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Date
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Ques What is AI? consider the COVID-19 pandemic situation how AI helped to survice, & renovated our way of life with different application?

Ans. AI (Artificial Intelligence) enables machine to learn, analyze data and make decision like human.

→ Healthcare :- AI detected outbreaks early, helped in diagonis (X-ray/CT scans), accelerated vaccine development.

→ Business & work : AI improved remote works tools (Zoom, chatbots), automated supply chains, and enhanced customer services

→ Education :- AI personalized online learning and ensured fair assessments through proctoring tools.

→ Entertainment - AI powered content recommendations, virtual events and social interactions.

→ Public Safety :- AI-powered contact tracing, predictive analyics, and robotics assited in monitoring and sanization.

Q4 What is PEAS description? give PEAS description for following

Taxi Driver

Medical diagonsis system

A music composer

An aircraft autolander

An essay evalutor

A robotic sentry gun for the keck lab.

Ans PEAS → standard for performance Analysis Environment, Actulator, Sensor this parmeter will decide how model perfect are.

Teacher's Sign.:

~~Taxi Driver~~

	Models	Performance Analysis	Environment	Actuator	Sense
1)	Taxi Driver	Safety, efficiency, distance	Roads, traffic conditions.	gear, brakes, steering wheel	Visi... fuel
2)	Medical diagnosis system	Speed, quality of treatment	Medical history records, patient.	report, Display	Imag... patien...
3)	A music composer	Harmony, composition quality	Musical styles instruments,	Sound o/p, musical	User... user f...
4)	An aircraft autolander	Safe and accurate, speed	aircraft sysm air obstacles	Throttle, rudders.	Altim... speedom...
5)	An essay evalutor	grammatical accuracy, coherence	Essay or text documents	scoring system.	Text in... gramm...
6)	A robotic sentry gun for the kick lab.	Accuracy of target hit, respons time, safety of nearby person.	kick lab, fire objects, obstracts.	mechanisms mobility.	Motion camera

Que. 6 Differentiate between Model-Based Agent and Utility Based...

1) Model-Based Agent :- Uses an internal model of the environm... to make decisions and predict outcomes. Focuses on achieving specific goals by understand the world

2) Utility-Based Agent :- Uses a utility function to measure a... maximize the desirability of different condition outco... Focuses on maximizing overall satisfaction or performance

Model Based Agent	Utility Based Agent.
less complex	1) More complex
Doesnot concern long term reward.	2) Focuses on long term reward.
eg. self-driving cars	e.g. Shopping recommedation system.

Explain the architecture of a knowledge based agent and Learning Agent?

Architecture: (knowledge based agent)

Knowledge Base (KB) ÷ Store the facts about world.

Inference Engine ÷ Reasoning system that derives conclusion from KB

Perception (Sensors) ÷ Receives inputs from the environment.

Action (Effectors) ÷ Performs actions based on decisions

Agent Controller ÷ coordinates perception, reasoning and actions.

Architecture (Learning agent)

Learning Element : Learns from past experiences to improve performance.

Performance Element ÷ Selects actions based on learned behaviour.

Critic ÷ Provides feedback on the agents actions

Problem Generator ÷ Generates new experience to aid learning.

2\. ~~How~~ What are AI Agent terminology, example with example?

The AI agent terminology includes :-

(i) Performance measures of Agent ÷ It ~~deno~~ determines the.

Teacher's Sign.: ____________

success of the Agent.

(ii) Behaviour / action of agent : It is optimal action pe[...] by an agent after any specified sequence of pe[...]

(iii) Percept :- Agent's perceptual inputs at a specified in[...]

(iv) Percept sequence : History of everything agent ha[...] perceived till date.

(v) Agent Function : map from percept sequence to an[...]

Agent function $a = f(P)$

where P is current percept, a is the action carri[...] out and f is the agent function.

f maps percept to action

$f : P \rightarrow A$ where P is the set of all percepts a[...] set of all actions. Actions may be dependent of all th[...] percepts observed, not only the current percepts.

$a_k = f(p_0, p_1, p_2 \ldots p_k)$ where $p_0, p_1 \ldots p_k$ [...] sequence of percepts recorded till date, a_k is t[...] resulting action carried out and f now maps percepts sequence to action

$f : P^* \longrightarrow A$

For example the vaccum cleaner problem :

Percept sequence	Action
[A, clean]	Right
[A, Dirty]	suck
[B, clean]	left
[B, Dirty]	suck
[A, Dirty] [A, clean]	Right
[A, clean] [B, Dirty]	suck
[B, Dirty] [B, clean]	left
[B, clean] [A, clean]	No operation

How is AI-technique used to solve 8-puzzle problem?

The 8 puzzle problem is a state space search problem in AI where a 3X3 grids contains 8 tiles numbered from 1 to 8 & 1 empty space. Objective is to rearrange the tiles to reach a predefined goal state

AI techniques :- 1) Uniformed Search methods

- BFS ÷ Expand the slowest node first.
- DFS ÷ Explores as deep as possible before back tracking
- IDS ÷ Combines DFS & BFS to increase depth unit gradually.

2) Informed search gradually.

- BFS → Best First Search based on heuristic func^n. 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 positive move
(ii) expand the state with the lowest $f(n)$ & repeat

Categories a shopping bot for a shopping bot for an offline bookstore according to the following system.

→ observability ; Partially observable. Relies on limited sensors inputs
- ~~Deterministic~~ ~~or~~ Episodic v/s sequential :- Sequential decisions affect future actions.
- Static vs dynamic ÷ Dynamic customer behaviour is always evolving

Discreate v/s continuous ÷ finite no of choices ...

(9) Convert the following to predicates:

→ Anita travels by car if available otherwise trav...

travels (x, y) → person x travels by y

Available (y) → y (a vehicle) is available

goesvia (y, x) → vehicle goes via z

puncture (y) → y (a vehicle).

a ~ Available (car) ⟶ Travels (Anita, bus)

→ Bus goes via andheri & goregoan.

Goesvia (bus, andheri)

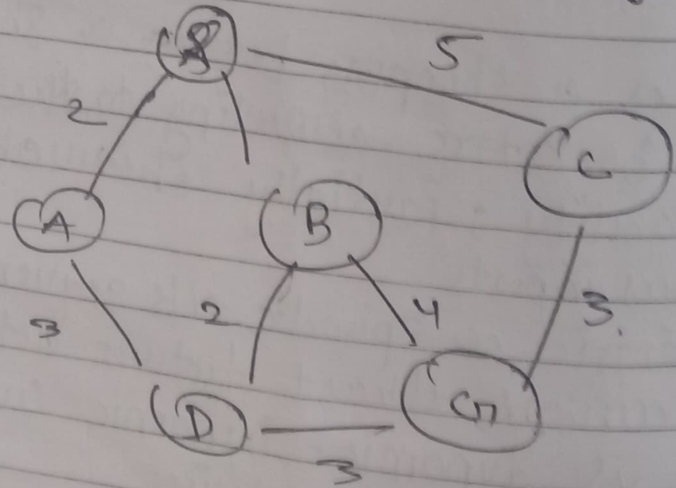
goes via (bus, goregoan);

→ Car has a puncture, so it is not available

puncture (car)

~ Available (car)

Que 10 Find the route from S to G using BFS.



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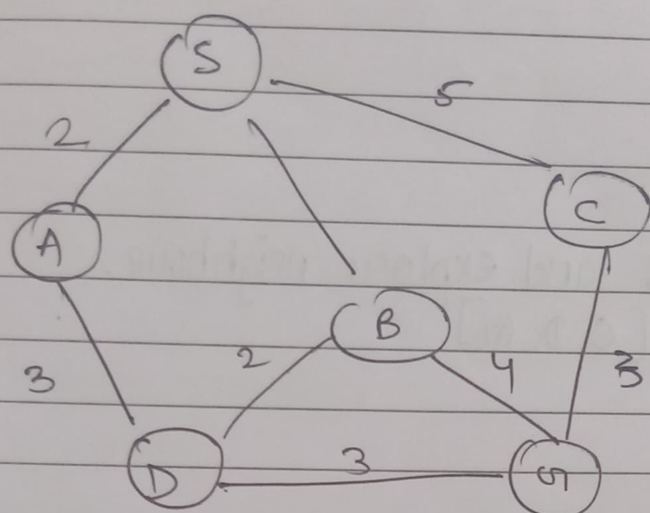
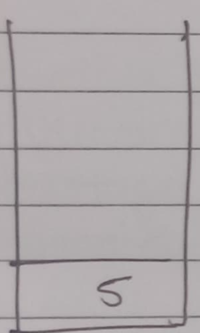
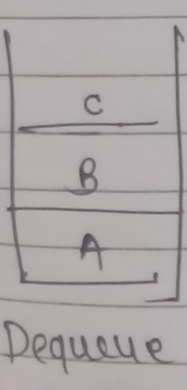


1) Start at S.



Queue = [S]

2) Dequeue S and explore and its neighbouring node.



Queue = [A, B, C].

3) Dequeue A and explore neighbour

Queue

B	C	D.

D
C
B

4) Dequeue B and explore neighbour.
Queue [C, D, G]

G
D
C

(5) Deque C and explore neighbour
Queue => [D, G].

(6) Dequeue D.
queue => [G]

(7) Dequeue G
G is our destination node. BFS will stop here

Route from S to G: S → B → G.

what do you mean by depth limit search? Explain iterative deepening search with example

DLS Depth limit search.

DLS is a DFS variant with a fixed depth L preventing infinite loop & saving memory

Advantages

1) Avoids infinite recursion
2) Memory efficient

Disadvantage

1) May miss ~~less~~ Deeper solutions
2) Need for good L choice (limit)

Iterative Deepening search (IDS) runs DLS repeatedly increasing L until the goal is found.

Advantages

1) Completes the whole search
2) Gives most optimized answer
3) Memory efficient.

Disadvantages

1) Redundant computation
2) Higher time cost

Example → searches levels by level until the goal appears.

2. Explain Hill climbing & its drawback in detail with example Also state limitations of steepest ascent Hill climbing.

→ It is an optimization algorithm that moves towa[rds] higher values (better solutions) until a peak (local) is reached.

Algorithm:-

1. Start with an initial state
2. Move to the best neighbouring state
3. Repeat until no strictly better neighbour exist[s]

Example (8 Queen. problem)

- Adjust queens position to minimize confits.
- Stop when no improvements are possibles.

Drawbacks

- Local maxima :- stuck at suboptimal peaks
- platequ : no direction for improvement
- Ridges :- need special move to progress variatio[n]
- Steepest Ascent : Evaluates all neighbour but since stuck

Que 13 Explain simulated Annealing & write it's example

→ Improve Hill climbing by allowing occasionally ba[d] moves to escape local maxima, inspired by meta[l]

Algorithm:-

1) Start with an intial solution & Temperature T
2) pick a random neighbour s, compute ΔE
3) Accept S is better & otherwise with probability $P = e^{(-\Delta E/T)}$
4) Reduce T untill stopping condition

Advantages.

Escaps local maxima
Handles Large problems
Near-optimal solutions

Disadvantages
1) Tricky cooling schedule
2) No guarantee of best solution.

Q14 Explain A* Algorithm with an example?

A* is a best-first search Algorithm for partitioning path finding combining:
1) ~~Unique~~ 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 (estimated)

Steps:-
1. Start with the initial node, compute
2. Expand the node with lowest.
3. If goal is reached return the path use update & continue.

Advantage
1) Optimal paths
2) Efficient in AI application.

Disadvantanges
1) High memory usage
2) Depends on Heuristic.

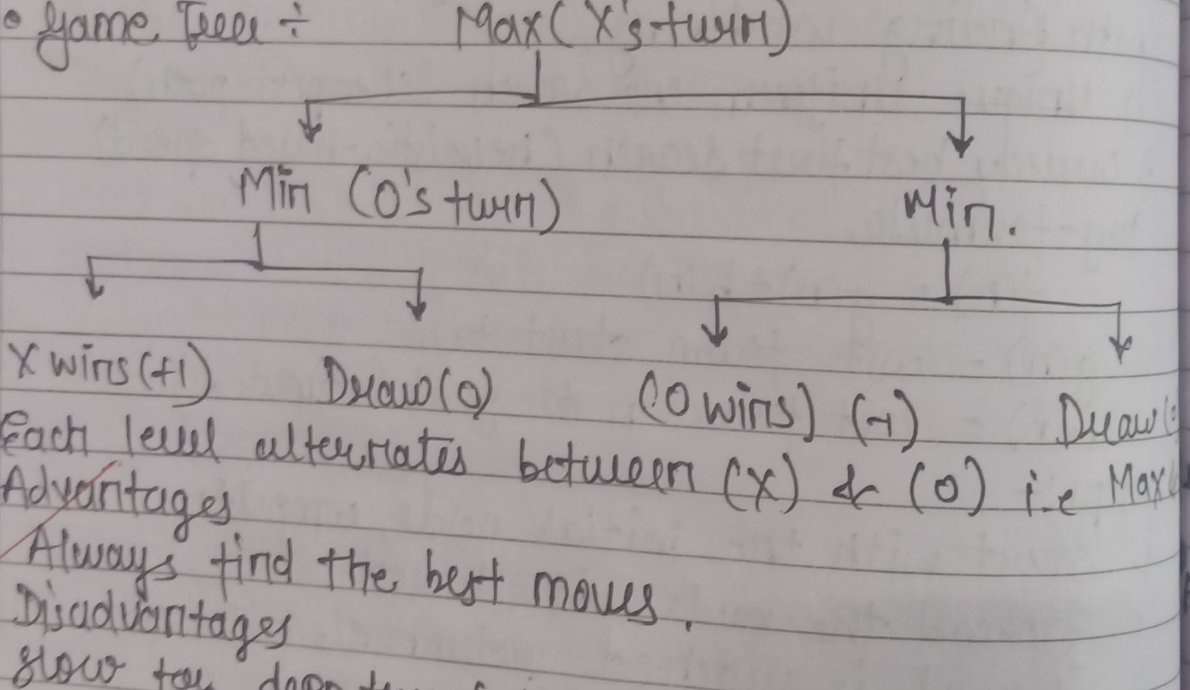
Que 15 Explain MiniMax algorithms & draw game tree for tac toe Game

→ Mimimax is a game strategy for 2 player game like Tic Tac Toe

How its works?

Maximize X) aims to increase the score (+1 for w
minimize (O) aims to for lowest score (-1) for loss
explore all possible moves, assigns score & picking the best one.

• Game Tree ÷



Each level alternates between (X) & (O) i.e Max & Mi

Advantages

1) Always find the best moves.

Disadvantages

1) Slow for deep tree (Alpha beta pruning helps)

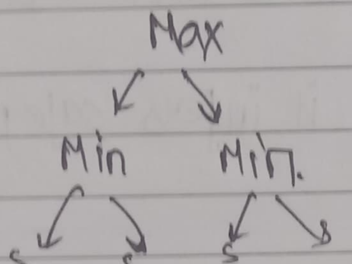
Que 16 Explain alpha beta pruning for adversarial search with example?

→ Alpha Beta pruning optimizes the minimax algori by skipping unnecessary branches, making it faster without affecting the result.

Explanation:-

1) Alpha(α) :- Best max value found so far.
2) Beta(β) :- Best min value found so far.
3) If a move worse than α or β is found then the further exploration is stopped (pruned)

Example (Simplified game tree):-



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

Advantages:-
1) Speeds up minimum max by ignoring bad choices.
2) Same results as minimax ~~best~~.

7) Explain WUMPUS world environments giving its PEAS description. Explain how percept sequence is generated?

Ans. Wumpus world is a grid based game environment. where an agent navigates a cave to find gold while avoiding pits. In the wumps

PEAS description

P (performance Measure) +1000 (Gold) -1000 (Wumpus) -100(pit) -1(move)

E (Environment) :- grid world with wumpus, gold, pits & Agents.

A (Actuators) Move, grab(gold), shoot(Arrow), climb.

S (sensor) ÷ (a) Breeze near pit b) stench (near
1) glitter near gold.
percept sequence generation ÷
The agent receives sensory input at each steps
based on its current location.
2. Example → if agent move next to pit it perceive
Breeze
3 Using percept history it infers safe path & avoid
danger.

Que 18) Solve the following crypto arithmetic problems
1) SEND + MORE = MONEY
→ Each letter represents a unique digit (0-9)
Step 1 ÷ Equation setup.
((1000S) + (100E) + (10N) + D) + (1000M + 100O) +
= (10000M + 10000 + 100N + 10E + Y)
Step 2 consider
- M = 1 (Since MONEY is a 5 digit number)
- S ≠ 0 (it is the first digit in SEND)
- All letters have unique value.

Step 3 :- Assigning Digits

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

1 Consider the following axioms, All people who are graduating are happy
All happy people are smiling
Someone is guarduating
Explain the following
1) Represent 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 $G(n) \rightarrow n$ is graduating
$H(n) \rightarrow n$ is happy
$S(n) \rightarrow n$ is smiling

Axioms :- 1 $\forall x \, (G(x) \rightarrow H(n))$
2 $\forall x \, (H(n) \rightarrow S(n))$
3 $\exists n \, G(n)$

2. convert to clause form.
1. $\neg(G(n)) \vee H(n)$
2. $\neg H(n) \vee S(n)$
3. $G(A)$ let A be a person guaducting.

3 prove is someone smiling?
1. $G(A)$ given
2. $\neg G(A) \vee H(A)$ axiom 1
3. $\neg H(A) \vee S(A)$ axiom 2

$\because$ we derived $S(A)$, the proof contains that someone is smiling

Resoulition text

$G(A)$ $\quad$ $\neg G(A) \vee H(A)$

$H(A)$

Que 20 Explain Modus Ponen with suitable example
→ Modus ponen is a fundalamental rule of interference in logic. It states
if P → Q (if P then Q) is true
& P is true, Then Q must be true.
Symbolicary :-

$$P \rightarrow Q \quad , \quad P + Q$$

Example
1) if it rains, ground will be wet
2) It is raining (P)
3) There, the ground is wet (Q)
This role is widely used in mathematical proofs & AI reasoning systems.

Que 21 Explain Forward & backward chaining with an example
Ans These are interface technique used in rule based sys and AI reasoning.
1) Forward chaining (Data-Driven) :- Starts with known facts & applies rules to infer new facts until the goal is reached
• works from cause → effect (bottom up approach)
Ex → 1) if it is Raining then the ground is wet (R→W)
2) if ground is wet then traffic is slow (W→T)
2) Backward chaining (goal based) Starts with the goal and goes backwards to find supporting facts
• Works from effect to cause (top down approach)
ex W→T : is the ground wet.
R→W : is it raining.