AIDs

What is AI? Considering the covid 19 pandemic situation how AI helped to survive and renoated our way of life with different applications?

→ Artificial Intelligence (AI) is a branch of computer science that focused on creating intelligent systems capable of performing tasks that typically decision making learning, perception, etc.

Role in surviving & renovating life during Covid-19

i Heathcare & medical diagnosis
CT Scan analysis & x-ray diagnosis helped in rapid detection of cancil cases.

ii Virus spread control
Social distance montioring tools helped to monitor & enforce laws in public places.

iii) remote work & education
work from home optimization & AI in online edu. help people continue with this work & education.

iv) Fake news detection
AI helped to identify rapidly spreading fake news on social media.

2. What are AI agents terminology ? Explain with example environment.
Everything which surroands the agen & influence its actions
It can be complete on partially observable

eg. rubics cube for solution it.

- percepts

It is a raw data that an agent gets from its sensor.

eg. self driving cars

Actuators:

They are the components that allow an agent to take actions in the env.

eg. A robotic arm uses motors as actuators

Goal

The final state of an agent to achieve is called as goal.

eg. Solving the rubics cube.

3. How is AI-technique used to solve-8-puzzle problems?

The 8 puzzle problems

The 8 puzzle problem is a state space search problem in AI where a 3×3 grids contains 8 tiles numbered from 1 to 8 1 empty space.

Objective is to rearrange the tiles to reach a predefined goal state.

techinques 1) Uniformed search methods

- BFS : Expand the shallowest node first
- DFS : Explores as deep as possible before backtrack
- IDS : Combines DFS & BFS to increase depth limit gradually.

2. Informed Search methods

- BFS - Best first search based on heuristic funce that appears closest to the goal.

A^* search $f(n) = g(n) + h(n)$ - Based on heuristic & cost to node.

Initial State: 1 2 3 / 5 6 0 / 4 7 8 Goal state: 1 2 3 / 4 5 6 / 7 8 0

i) Compute heuristic of each possible move

ii) expand the state with the lowest f(n) & repeat

4. What is PEAS description? give PEAS description to, following?

Performance Measure: How success of agent is evaluated

environment Surrounding in which agent appears.

Activators - Component that allows agent to take action

Sensor - Component that allows agent to percive the environment.

i) Taxi driver agent -

Performance measure	Enviroment	Activators	Sessor
- Safe driving	- Traffic signal	- Stering wheel	- Camera
- travel time	- roads	- accelarator	- GPS
- traffic rules	- weather	- brake	- fuel gauge

ii) Medical Dignosis agent

Perfo. Measure	Enviroment	Activator	Sensor
- health of Patient	Patien data	display screen	heart rate

accuracy of diagnosis	Symptoms	~~dia~~ alarm sys	heart rate monitor
recomended treatment	test repo.	roboticarms	lab results

iii) Music Comporent Agent:

Perf. Measure	Enviroment	Activator	Sensor
originality	Music db	speaker	
listener engagment	user perfor.		

iv) Aircraft autolander

Perfo. measure	environment	Actuator	Sensor
Smooth landing	runway	landing gear	GPS
accuracy in	wind condition	flap	Camera
touchdown	air traffic	air brakes	

v) ~~EA~~ Essay evaluator Enviroment Actuator Sensor

prof. masure	plagrism	display screen	optical char.
grading	rubric	text to	recognition
grammer	criteria	speech	OCR(R)
paradigm check			

vi) Robotic seq. gun

per. measure	Environment	Actuator	Sensor
neutralize threats	lab area	gun mech-	Camera
target talking	potential	anism	thermal
false alarm	intruders	alarm	sensor

5. Categorize a shopping bot for a shopping bot for as offline books store according to following system.

→ observability : partially observable relies on limited sensor input

- Deterministic or stochastic - stochastic sensor are is unpredicted
- Episodic vs sequential : sequential affect future actions.
- static vs dynamic - Dynamic customer behaviour is always
- Discrete vs continuous no of choices such as

6. Differentiate between model based & utility based agent

	Model based agent	Utility based agent
-	agent that maintains the internal model of the env. to understand its current state & predict future states	Agent that selects actions based on the utility functions aiming to max long term benefit.
-	Model updates its info about the env.	- Measures how desirable diffrent states are
-	less complex	- More complex
-	Doesn't concern long term rewards	- Focuses on long term rewards.
-	eg. Self driving cars	- shopping reco. System

7 Explain architecture of knowledge based ~~sy~~ agent & learning agent.

-> Knowledge based agents - stores knowledge & reasons based on logical interference

Knowledge based - stores facts, rules and heuristics function about the environment

- Interference engine: Uses logical reasoning techniques like forward & backward chaining.
- Perception - gathers data from the env.
- actions executes actions based on ~~inter~~ infered knowledge
- Knowledge update mechanism - updates itself as new facts are learned.
- learning based agent - Agent that improves its port overtime by learning from experience, data & feedback
- learning element - responsible for improving agents pref by analyzing past experience using ML techniques.
- critic: Provides feedback on agents actions by evaluating success or failure.
- Problem generation - supports new exprience for learning & explaning.

8 Convert the following to predicates

Anita travels by car if available otherwise travells by bus.
travels (x, y) → person travel y by y.
Available (y) → y (a vehicle) is available
goesvia (y, z) → vehicle goes via z
punchure (y) → y (a vehicle)

a Available (car) → Travels (Anita, bus)
b. Bus goes via andheri & Goregaon
Goes Via (bus, andheri)
Goes Via (bus, goregaon)
c. Car has a puncture so its not available
puncture (car)
~ Available (car)

9. (what do you mean by depth limit search)
Explain iterative Deepening search with eg.
Depth limit Search (DLS)
DLS is a Depth-limited search DFS variant with a fixed depth L. preventing infinte loop & saving memory

Adv.
1) Avoids infinite recursion
2) Memory effective

Disadv.
1) Many miss less deper solutions
2) need for good L choice (Limit)

eg: Searches level by level until the goal appears

b) Explain Hill climbing & its drawback in detail with eg. Also State limitations of steepest ascent hill climbing

→ It is an optimization algorithm that moves towards higher values (better solutions) until a peak (local - optimum) is reached.

Algorithm

1. Start with an initial state
2. Move to the best neighbouring State.
3. Repeat ~~until~~ no strictly better neighbour exists

eg: Adjust queens position to minimize conflicts
Stop when no improvements are possible

Drawbacks

local maxima stuck at subpoint peaks
Plateue - no directions for improvement
Ridges needs special move to progress.
Variations & solutions
steepest - Ascent - Evaluates all neighbour

4. Explain simulated Annealing & write its

→ SA improves Hill climbing by allowing occasionally bad moves to escape local maxima inspired by metal aneling.

Algorithm :

1. Start with an initial solution & temperature T
2. Accept S is better, otherwise with probability
   $P = e^{(-\Delta S / T)}$
3. Reduce T until stopping condition

Adv

1) Escapes local minima
2) Handles large problems
3) Near - optimal solutions

Disadvantage

Tuning cooling schedule
No guarantee of best solution

12. Explain A* algorithm

A* is a best-first search Algo for pathfinding combining

1) Uniform cost search (cheapest path)
2) Greedy best-first search (heuristic-based speed)

Key formula

$f(n) = g(n) + h(n)$

$g(n)$: Cost from start to n

$h(n)$ = Cost from n to goal state.

Steps :

1. Start with the initial node, compute $f(n)$
2. Expand if reached, return the path, use update & continue.

Adv.

+ Optimal paths 2) efficient in AI applications

Dis advantage

1. High ~~Speed~~ memory usage
2. Depends on heuristics.

13. Explain Min Max Algo & Draw game tree from Tic tac toe game.

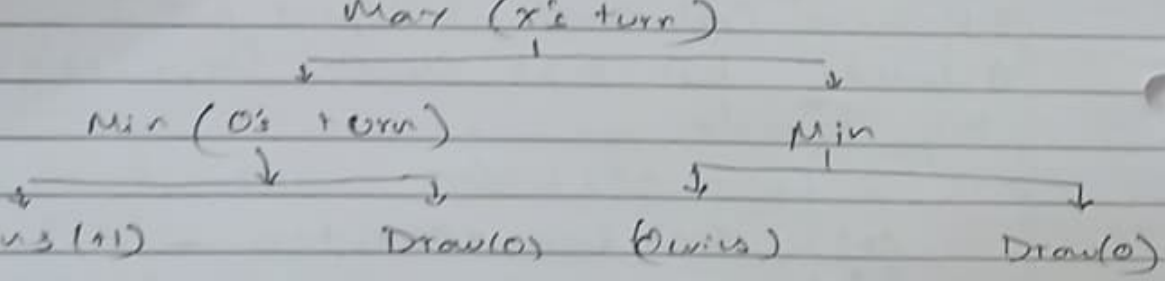
Min Max is a game strategy for 2 player games like Tic-Tac-Toe.

How it works?

Maximize(X) aims to increase the score (+1 for win.

Minimize(O) aims for lowest score (-1 for loss.

Explore all possible moves as signs score & picking the best one.



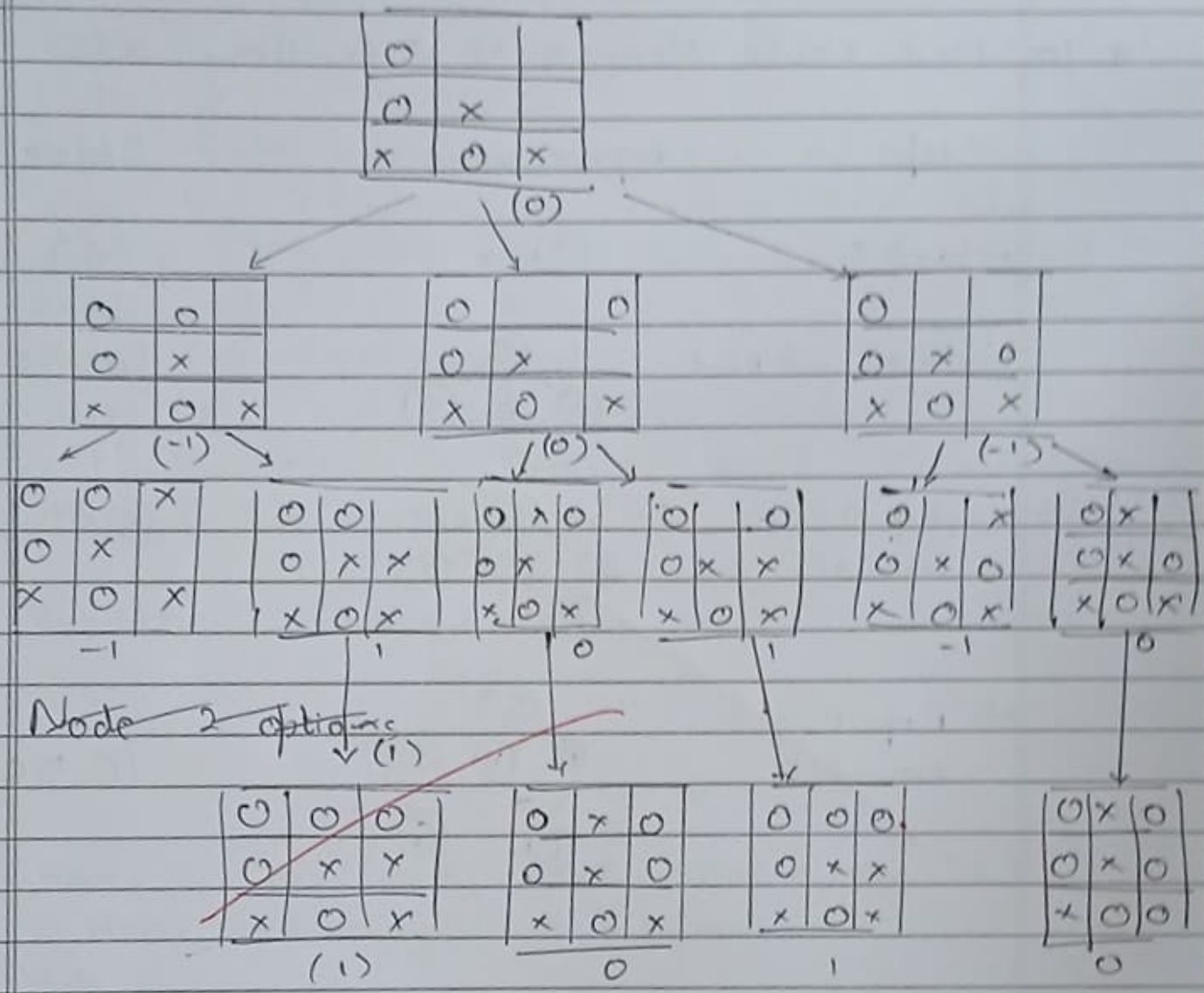
Each level alternates between X & O i.e. Max and Min

Adv

1) Always find the best moves

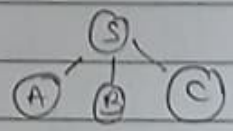
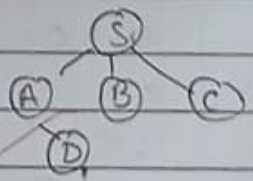
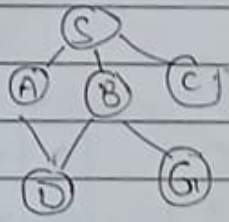
Dis adv

1. Slow for deep tree (Alpha beta pruning)



2 Node options has the most optimal Choice

14 10 Find route from S to G using BFS

Steps	Representation	Stack
i load S		[S]
ii Pops and A,B,C		[A, B, C]
iii) Pop A Expand D		[B, C, D]
iv) Pop B expand G		[C, D, G]

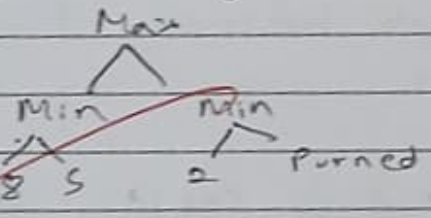
15) Explain alpha beta pruning for adversial search with eg.

→ Alpha beta pruning optimizes the min Max algo by skipping unecessary branches making it faster without affecting the result.

Explanation-

1. Alpha (α) best Max value found so far.
2. Beta (β) : min value - found so far.
3. If a mov wels then α or β is found then the further exploration is stopped, (purned)

Example (simplified game tree):



Here if min finds move worse than 5 it stops exploring that branch

Adv.

1. Speeds up minimax by ignoring bad choices
2. Same result as minmax but faster.

16) Explain Wumpus world env. giving its PEAS description. Explain how percept sequence is generated

→ Wumpus World is a grid based game env. where an agent navigates a cave to find gold while avoiding pits and the wumpus monster

PEAS description:

Performance Measure - +1000 (Gold), -1000 -100 (Pit) -1 (Move)

Environment - grid world with wumpus gold Pits & agents.

A (Actuators) - Move, Grab (Gold), Shoot, Climb

S (Sensor) - a) Breeze near pit b) stench (near wumpus) c) Glitter (near gold)

Percept Sequence generator -

The agent receives sensory input at each step based on its current location.

eg. If agent move next to pit, it perceives 'Breeze'. Using percept history it infers safe path & avoid danger.

17 Solve the following crypto arithmetic problems

SEND + MORE = MONEY

Each letter represents a unique digit (0-9)

Step1 - Evaluation

((1000 S) + 100E + 10N + D) + (1000M + 100O + 10R + E) = (10000M + 1000O + 100N + 10E + Y)

Step2: Constraints

M = 1 (since MONEY is a 5 digit number S ≠ 0 as it is the first digit in SEND)

All letters have unique values.

Step3: Assigning Digits

letter	Digit
S	9
E	5
N	6
D	7
M	1
O	0
R	8
Y	2

18) Consider the following axioms
All people who are graduating are happy
All happy people are Smiling
Someone is graduating.
Explain the following:

1) Represents these axioms in first order predicate
2) Convert each formula to clause form
3) Prove that " is Someone Smiling " using resolution technique - Draw the resolution tree

1) FOPL:

let G(n) → n is graduating, H(x) → x is happy, S(x) → x is smiling

Axioms: (G(n) → H(n))

1. ∀ n (H(n) → S(n))
3. ∃ x G(n)

2 Convert to clause form

¬ G(n) ∨ H(n)

¬ H(n) ∨ S(x)

G(A) let A be a person graduating

3 Prove it Sara are smiling?

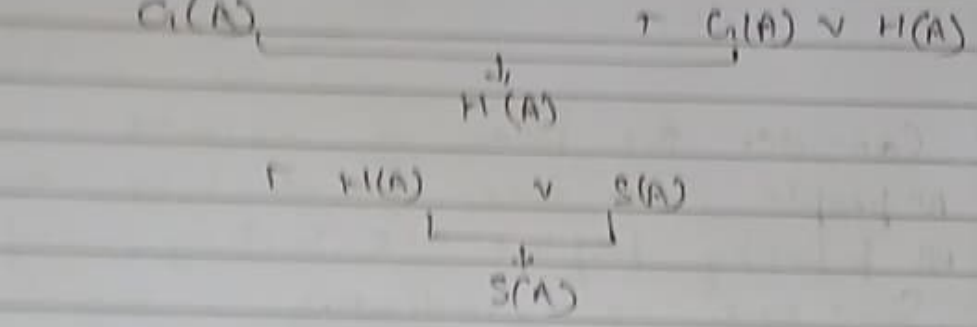
1 G(A) given

2 ¬ G(A) ∨ H(A) → axiom 1

3 ¬ H(A) ∨ S(A) → axiom 2

Since we derived S(A) the proof confirms that someone is smiling

Resolution tree



11 15 Explain Modus Ponen with suitable example

Modus Ponen is a fundamental rule of inference in logic it states.

If P→Q (if P, then Q) is true.

& P is true, then Q must be true

Symbolically

P→Q P ⊢ Q

eg If it rains ground will be wet

It is raining (P)

∴ here, the ground is wet

This rule is widely used in mathematical proofs & AI reasoning system.

20. Explain forward & Backward chaining with eg. These are inference techniques used in rule based system & AI reasoning.

1. Forward chaining (Data. Driven):
   Starts with known facts & applies rules to in per new facts until the goal is reacted
   Works from Cause → effect (bottom up)

eg. 1. If it is raining then the ground is wet.
2. If ground is wet then traffic is slow

2. Backwards chaining (Goal driven)
   Starts with the (goal driven)
   support facts
   Works from effect to cause (top-down)
   W → R is the ground wet
   R → W is it raing