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Assignment 1

Q1) Explain the concept of rationality in the context of intelligent agents. How does rationality relate to the behaviour of agent in their environment? Provide example to illustrate your explanation

→ Rationality: The state of being reasonable sensible and having a sound sense of judgement is known as rationality. Rationality is concerned with the predicted behaviour and outcome based on the agent perception. An essential aspect of rationality is taking actions intending to collect valuable knowledge.

→ Rationality at any given time depend on four things:
- The performance measure that defines the interia of success
- The agents prior knowledge of environment
- The action the agent can perform
- The agent percept sequence to data.
- The behaviour of rational agent is guided by the principle of achieving the best outcome or maximizing expected utility. It involves making decision based on reasoning, logical inference, and learning from experience
- Key components and the relationship between rationality and the behaviour of agents in their environment.
- Goals and objectives
- Information and perception
- Decision-making
- Adaptation and learning
- Consistency and coherence.
- Expected utility
- Trade-offs and constraints.

Eg Simple vaccum-cleaner agent that clean a square if it is dirty and moves to the other square. if not, But here we need to say what the performance measure is, what is

known about the environment and what sensors and actuators the agent has

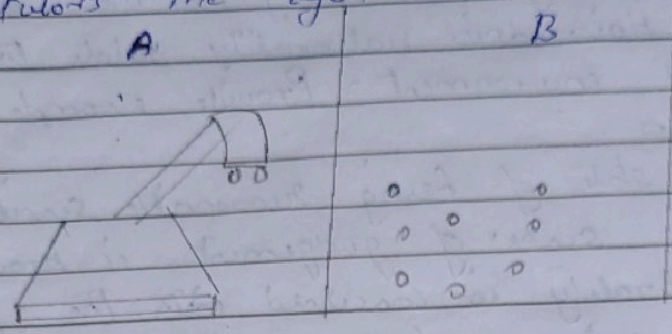


Fig A vacuum-cleaner with just two locations.

Percept sequence	Action
[A, clean]	Right
[A, Dirty]	Suck.
[B, clean]	Left.
[B, Dirty]	Suck.
[A, clean] [B clean]	Right.
[A, clean] [A Dirty]	Suck
[A, clean] [A clean] [A, clean]	Right.
[A, clean] [A, clean] [A, dirty]	Suck

Q2 Discuss the nature of environment in which intelligent agent operate what are the key characteristic that define an environment and how do they influence the design and behaviour of agent?
Provide examples of different types of environment and the challenge they present to the agents.

→ An environment in AI is the surrounding of the agent. The agent takes input from the environment and the challenges they present to agents. Through sensors.
- and delivers the output to the environment through actuators.
There are several types of environment.

1) Full observable vs partially observable.

→ When an agent is capable to sense or access the complete state of an agent at each point in time it is said to be a fully observable environment.
- When the agent has limited or incomplete information about the current state
Eg chess - The board is fully observable, and so are the opponents moves.
Eg Driving - The environment is partially observable, because what around the corner is not known

2) Deterministic vs stochastic.

→ When a uniqueness in the agent current state completely determine the next state of the agent, the environment is said to be deterministic.
- The stochastic environment is random in nature which is not unique and cannot be completely determined by the agent.
eg chess - There would be only a few possible moves for a coin at the current state, and the moves can be determined.
Eg self-Driving cars - The action of a self driving car are not unique it varies time to time

(3) Competitive vs collaborative.
- An agent is said to be in a competitive environment when it competes against another agent to optimize the output.
- An agent is said to be in a collaborative environment when multiple agents cooperate to produce the desired output.

eg Financial markets, where traders compete to maximize profits, potentially at the expense of others.
eg Team-based projects in business where members collaborate the achieve project objectives.

(4) Single-Agent vs Multi-Agent.
- An environment consisting of only one agent is said to be a single-agent environment.
- An environment involving more than one agent is a multiagent environment.

Eg A person left alone in a maze is an example of the single agent system
eg The game of football is multi agent as it involves 11 player in each team.

(5) Static vs Dynamic.
⇒ An idle environment with no change in its state is called a static environment. An environment that keeps on changing is called when the agent is up with some action is said to be dynamic.
eg An empty house is static as there is no change in the surrounding when an agent enters.
eg A roller coaster ride is dynamic as it is set in motion and the environment keeps changing every instant

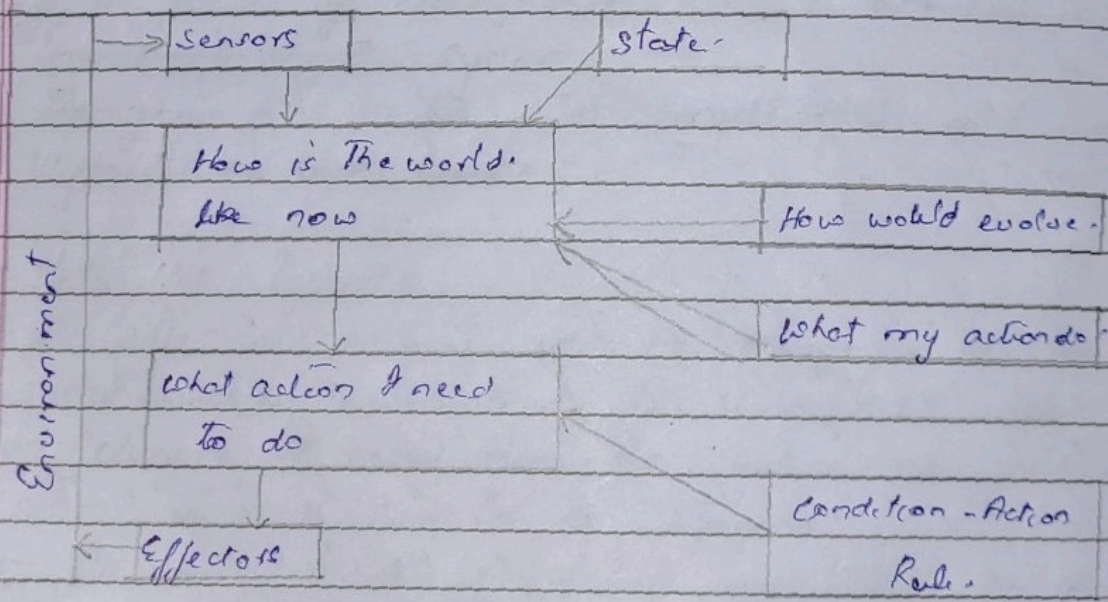
Discrete vs continuous:

If an environment consists of a finite number of a
That can be deliberated in the environment to obtain
output, it is said to be a discrete environment.
The environment in which the action are performed ca
be numbered (ie) is not discrete is said to be contin
Discrete grid world in robotic & board games lik
self driving cars are an example of continous enviro
as their actions are driving, parking, etc which ca
be numbered.

Q3 Describe the structure of intelligent agent and the type of agents commonly used in artificial intelligence. What are the components of an agent, and how do they interact to achieve intelligent behaviour? Provide examples of different types of agents and their applications in real-world scenarios.

→ The Intelligent Agent (IA) structure consist of three main part: Architecture, Agent function and agent programming

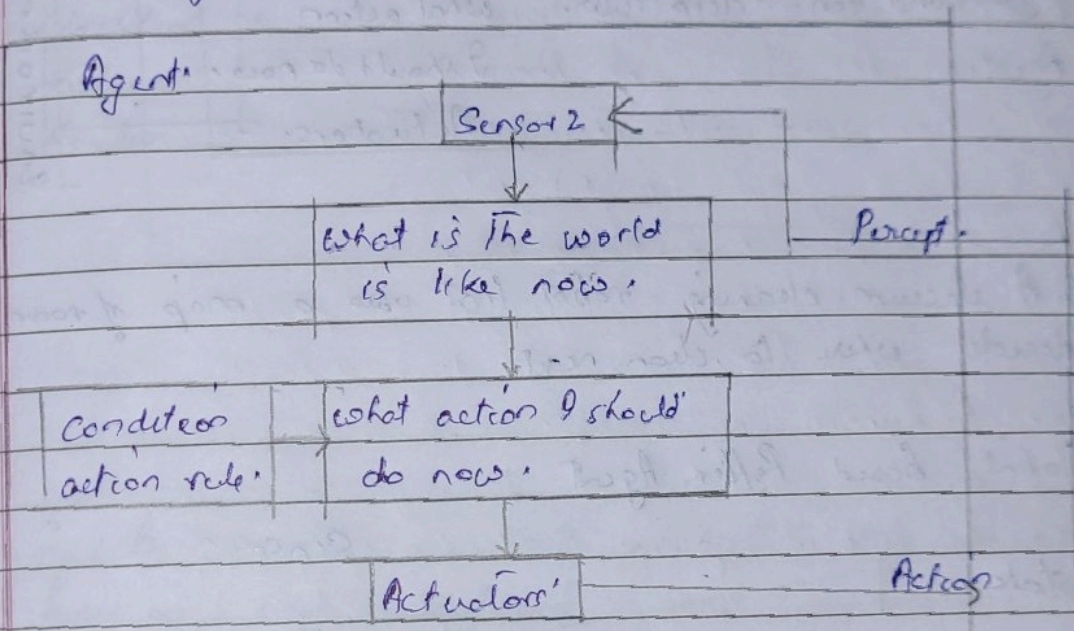
→ Architecture: refers to machinery or device that consist of actuators and sensors. The IA execute on this machinery. The tool allows the adjusting of image details and clarifies. Using this tool we can obtain greed detail & get a smoother picture with less detail. This is the main tool to increase the contrast of the image and visualize more details of the image.



Types of agents commonly used in artificial intelligence are as follows

(1) Simple - reflex agents
(2) Model - based reflex agents.
(3) Goal - based agent.
(4) utility - based agents.

Simple reflex agents



Eg: Thermostat that adjusts the temperature based on current reading

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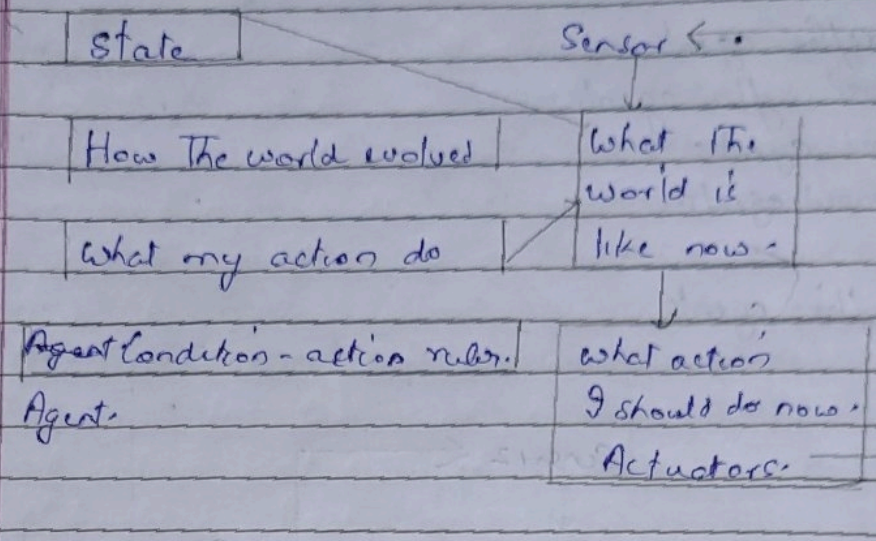
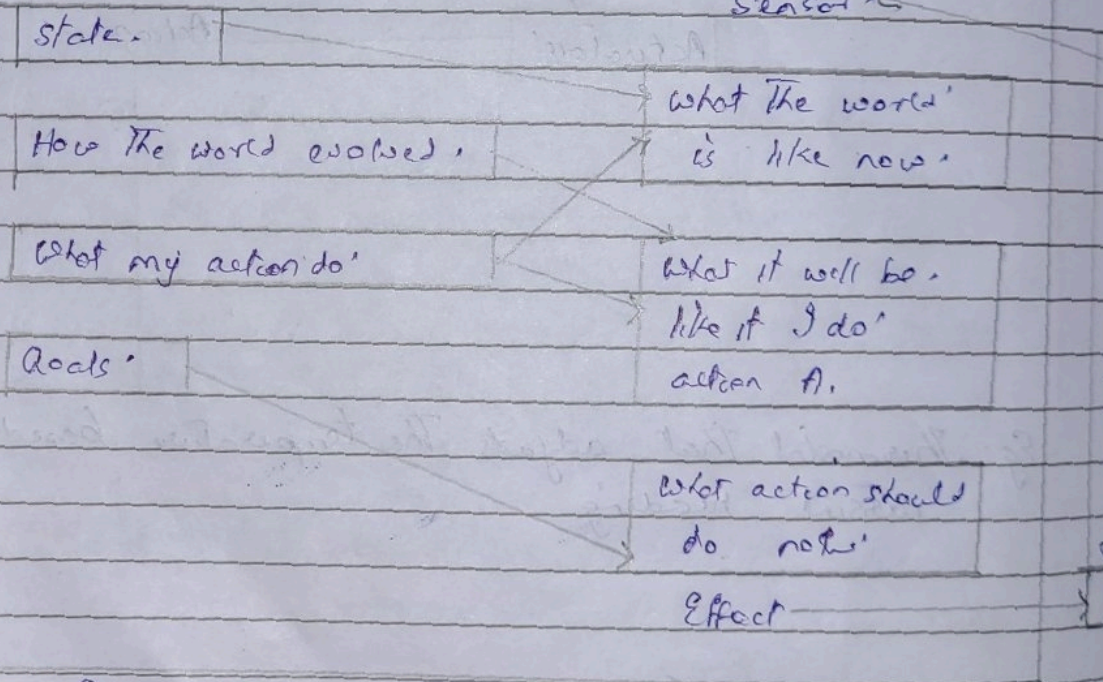
Model-based reflex agent



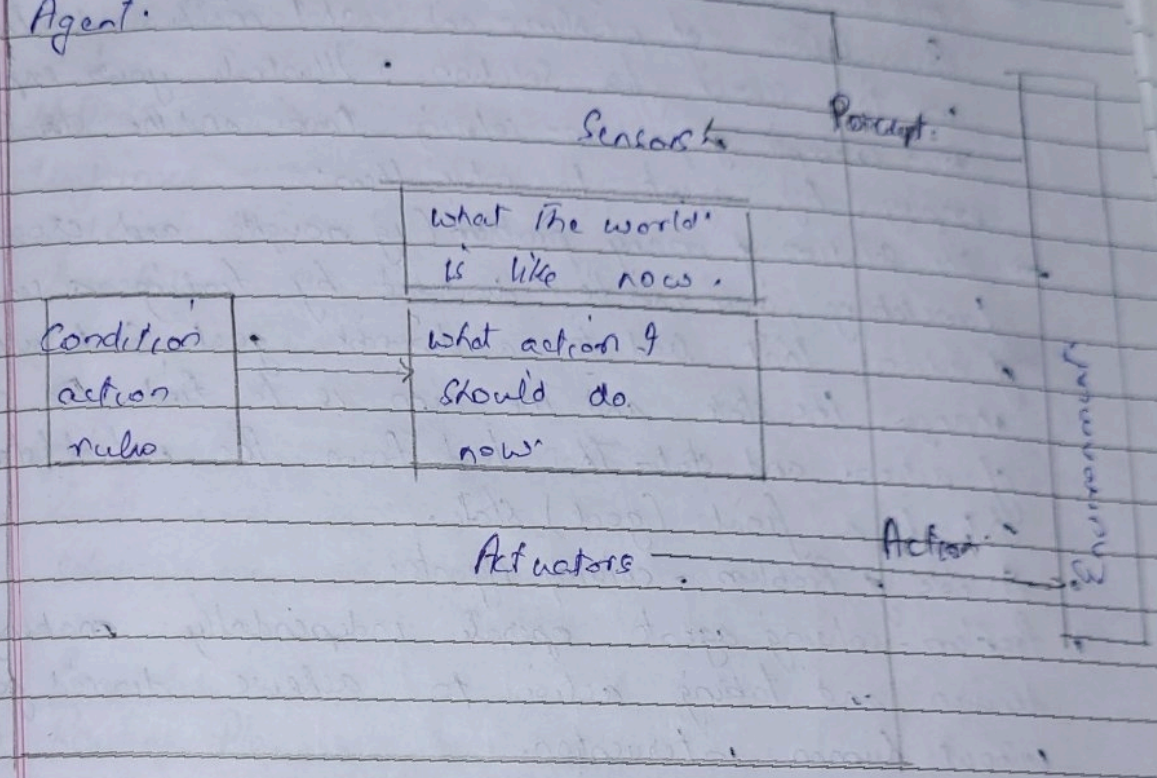
eg A vacuum cleaning robot that uses a map of room to decide where to clean next.

Global based Reflex Agent



eg: Delivery Drone that navigates to deliver package to specific location.

Utility-based Reflex agent



Eg: A personal assistant app that schedule tasks based on user preference and priorities.

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Q4 Outline the process of problem-solving by searching including the role of problem-solving agents and its formulation of problems and what methods do they use to search for solution? Illustrate your explanation with example of problem-solving tasks and the strategies employed by agents to solve them.

→ The solution of many problem (eg noughts and crosses, timetabling, etc) can be described by finding a sequence of action that lead to a desirable goal. Each action changes the state and the aim is to find the sequence of actions and states that lead from the initial (start) state to a final (goal) state.

- A Role of Problem-solving Agents.

1) Problem-solving agents operate independently making decision and taking action to achieve desired goals without human intervention.
2) These agents are designed to efficiently explore and navigate problem space to find optimal or satisfactory solutions.
3) Problem-solving agents can adapt to change in their environment or problem domain adjusting their strategies to accomodate new information or new constraints.
4) They can handle a wide range of problem types and complexities from simple puzzles to complex real world scenarios.

- Formulation of problems

1) Problem formulation involves abstracting real-world scenarios into a formal representation that can be understood and processed by problem solving agents.
2) Problem are represented in a way that captures essential elements such as initial states, goal states, actions and constraints.

(3) Formulating problem provides a structured approach to problem-solving breaking down complex issues into smaller more manageable components.

Method used for searching solutions:

1) Uniformed search: Agents explore the problem space systematically without consideration of domain specific knowledge.
eg Breadth ... first search Agents, use domain specific knowledge.
ie heuristics to guide the search towards promising solutions.
eg A search, greedy best-first search.

(3) Local search agents - Agents iteratively improves candidate solutions by making small modifications.

Examples

1) Routing Planning: In navigation systems, problem-solving agents search for the shortest path between two locations. and they analyse the road network consider traffic conditions and employ algorithm like A to find optional routes.

(2) Puzzle solving: In games like sudoku & Rubik cube agents aim to find solutions satisfying certain constraints They analyse the puzzles initial state, explore possible moves and use strategies like constant propagation & backtracking to solve the puzzle.

(3) Automated planning: In robotics & automated systems problem solving agents plan sequence of action to achieve desired outcomes. They analyse the environment constraints and employ planning algorithm like RRT to generate action sequence.