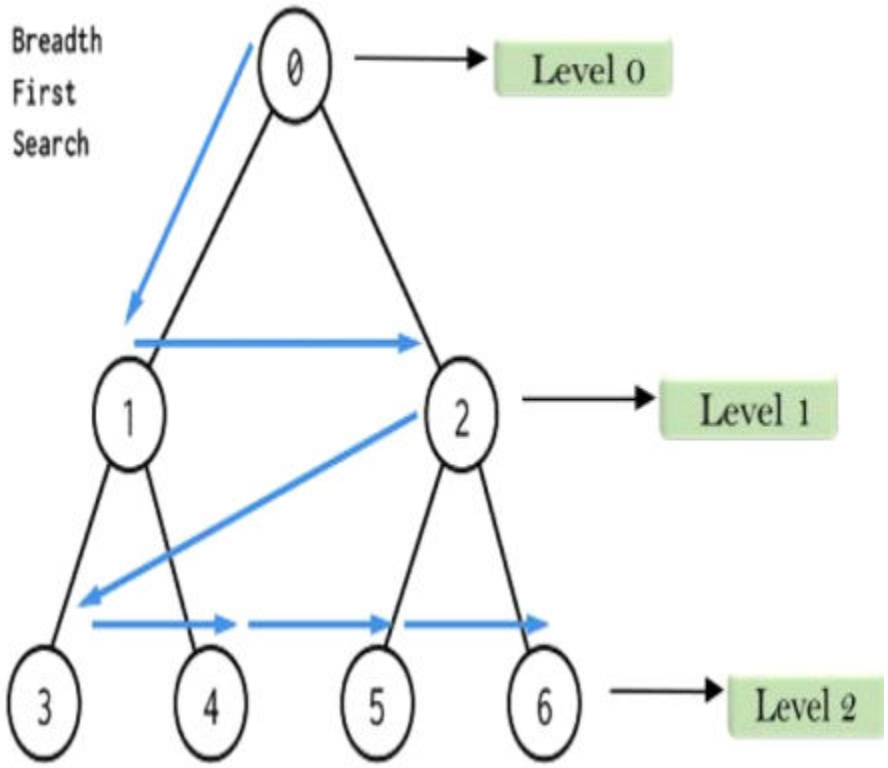
- It uses last in- first-out strategy and hence it is implemented using a stack.



2. Breadth First Search -

Breadth-first search (BFS) is an algorithm for traversing or searching tree or graph data structures.

- It starts at the tree root (or some arbitrary node of a graph, sometimes referred to as a 'search key'), and explores all of the neighbor nodes at the present depth prior to moving on to the nodes at the next depth level.
- It is implemented using a queue.



4. Explain Heuristic Search Techniques ?

A **Heuristic** is a technique to solve a problem faster than classic methods, or to find an approximate solution when classic methods cannot.

1. Hill Climbing:

Hill Climbing Algorithm is a local search algorithm which continuously moves in the direction of increasing elevation/value to find the peak of the mountain or best solution to the problem.

- It terminates when it reaches a peak value where no neighbour has a higher value.
- Hill climbing algorithm is a technique which is used for optimizing the mathematical problems.
- One of the widely discussed examples of Hill climbing algorithm is Traveling-salesman Problem in which we need to minimize the distance travelled by the salesman.

Features of hill climbing -

- No Backtracking
- Greedy Approach
- Generate And Test Variant

Steps of simple hill climbing technique -

- **Step 1:** Evaluate the initial state. If it is the goal state, then return success and Stop.
- **Step 2:** Loop Until a solution is found or there is no new operator left to apply.
- **Step 3:** Select and apply an operator to the current state.
- **Step 4:** Check new state:

  If it is a goal state, then return to success and quit.

  Else if it is better than the current state, then assign a new state as a current state.

  Else if not better than the current state, then return to step2.
- **Step 5:** Exit.

Types of hill climbing technique -

1. Simple Hill Climbing
2. Steepest-Ascent hill climbing
3. Stochastic hill climbing

2. Best First Search:

Best – First Search uses the concept of a Priority queue and heuristic search. To search the graph space, the best first search method uses two lists for tracking the traversal.

Advantages -

- Memory Effiecient as compared with DFS and BFS
- It is complete.

Disadvantages -

- It gives good solution but no optimal solution.
- It worst case it may behave like unguided DFS.

3. Problem Reduction (Imp) -

Problem reduction is an algorithm design technique that takes a complex problem and reduces it to a simpler one.

The simpler problem is then solved and the solution of the simpler problem is then transformed to the solution of the original problem.

Types of problem reduction:

1. The A* Algorithm

- A* search is the most commonly known form of best-first search.
- A* algorithm represents an OR graph algorithm that is used to find a single solution (either this or that).
- It is a computer algorithm which is used in path-finding and graph traversal.
- It is used for plotting an efficiently directed path between several points called nodes.
- It uses the heuristic function h(n) and cost to reach the node n from the start state g(n).

Advantages Of A* Algorithm

- A* algorithm solving complex problems.
- This algorithm is optimal and complete.
- It is the best search algorithm.

Disadvantages Of A* Algorithm

- It does not always produce the shortest path.

- In the A* algorithm complexity issues occur.
- It also requires memory

2. The AO* Algorithm

AO* represents an AND-OR graph method that ANDs many branches to find multiple solutions.

- Its an informed search and works as best first search.
- AO* Algorithm is based on problem decomposition (Breakdown problem into small pieces).
- an efficient method to explore a solution path.
- AO* is often used for the common pathfinding problem in applications- video games, stochastic grammars in NLP, an Informational search with online learning.
- It is useful for searching game trees, problem solving etc.

Advantages of AO* Algorithm

- It is an efficient method to explore a solution path.
- It uses a divide-and-conquer strategy.

Disadvantages of AO* Algorithm

- This algorithm does not guarantee to give the optimal solution.
- It can be more complex than simpler algorithms due to its adaptability & nature.

5. List the differences between A* and AO* Algorithm ?

Feature	A*	AO*
Optimality	Guaranteed to find optimal solution if heuristics are consistent	Does not guarantee optimality; provides approximate solutions
Completeness	Complete: Will find a solution if one exists	Complete: Will converge to a solution over time
Memory Requirement	Requires memory to store entire search tree/graph	More memory efficient; does not require storing entire search tree/graph
Time Complexity	Can have exponential time complexity	Typically converges faster than A*, but may sacrifice optimality
Resource Allocation	Fixed computational resources	Adapts resource allocation, can be interrupted at any time
Iterative Improvement	Does not iteratively improve solution	Iteratively improves solution over time
Interruptibility	Not interruptible during computation	Interruptible at any time, providing a solution at any point
Solution Quality Control	Produces optimal solutions if possible	Provides solutions of varying quality depending on resources
Application	Well-suited for scenarios where finding the optimal solution is crucial, e.g., pathfinding in robotics or games	Useful for real-time systems or resource-constrained scenarios

4. Constraint Satisfication:

Constraint Satisfaction is deals with solving problems by identifying constraints and finding solutions that satisfy those constraints.

Types of contraints -

1. Unary Constraints:

A unary constraint is a constraint on a single variable. For example, Variable A not equal to “Red”.

2. Binary Constraints:

A binary constraint involves two variables and specifies a constraint on their values.

3. Global Constraints:

Global constraints involve more than two variables and specify complex relationships between them.

6. Explain Game Playing ?

It refers to technique used in computer and video games to produce illusion of the intelligenin the behaviour of non player characters (NPCs).

Characteristics of game playing

- “Unpredictable” opponent: Solution is a strategy specifying a move for every possible opponent reply
- Time limits: Unlikely to find goal, must approximate

Advantages of Game Playing

- Advancement of AI
- Education and training
- Research
- Real-world applications

Disadvantages of Game Playing

- Limited scope
- Computational cost

7. Define Adversarial Search ?

The Adversarial search is a well-suited approach in a competitive environment, where two or more agents have conflicting goals.

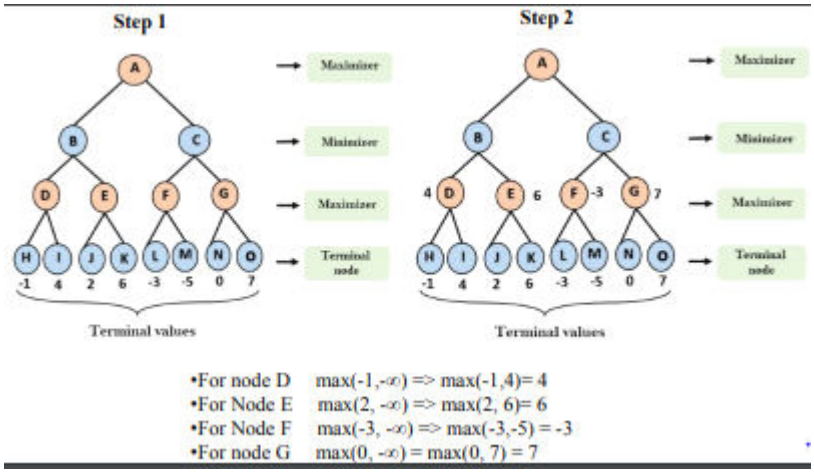
Role of Adversarial Search

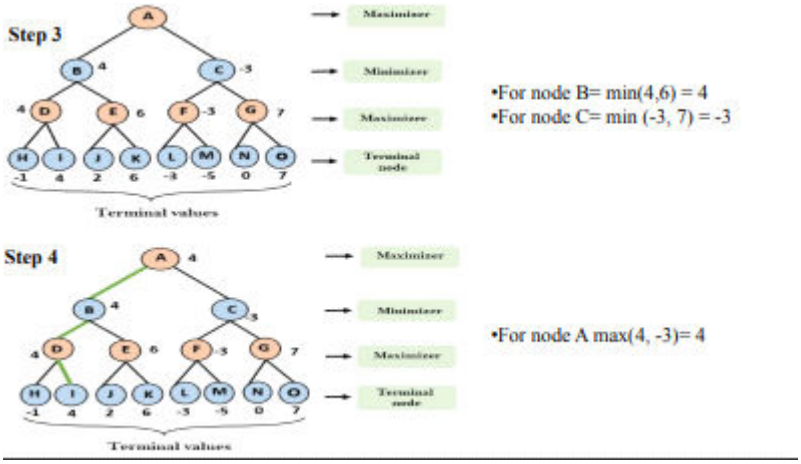
- Game-playing
- Decision-making

8. Define MINIMAX Search Procedure and explain with example ?

Mini-max algorithm is a recursive or backtracking algorithm which is used in decision-making and game theory.

Example





9 Define Alpha-beta pruning ?

Alpha-beta pruning is a modified version of the minimax algorithm. It is an optimization technique for the minimax algorithm.

UNIT - 3

Knowledge Representation Issues

1. Define Knowledge ?

Knowledge is the information about a domain that can be used to solve problems in that domain and this knowledge must be represented in the computer.

2. Define the different kinds of knowledge?

- **Object:** All the facts about objects in our world domain. E.g., Guitars contains strings, trumpets are brass instruments.
- **Events:** Events are the actions which occur in our world.
- **Performance:** It describe behaviour which involves knowledge about how to do things.
- **Meta-knowledge:** It is knowledge about what we know.
- **Facts:** Facts are the truths about the real world and what we represent.
- **Knowledge-Base:** The central component of the knowledge-based agents is the knowledge base. It is represented as KB.

3. List & Define Types of Knowledge?

Declarative Knowledge –

It includes concepts, facts, and objects and expressed in a declarative sentence.

Structural Knowledge –

It is a basic problem-solving knowledge that describes the relationship between concepts and objects.

Procedural Knowledge –

This is responsible for knowing how to do something and includes rules, strategies, procedures, etc.

Meta Knowledge –

Meta Knowledge defines knowledge about othertypes of Knowledge.

Heuristic Knowledge –

This represents some expert knowledge in the field or subject

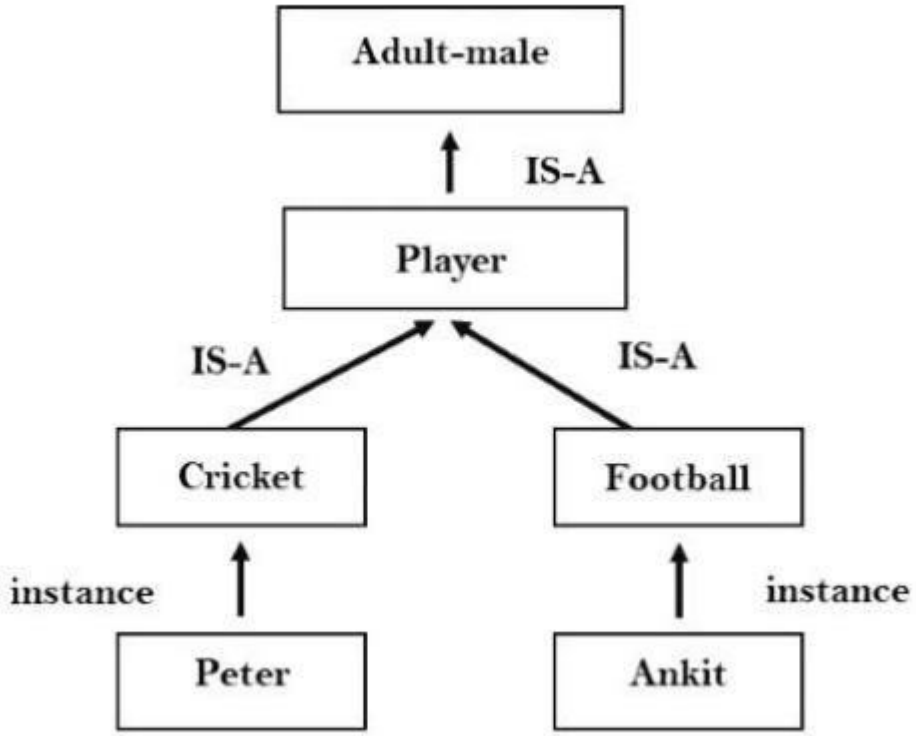
4. List and explain Approaches to Knowledge Representation in AI ?

1. Simple Relational Knowledge

- It is the simplest way of storing facts which uses the relational method. Here, all the facts about a set of the object are set out systematically in columns.
- Also, this approach of knowledge representation is famous in database systems where the relationship between different entities is represented.

2. Inheritable Knowledge

- In the inheritable knowledge approach, all data must be storeinto a hierarchy of classes and should be arranged in a generalized form or a hierarchal manner.
- Also, this approach contains inheritable knowledge which shows a relation between instance and class, and it is called instance relation.
- Every individual frame can represent the collection of attributes and its value.
- In this approach, objects and values are represented in Boxed nodes.
- We use Arrows which point from objects to their values.



3. Inferential Knowledge

- The inferential knowledge approach represents knowledge in the form oformal logic.
- Thus, it can be used to derive more facts.
- Also, it guarantees correctness.
- **Example:**

  Statement 1: John is a cricketer.

  Statement 2: All cricketers are athletes.

4. Procedural knowledge

- Procedural knowledge approach uses small programs and codes whichdescribes how to do specific things, and how to proceed.
- In this approach, one important rule is used which is If-Then rule.
- In this knowledge, we can use various coding languages such as LISP language (list processing) and Prolog language

5. List and explain Knowledge Representation Techniques in AI?

1. Logical Representation

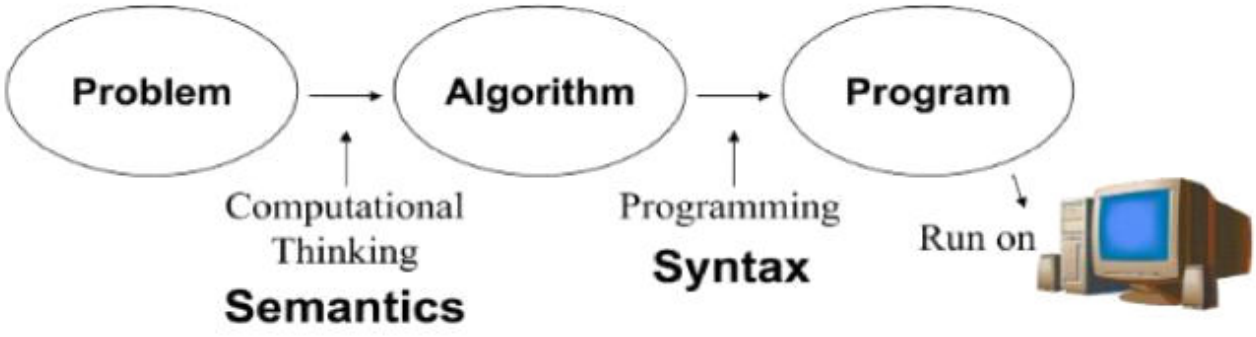
- Logical representation is a language with some definite rules which deal with propositions and has no ambiguity in representation.
- It represents a conclusion based on various conditions and lays down some important communication rules

Advantages:

- Logical representation helps to perform logical reasoning.
- This representation is the basis for the programming languages.

Disadvantages:

- Logical representations have some restrictions and are challenging to with.



2. Semantic Network Representation

Semantic networks work as an alternative of predicate logic for knowledge representation. In Semantic networks, you can represent your knowledge in the form of graphical networks.

This representation consist of two types of relations:

1. IS-A relation (Inheritance)
2. Kind-of-relation

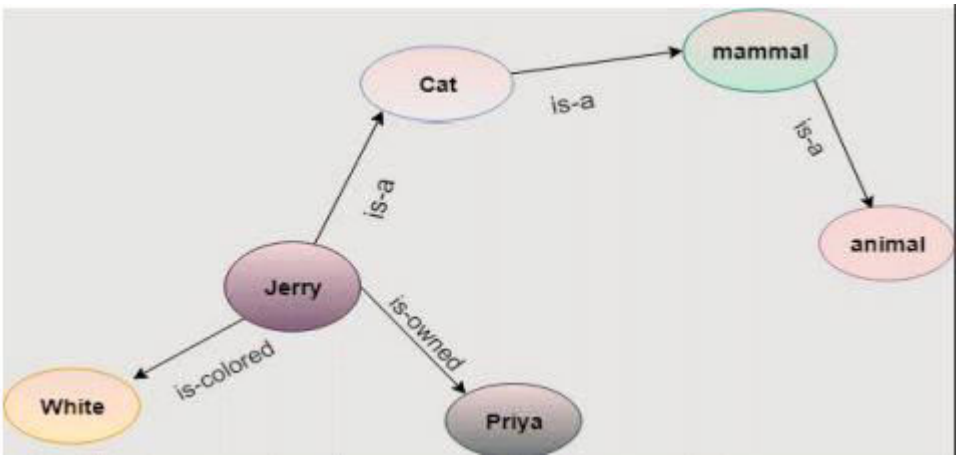
Advantages:

– Semantic networks are a natural representation of knowledge.

– These networks are simple and easy to understand.

Disadvantages:

– Semantic networks take more computational time at runtime.



3. Frame Representation

A frame is a record like structure that consists of a collection of attributes and values to describe an entity in the world.

AI data structure divides knowledge into substructures by representing stereotypes situations. Basically, it consists of a collection of slots and slot values of any type and size. Slots have names and values which are called facets.

Advantages:

- It makes the programming easier by grouping the related data.
- Frame representation is easy to understand and visualize.

Disadvantages:

- The mechanism cannot be easily processed.
- The inference mechanism cannot be smoothly proceeded by frame representation.

Frame for a book

Slots	Filters
Title	Artificial Intelligence
Genre	Computer Science
Author	Peter Norvig
Edition	Third Edition
Year	1996
Page	1152

4. Production Rules

- Production rules system consist of (condition, action) pairs which mean, "If condition then action".
- In production rules, agent checks for the condition and if the condition exists then production rule fires and corresponding action is carried out.

Advantages:

– The production rules are expressed in natural language.

– The production rules are highly modular and can be easily removed or modified.

Disadvantages:

– It does not exhibit any learning capabilities and does not store the result of the problem for future uses.

6. List differences between procedural knowledge and declarative knowledge?

PROCEDURAL KNOWLEDGE	DECLARATIVE KNOWLEDGE
It is also known as Interpretive knowledge.	It is also known as Descriptive knowledge.
Procedural Knowledge means how a particular thing can be accomplished	While Declarative Knowledge means basic knowledge about something.
Procedural Knowledge is generally not used means it is not more popular.	Declarative Knowledge is more popular.
Procedural Knowledge can't be easily communicate.	Declarative Knowledge can be easily communicate
Procedural Knowledge is generally process oriented in nature	Declarative Knowledge is data oriented in nature.
In Procedural Knowledge debugging and validation is not easy.	In Declarative Knowledge debugging and validation is easy.

7. Define logic programming ?

Logic programming offers a formalism for specifying a computation in terms of logical relations between entities.

8. Define forward reasoning ?

The solution of a problem generally includes the initial data and facts in order to arrive at the solution.

9. Define backward reasoning ?

AnThe backward reasoning is inverse of forward reasoning in which goal is analysed in order to deduce the rules, initial facts and data.

10. List differences between forward and backward reasoning ?

Forward Chaining	Backward Chaining
It starts from known facts and applies inference rule to extract more data unit it reaches to the goal.	It starts from the goal and works backward through inference rules to find the required facts that support the goal.
It is a bottom-up approach	It is a top-down approach
It is known as data-driven inference technique as we reach to the goal using the available data.	It is known as goal-driven technique as we start from the goal and divide into sub-goal to extract the facts.
It applies a breadth-first search strategy.	It applies a depth-first search strategy.
It tests for all the available rules	It tests only for few required rules.
It is suitable for the planning, monitoring, control, and interpretation application.	It is suitable for diagnostic, prescription, and debugging application.
It can generate an infinite number of possible conclusions.	It generates a finite number of possible conclusions.
It operates in the forward direction.	It operates in the backward direction.

11. Define control language ?

Knowledge about which paths are most likely to lead quickly to a goalstate is often called search control knowledge.

UNIT - 4

Learning

1. Define Learning ?

It is the activity of gaining knowledge or skill by studying, practising, being taught, or

experiencing something.

2. Define Propositional logic ? Give example

It is declarative, so it guides us on how to represent information in a logical form and draw conclusions. It assumes the world contain facts.

Examples

- Joe Root likes football.
- I like to eat

3. Define First Order Logic OR Predicate logic?

First-order logic is a powerful language that develops information about the objects in a more easy way and can also express the relationship between those objec

4. List and explain Key Components Of First-order Logic ?

1. Syntax

FOL statements consist of terms, predicates, quantifiers, and logical connective

2. Semantics -

It define meaning of FOL statements in terms of interpretations & truth assignments.

3. Inference -

It involves deriving new statements or conclusions from existing knowledge using logical deduction rule

4. Expressiveness -

FOL is more expressive than propositional logic and can represent complex statements involving variables, quantifiers, and relations.

5. List and explain types of sentences in First Order Logic ?

1. Atomic Sentence

This is a basic sentence of FOL formed from a predicate symbol followed by a

parenthesis with a sequence of terms.

We can represent atomic sentences as a predicate (value1, value2., value n).

Example

- Ravi and Ajay are brothers: => Brothers(Ravi, Ajay).
- Chinky is a cat: => cat (Chinky)

2. Complex sentence

Complex sentences are made by combining atomic sentences using connectives.

FOL is further divided into two parts:

1. Subject: the main part of the statement.
2. Predicate: defined as a relation that binds two atoms together.

Example

Consider the statement: "x is an integer.",

It consists of two parts, the first part x is the subject of the statement and second part "is an integer," is known as a predic

6. Define quantifiers in first order logic ?

A quantifier is a language element which generates quantification, and quantification specifies the quantity of specimen in the universe of discourse

7. Define Forward Chaining and Backward Chaining ?

1. Forward Chaining:

Forward chaining, also known as data-driven or bottom-up reasoning, starts with the available data and uses inference rules to derive new conclusions until a desired goal is reached.

2. Backward Chaining:

Backward chaining, also known as goal-driven or top-down reasoning, starts with a given goal or query and works backward through the inference rules to determine if the goal can be satisfied by the available data.

8. Define Resolution?

Resolution is a fundamental inference rule used in artificial intelligence and automated reasoning to derive new logical statements from existing ones.

10. Define decision trees ?

Decision trees are a popular machine learning technique used for classification and regression tasks in artificial intelligence.

11. Define explaination based learning ?

Explanation-based learning (EBL) is a machine learning approach that leverages domain-specific knowledge to accelerate the learning process and improve generalization.

Objective: EBL aims to learn new concepts or problem-solving strategies by using explanations provided by a domain expert or previous learning experiences.

Applications:

- Medical Diagnosis
- Robot Navigation
- Fraud Detection

12. Define Statistical learning methods ?

Statistical learning methods in AI involve algorithms that learn from data to make predictions or decisions by identifying patterns or relationships

Objective: Statistical learning methods aim to build predictive models from data by analyzing the underlying statistical properties and relationships.

Key Concepts

1. Supervised Learning:

In supervised learning, the algorithm is trained on labeled data, where each input is associated with a corresponding output or target variable.

2. Unsupervised Learning:

In unsupervised learning, the algorithm is trained on unlabeled data, and the goal is to discover hidden patterns, structures, or relationships within the data.

3. Semi-supervised Learning:

Semi-supervised learning combines elements of supervised and unsupervised learning by training on a combination of labeled and unlabeled data.

Applications -

Finance, Healthcare, Marketing, Natural Language Processing, Computer Vision, Speech Recognition, And Bioinformatics.

13. Define Reinforcement learning ?

Reinforcement learning is a type of learning where an agent learns to make decisions by interacting with an environment and receiving feedback in the form of rewards or penalties.

Main points in Reinforcement learning –

Input: The input should be an initial state from which the model will start

Output: There are many possible outputs as there are a variety of solutions to a particular problem

Training: The training is based upon the input, The model will return a state and the user will decide to reward or punish the model based on its output.

Types of Reinforcement learning -

- Positive
- Negative

UNIT - 5

Expert Systems

1. List AI Applications ?

- Healthcare
- Finance
- Autonomous vehicles
- Natural Language Processing
- Robotics
- Manufacturing
- Retail
- Transportation
- Energy
- Government
- GPS and Navigations
- Education
- Agriculture
- Social Media

2. Define Expert systems and list its characteristics ?

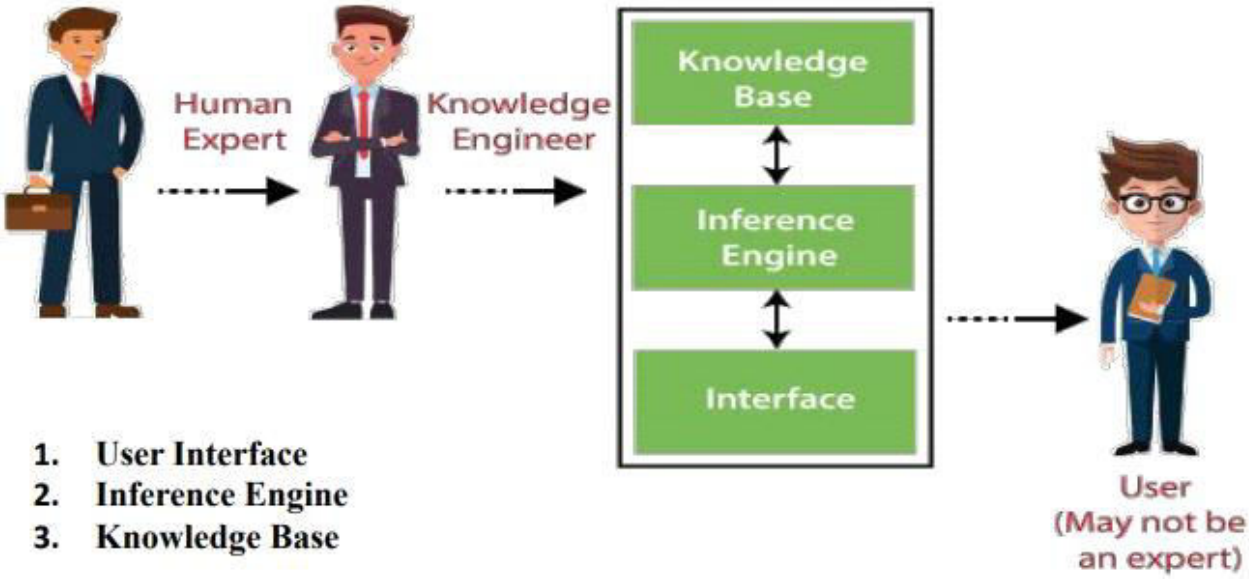
The expert systems are the computer applications developed to solve complex problems in a particular domain, at the level of extra-ordinary human intelligence and expertise.

Characteristics -

- **High Performance:** The expert system provides high performance for solving any type of complex problem.
- **Understandable:** It responds in a way that can be easily understandable by the user.
- **Reliable:** It is much reliable for generating an efficient and accurate output.

- **Highly responsive:** ES provides the result for any complex query within a very short period of time.

3. Explain Structure/Components of Expert System ?



1.User Interface (UI):

The user interface allows users to interact with the expert system, input queries, provide information, and receive outputs or recommendations.

2. Inference Engine(Rules of Engine):

The inference engine is known as the brain of the expert system as it is the main processing unit of the system. The system extracts the knowledge from the knowledge base.

Types of inference engine:

1. Deterministic Inference engine: The conclusions drawn from this type of inference engine are assumed to be true. It is based on facts and rules.

2. Probabilistic Inference engine: This type of inference engine contains uncertainty in conclusions, and based on the probability.

3. Knowledge Base:

The knowledge base is a type of storage that stores knowledge acquired from the different experts of the particular domain. It is considered as big storage of knowledge.

The more the knowledge base, the more precise will be the Expert System.

Components of knowledge base -

1. Factual knowledge.
2. Heuristic Knowledge
3. Knowledge Acquisitions
4. Knowledge reprentation.

4. Define The human element in expert system ?

The human element in an expert system in AI refers to the involvement of human expertise in the development, maintenance, and operation of the system.

5. List and explain Types of Expert Systems ?

1. Rule-Based Expert Systems:

- These are simple expert systems representing knowledge as a collection of rules.
- These rules guide the system in making decisions & providing solutions to user queries.

2. Fuzzy Logic Expert Systems:

- In these systems, multi-valued logic, also known as fuzzy logic, differentiates between class members & non-members when solving problems.
- This allows for more flexible & nuanced decision-making.

3. Frame-Based Expert Systems:

- Systems use frames to store & represent knowledge.
- Frames act as structured templates that organize information for efficient problem-solving.

4. Neural Expert Systems:

- Systems store knowledge as weights in neurons, simulating the functioning of the human brain.
- This approach replaces traditional knowledge bases with neural networks to process & solve problems.

5. Neuro-Fuzzy Systems:

Combining the power of parallel computation, learning capabilities, knowledge representation, & explanatory skills, neuro-fuzzy systems create a hybrid approach to problem-solving

6. List expert systems success factors or advantages ?

- High Quality knowledge base
- Effective knowledge acquisition
- Sound reasoning mechanisms
- User friendly interface
- Robust performance
- Continuous improvement
- Integration with workflow
- Domain expert involvement
- Training and support
- Clear objectives and metrics

7. List limitation of expert systems ?

1. Expert systems rely on human knowledge & expertise
2. Expert systems are limited by their programming
3. Expert systems lack creativity & intuition

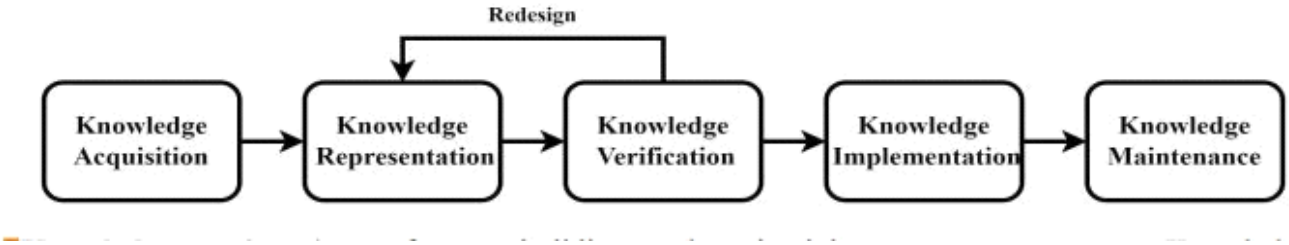
4. Expert systems require extensive knowledge engineering

5. Expert systems may not be able to handle all types of problems

8. Explain Knowledge Engineering OR Development of ES ?

Knowledge engineering refers to building and maintaining an expert system.

Knowledge Engineering in artificial intelligence is the process of capturing, modeling, representing, and integrating knowledge into computer systems to enable them to perform intelligent tasks.



Techniques -

1. Knowledge Acquisition -

Acquire knowledge by gathering information from human experts.

This process involves various techniques, including interviews, questionnaires, and observation.

2. Knowledge Representation -

Transform acquired knowledge into a format the system can understand and use.

3. Knowledge Verification -

Ensure that the knowledge in the expert system is accurate and complete.

4. Knowledge Implementation -

Once validated, we'll implement the system using an inference engine.

5. Knowledge Maintenance -

Finally, we maintain our expert system's knowledge base by regularly updating it with new information.

9. List Knowledge acquisition techniques ?

1. Protocol-generation techniques
2. Protocol analysis techniques
3. Hierarchy generation techniques
4. Matrix-based techniques
5. Sorting techniques
6. Limited information and contrained-processing
7. Diagram-based techniques