Analytical AI

) Analyze the diversity of environments in which intelligent agents operate, ranging from deterministic to stochastic, observable to partially observable, and discrete to continuous. Discuss how the characteristics of environments. Evaluate the challenges posed by dynamic and uncertain environments and the strategies agents employ to adapt and succeed.

Ans):- Deterministic VS Stochastic:-

* Deterministic environment have predictable outcomes while Stochastic ones involve chances agents in Stochastic environment need to use probability and learning.

Fully observable VS partially:-

In fully observable environments, agents see everything need to decide in partially observable ones they must estimate or remember past data.

Discrete VS Continuos:-

* Environments have limited, countable options, Continuous ones involve real-world values like distance or speed needing more complex.

Agent Strategies to Adapt:-

* To handle these challenges, agents:
  - Learn for experience.
  - Use Sensors and feed back.
  - plan under uncertainty using models like MDPs.

(2) Analyze the relationship between the nature of the environment and the structure of an intelligent agent. How does the Complexity, observability, and dynamicity of environment influence the design agents?

Relation b/w Environment and Intelligent Agent:-

* Complexity:- Complex environment need Smart agents with planning and memory
* Observability:- if the Environment is partially observable, agents need internal models to guess info.
* Dynamicity:- In fact - changing environments, agents must react quickly and adapt in real time.

Agent Architectures and Suitability:-

Type:-	Environment:-	Example:-
Simple Reflex agent	Simple, fully, observable, static	Thermostat
Model-Based Agent	partially observable	Cleaning robot
Goal-Based Agent	Complex, dynamic Sequential	Chess AI
Utility-Based agent	Decision with preference	Self-driving car
learning Agent	unknown or changing	chatbots, recommendation

3) Develop a PEAS description of the task environment for the following agents list out all of it
a) Medical Diagnosis System ; Part picking Robot

Medical DS

PEAS Description:-

- performance measure:
  - Accuracy of diagnosis
  - speed of decision
  - Reduced false positives
  - patient Satisfaction

Environment:-

- Hospital or clinics
- patient medical history
- Lab reports and Symptoms

Actuators:-

- Display Screen
- Report generation
- Alerts / to doctor

Sensors:-
Input forms, Lab data, medical test results.
characteristics:-
partially observable, Stochastic, Dynamic, Sequential
b.) part picking Robot:-
PEAS Description:
performance measure:-
picking accuracy, Speed of operation, Efficiency and minimal damage.
Environment:-
Factory floor, Shelves, bins, Conveyor belts.
Actuators:-
Robotic arms, Grippers, moving wheels or Sliders.
Sensors:-
Cameras, Barcode readers, proximity and weight Sensors.
characteristics:-
fully observable, Deterministic, Static, Episodic.

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Day-2

① The Explore the Search Space using search Strategies and formulate the problem Components for the Queens problem using the following information place 8 queens on a chessboard such that none of The Queens attack any of the others.

problem formulation:-

1) initial State:-

An empty 8x8 chessboard or a partial board with fewer than 8 queens placed, from row 0.

2) State Space:-

- All possible ways of placing 0 to 8 queens on the board such that no two queens are in the same column or diagonal. Each state can be represented as an array where the index is the row and value is the column where the queen is placed.

3) Actions:-

place a queen in a valid column of the next row such that it is not attacked by any previously placed.

Transition Model:-

When a queen is placed in a valid position on the current row, a new state is generated with that queen added

Goal Test:-

The state with 8 queens placed on the board such that on two attack each other.

2. Discuss the properties of environment. How does the vaccum cleaner preceives its environment? What sensing machanisms are employed and their role in detecting relevant features.

properties of the environment:-

* partially observable - only knows current location and dirt
* Stochastic - Dirt may appear randomly.
* Stoc Sequential - past actions affect future ones.
- Dynamic - Environmental can change while agent works.
- Discrete - Limited actions (move left/right, suck).
- Single-Agent - only one vaccum cleaner acts

How vaccumm cleaner perceives Environment:-

- Dirt Sensor - Detects dirt at current location
- Bump Sensor - Detects walls or obstacles
- Cliff Sensor - prevents falling from stairs.
- Infraredl optical sensors - Help avoid objects and map area.

Actuators used:-

Wheels / Motors - Move the vaccum
Suction Motor - Sucks up dirt.
Brushes - Help collect dirt into suction area

Decision-making progress:-

- Sense: use sensors to detect dirt or obstacles
- Decide: Choose action (clean, move, turn).
- Act: Use actuators to perform the action.

Solve the water jug problem: you are given 2 jugs, a-4 gallon one and 3-gallon one. How can you get exactly 2 gallons of water into 4-gallon?

Jug A: 4 gallons ; Jug B = 3 gallons

Goal: Get exactly 2 gallons in the 4-gallon jug

* Allowed operations:-
  - Fill a jug completely from pump
  - Empty a jug onto the ground
  - pour water from one jug to another until one is full or Empty

Step 1:- (0,0)
Both jugs are empty.

Step 2:- fill jug B (3-gallon) → (0,3)

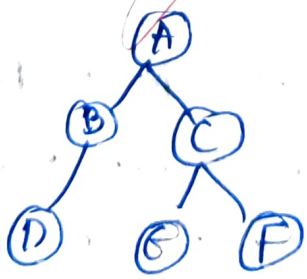
Step 3:- pour jug B into jug A → (3,0)

Step 4:- fill jug B again → (3,3)

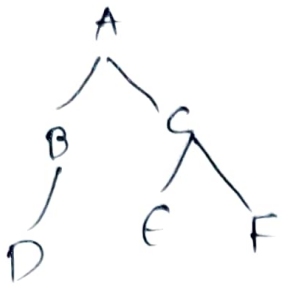
Step 5:- pour from Jug B into jug A
jug A can take 1 gallon more → (4,2)

Step 6:- Empty JUG A → (0,2)
pour jug B into jug A → (2,0)

Show how BFS & DFS work on the search tree for given state space



BFS & DFS work on the given state space graph, let's first understand the structure from input



A as a root
B and C as children of A
D is child of B
E and F are children of C

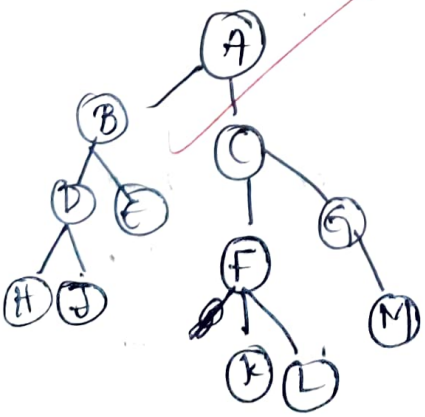
BFS (Breadth - first search):
visits level by level (left to right):
order :-

(A) → (B) → (C) → (D) → (E) → (F)

DFS (Depth - first - search):-
visits as deep as possible before backtracking
let's use pre-order DFS (Node - left - right):
order :-

(A) → (B) → (D) → (C) → (E) → (F)

(7) Discuss uninformed searching strategies BFS and DFS with its advantages



How it works:-

Both strategies with advantages and disadvantages.

Breadth First Search (BFS):-

order:-

A → B → C → D → E → F → G → H → I → J → K → L

Steps to reach L : 13

Advantages:-

Complete (will find solution exists).

optimal (finds shortest path)

Disadvantages:-

Uses more memory

Slower on large trees

Depth - first search (DFS):-

order → A → B → D → H → I → E → J → C → F → K → L

Advantages:-

Uses less memory

May reach deep goal faster

Disadvantages:-

Not always complete

Not optimal (may find longer path)

final output:-

Strategy	Steps	Complete	optimal	memory
BFS	13	Yes	Yes	High
DFS	12	No	No	Low

(5) A Customer wants to travel one location to another using OLA Cab booking mobile application while the pseudo code of it

the goal is to reach a destination

the agent selects an action based on:

User preferences; cabs availability, cost, time to reach

Pseudo code:-

```
function OLA_Cab_Booking (start, destination,
                          preferences):
    cab_types ← [mini, micro, sedan, shared, prime]
    available_cabs ← CheckAvailableCabs (start,
                                         cab_types)
    best_option ← null
    min_cost ← ∞
    For each cab in available_cabs:
        route ← FindBestRoute (start, destination)
        time ← EstimateTime (route, cab)
        cost ← EstimateCost (route, cab)
        Comfort ← GetComfortLevel (cab)
        If matchesPreference (preferences, cab,
                              Comfort, cost, time):
            if cost < min_cost:
                best_option ← cab
                min_cost ← cost
    If best_option ≠ null:
        ConfirmBooking (best_option, start,
                        destination)
    else:
        Display ("No suitable cabs found")
End function.
```

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