

Define an agent.

An agent is an entity that can perceive information and act on that information.

Types of agent: Table driven agent, Simple Reflex agent, Model based reflex agent, Goal based agent, Utility based agent

What is forward chaining and backward chaining?

Forward chaining: Also known as data-driven reasoning. The system starts with available data and facts. It then iteratively applies production rules to the data to derive new conclusions or facts. This strategy continues until a specific goal or condition is satisfied.

Backward chaining: Also known as goal-driven reasoning. A clear objective is established. The system then determines which production rules are necessary to accomplish that goal and works backward, triggering rules as necessary until the goal is met or no more rules can be applied.

What is an Ontology?

Ontology is a way of representing knowledge. It involves defining a common vocabulary and a set of relationships for a specific domain. It provides a formal and shared understanding of a domain's concepts and their interrelations.

What is greedy best first search?

Greedy Best-First Search is an AI search algorithm that attempts to find the most promising path from a given starting point to a goal. It prioritizes paths that appear to be the most promising, regardless of whether or not they are actually the shortest path. The algorithm works by evaluating the cost of each possible path and then expanding the path with the lowest cost. This process is repeated until the goal is reached.

What are the problems faced by a local search algorithm?

1. The main disadvantage of the local search algorithm is that it gets trapped in the local optima.
2. If the cost function of the problem is high, then the schedule becomes slow.
3. The local search algorithm cannot tell the user that it got the optimal solution.

How agents do communication?

1. **Message Passing:** Agents exchange messages to convey information. Messages can contain data, instructions, or requests for action.
2. **Shared Memory:** Agents share a common memory space where they can read and write information.

3. **Blackboard Systems:** A central knowledge repository, known as the "blackboard," is used for communication. Agents contribute information or solutions to the blackboard, and other agents can access or modify this shared space.

Discuss the following search Technique with the help of an example. Also discuss the benefits and shortcoming of each

(a) Breadth First Search.

Algorithm:

Step 1: Enter starting node in the queue

Step 2: If queue is empty, then return fail and stop

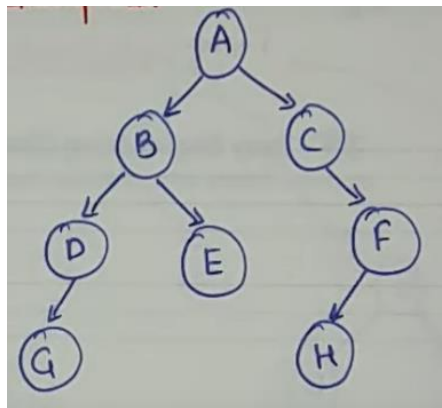
Step 3: If first element in the queue is goal node, then return success and stop

Step 4: Else remove first element from the queue and place its children at end of the queue

Step 5: Go to step 2

Example:

- ✓ {A}
- ✓ {B, C}
- ✓ {C, D, E}
- ✓ {D, E, F}
- ✓ {E, F, G}
- ✓ {F, G}
- ✓ {G, H}



Advantages

- If there is a solution, BFS will definitely find it.
- If there is more than one solution, then BFS will find the minimal one that requires least number of steps.

Disadvantages

- It needs more memory
- It needs more time

(b) Depth First Search.

Algorithm:

Step 1: Enter the root node in the stack

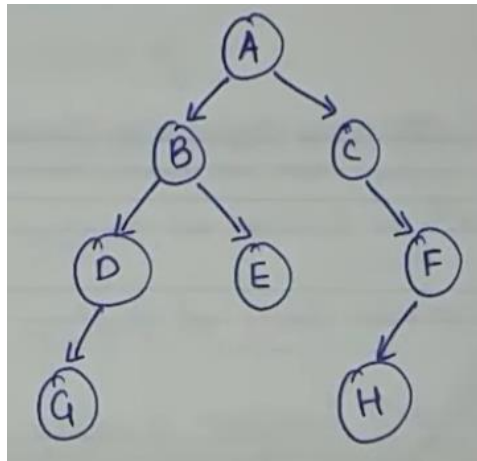
Step 2: Do until stack is not empty

a) Remove node

- b) If node is goal node, then stop
- c) Push children of node in the stack

Example:

- ✓ {A}
- ✓ {B, C}
- ✓ {D, E, C}
- ✓ {G, E, C}
- ✓ {E, C}
- ✓ {C}
- ✓ {F}
- ✓ {H}



Advantages:

- It requires less memory
- It requires less time

Disadvantages:

- No guarantee of finding solution
- In case of multiple solutions, there is no guarantee of finding minimal solution

Discuss Problem Reduction (AO* Algorithm)

When a problem can be divided into a set of sub problems, where each sub problem can be solved separately and a combination of these will be a solution, AND-OR graphs are used for representing the solution. The decomposition of the problem generates AND arcs. One AND arc may point to any number of successor nodes. All these must be solved so that the arc will rise to many arcs, indicating several possible solutions. Hence the graph is known as AND - OR instead of AND.

AO* Algorithm

Step 1: Place the starting node in OPEN.

Step 2: Compute the most promising solution tree say T0.

Step 3: Select a node n that is both in OPEN and a member of T0. Remove it from OPEN and place it in CLOSE

Step 4: If n is the terminal goal node then label n as solved and label all the ancestors of n as solved. If the starting node is marked as solved then success and exit.

Step 5: If n is not a solvable node, then mark n as unsolvable. If starting node is marked as unsolvable, then return failure and exit.

Step 6: Expand n. Find all its successors and find their h (n) value, push them into OPEN.

Step 7: Return to Step 2.

What is production system? Explain it with an example. Discuss the characteristics of a production system.

Production systems automate complex tasks through production rules, efficiently processing data and generating insights.

Components:

- **Global Database:** The global database serves as the system's memory, storing facts, data, and knowledge relevant to its operation.
- **Production Rules:** They are a set of guidelines that the system follows for decision making
- **Control System:** It determines the sequence in which production rules are applied, ensuring efficient processing and optimizing the system's performance.

Examples:

- **Customer Support Chatbots:** AI-powered chatbots in customer support systems use production rules to handle customer inquiries.
- **Fraud Detection Systems:** In financial institutions, AI production systems detect fraudulent activities by analysing transaction data and applying predefined fraud detection rules.

Characteristics:

- **Simplicity:** They provide a simple way to execute rules
- **Modularity:** They are composed of modular components
- **Modifiability:** They can be easily modified
- **Knowledge-intensive:** They have a comprehensive global database.
- **Adaptability:** They can dynamically adapt to new data

Illustrate A* Search Technique through an example.

<https://www.youtube.com/watch?v=95s0b0HBe3w>

Discuss various issues in knowledge representation. Also discuss various problems in representing knowledge.

Issues in Knowledge Representation:

1. Expressiveness: Ensuring that the chosen representation language can express the complexities of real-world knowledge.
2. Inference: Developing mechanisms to infer new knowledge from existing representations.
3. Efficiency: Representations should be efficient in terms of storage and processing
4. Scalability: Ensuring that the representation scales effectively as the knowledge base grows.
5. Uncertainty: Dealing with uncertain or incomplete information

Problems in Knowledge Representation:

1. Context Sensitivity: Difficulty in representing and maintaining context-sensitive information
2. Dynamic Knowledge: Representing knowledge that changes over time
3. Interoperability: Ensuring that knowledge representations from different sources can be integrated and used together seamlessly.
4. Commonsense knowledge: Representing commonsense knowledge is difficult for computers.

Explain resolution in predicate logic.

Steps for resolution:

1. Convert facts into First Order Logic(FOL)
2. Convert FOL into CNF (Conjunctive Normal Form)
3. Negate the statement to be proved, and add the result to the knowledge base
4. Draw resolution graph
5. If empty clause (NIL) is produced, stop and report that original theorem is true

Example

<https://www.youtube.com/watch?v=-gClrA5NwT4>

Explain any two applications of artificial intelligence in detail in the area of science and technology.

Same as application in medical science, robotics and aerospace as given in 2023 Sol