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DISC 50

AIDS ASSIGNMENT

05/03

Q1] What is AI? Considering the covid 19 pandemic, how AI helped to survive & renovated our way of like with different applications?

→ AI refers to simulation of human intelligence in machines, enabling them to perform tasks like learning, reasoning and problem solving and decision making.

i) AI assisted in medical imaging and prediction to help detect covid 19 early.
ii) AI accelerated the identification of potential drugs & vaccines.
iii) AI driven apps tracked virus spread.
iv) AI powered remote work tools, online learning platforms and automated grading systems enabled continuity in work & education.

Q2] What are AI agents terminology? explain with examples.

→ i) Agent : An entity that senses & acts.
ii) Environment : The surroundings where agents operate
iii) Percept – Information received from sensors.
iv) Actuators : Components that perform actions
v) Performance – Criteria of

• Types of Agents

i) Simple Reflex : Eg : thermostat
ii) Model based Agent : Eg : Self driving car.

iii) Goal based agent: Eg: Google Maps
iv) Utility based agent: Eg: AI stock trading
v) Learning Agent: Eg: ChatGPT

[Q3] How is AI technique is used to solve 8puzzle problem?

→ The 8 puzzle problem is a sliding puzzle where the goal is to arrange tiles in a specific order by moving within a 3x3 grid.

- Techniques used:

1. Uninformed Search Algorithms:
   i) BFS: Explores all moves level by level.
   ii) DFS: May not be optimal.

2. Informed Search
   i) A* Search
   ii) Greedy Best first search.

3. Other techniques
   i) Genetic algorithm
   ii) Reinforcement learning.

4] What is a PEAS descriptor?

→ PEAS is a framework used to define an AI agent
P: Performance measure
E: Environment
A: Actuators
S: Sensors

i) Taxi driver AI
P: Safe driving, fuel efficiency, short route.
E: Roads, traffic, weather, passengers.
A: Steering, acceleration, braking
S: GPS, LiDAR, cameras.

ii) Medical Diagnosis System
P: Accuracy, recovery rate
E: Patients, records, symptoms
A: diagnosis, give treatment.
S: Patient input, medical history.

iii) AI music composer
P: Quality, uniqueness.
E: Styles, preferences, music theory.
A: Modify musical notes, output.
S: Genre, Input from users.

iv) Aircraft Autolander.
P: Accuracy, ~~correctness~~ safety, smooth lan
E: Runway conditions, wind, altitude.
A: Adjust flaps, throttle
S: Sensors, cameras.

v) AI essay evaluator
P: Accuracy, correctness.
E: Essays, rubrics, grammar.
A: Assign grades, feedback
S: Text input, checkers

vi) Robotic Sentry Gun.
→ P: Target detection, response time.
E: Intruders, personnel, conditions.
A: Turret, firing mechanism
S: Motion detectors, infrared sensors

Q5] Categorize a shopping bot for an online according to each of six dimensions.

→ Shopping bot assists customers in finding books, checking availibility and providing recommendations.
• Six dimensions are:
i) Partialy observable
ii) Stochastic
iii) Sequential
iv) Dynamic
v) Discrete
vi) Multiagent.

6] Differentiate between Model Based & Utility based System.

→

	MODEL BASED	UTILITY BASED
i)	Use an internal model to take decision.	Chooses actions ba on utility functi that ranks outco
ii)	Tracks changes on internal state.	Chooses action max -zing utility.
iii)	Acheives a specific goal	Seeks best poss outcome
iv)	Eg: Self driving car	Eg: Stock trading A.I.

Q7] Explain architecture of a knowledge based and Learning agent.

a) Knowledge Based
i) Knowledge Base : Stores fact & rules.
ii) Inference Engine : Uses logical reasoning
iii) Perception: Collects input.
iv) Action : Takes Action.
v) Knowledge updating mechanism updates with new information.

↳ Agent:

i) Learning Element
ii) Performance element
iii) Critic
iv) Problem Generator.

9] i) Available(Car) → Travels(Anita, Car)
¬Available(Car) → Travels(Anita, Bus)

ii) Route(Bus, Andheri)
Route(Bus, Goregaon)

iii) Puncture(Car) → ¬Available(Car)
Puncture(Car) → ¬Available(Car)

Forward reasoning.

i) ¬Available(Car)

ii) Travels(Anita, Bus)

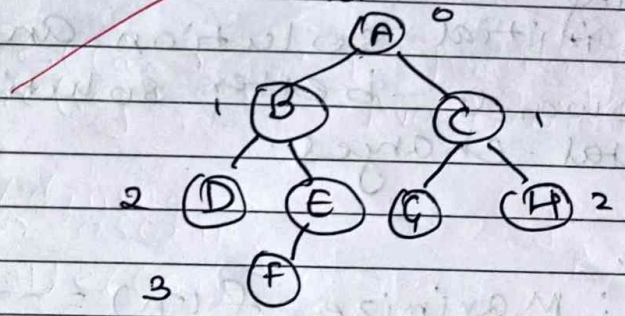
iii) From ② Route(Bus, Goregaon)

iv Since Anita travels by bus and bus goes via goregaon, Anita will travel via goregaon.

Q11] What do you mean by depth limited search & iterative deepening search?

→ i) Depth Limiting search:

- DLS is a variation of DFS that explores nodes only upto a predefined depth l (limit).
- It prevents infinite loops in deep or infinite search spaces.
- If a solution is beyond limit, it may not be found.



Search: F

limit l = 2, so the search will go to level 2 and not find 'F', hence, ending search.

ii) Iterative Deepening search.

→ IDS repeatedly runs depth limited search with increasing depth limits until a solution is found.

→ It combines the memory efficiency of

DFS with completeness of BFS.

Eg: If the goal is at depth 4, IDS runs DLS iteratively for
l = 0 (No solution)
l = 1 (No solution)
l = 2 (No solution)
l = 3 (No solution)
l = 4 (Solution found)

Q12] Explain hill climb algorithm and drawbacks.

→ Hill Climbing is a local search algorithm with an initial solution and iteratively moves towards better solutions by making incremental changes.

→ Example:
problem: Maximize $f(n) = -n^2 + 6n$ for $n \in [0, 5]$.

n	1	2	3	4	5
f(n)	5	8	9	8	5

- If we start at n = 1, we move to n = 2 then to n = 3 reaching peak
- If n = 5, local maximum at n = 4 missing global maximum at n = 4 missing global maximum at n = 3

- Limitations of Steep Ascent Hill Climbing.

→ Computational Cost
→ Can suffers from local maxima.
→ Plateaus and Ridges.

Q13] Explain Simulated annealing and write its algorithm.

→ Simulated Annealing is an optimization algorithm and helps escape local maxima by allowing occasional downward moves. It is inspired by the annealing process in metallurgy where materials where materials are heated and cooled slowly to reach a stable state.

- Algorithm.

1. Initialize
   - Start with solution S
   - Set initial temperature T

2. Repeat until stopping condition is met
   - Select neighbouring solution S'
   - Compute change in cost $\Delta E = f(S') - f(S)$
   - If S' is better, accept it
   - Else accept with probability $e^{-\Delta E/T}$
   - Compute change in cost ΔE
   - If S' is better, accept it

- Else accept with $e^{-\Delta E/T}$
- Decrease $T = T\alpha$

3 Return best solution.

Q14] Explain A* Algorithm.

→ A* is a best first search algorithm that finds shortest path from a start node to a goal node.

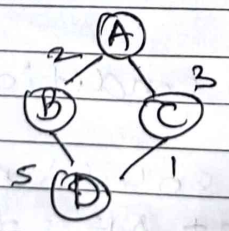
→ It combines,
1. Greedy search
2. Uniform cost search.

→ Formula used:

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

$g(n)$ = actual cost

$h(n)$ = heuristic cost

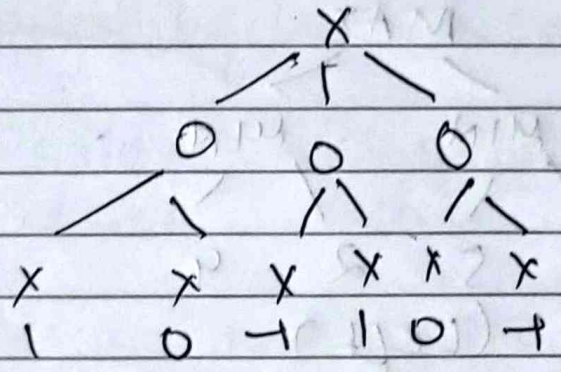


15] ~~What is min max?~~

15] Minmax Algorithm and draw game tree for TicTAc Toe

→ Minmax is a decision making algorithm used in game theory to find optimal move in two player games.

i) Game is represented as a tree
MAX player tries to maximise the score
ii) Minimizing player Minimizes the score.
iii) Algorithm simulates all possible moves until the game reaches a terminal state
iv) values assigned to nodes, and players choose moves that give them best outcome



Terminal nodes Win = 1, Draw = 0, Loss = -1

Min chooses lowest value (worst for X)
Max Chooses highest value (best for X)

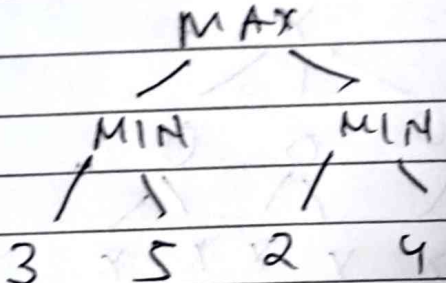
X picks move leading to 1 (win).

16] Explain Alpha Beta pruning algorith with example.

→ Alpha beta pruning is an optimizatio technique for minmax algorithm th reduces the number of nodes evalua making the search faster without cha the final decision.

→ It prunes branches that do not affec the final decision.

- Alpha (α) Best value found by MAX
- Beta (β) Best value found by MIN
- Pruning Condition α ≥ β evaluation is stopped.



1. Start at MIN (Left)
   Eval 3 → β = 3
   Eval 5 → β = 3 (3 < 5)

   β = 3 return to MAX

2. Move to MIN (Right subtree)
   Eval 2 → β = 2

Since $2 < 3$ we stop checking

3. MAX Chooses higher value MAX(3,2)
MAX = 3.

8 17] Explain WUMPUS World environment giving its PEAS description. Explain how perce sequence is generated.

→ WUMPUS World is a grid based environm used in AI to navigate a world with hazards. The agent's goal is to find gold while avoiding wumpus.

PEAS

P: Grabbing gold (+1000 points)
falling in pit (-1000) point
Caught by Wumpus (-1000 points)

E: World is 4x4 grid, gold, pits, breeze, stench

A: Move forward, Turn left, right, grab gold, shoot arrow

S: Agent senses breeze, stench.

Since 2 < 3 we stop checking

3. MAX Chooses higher value MAX(3,2)
MAX = 3.

17] Explain WUMPUS World environment giving its PEAS description. Explain how percept sequence is generated.

→ WUMPUS World is a grid based environment used in AI to navigate a world with hazards. The agent's goal is to find gold while avoiding wumpus.

PEAS

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A: Move forward, Turn left, right, grab gold, shoot arrow

S: Agent senses breeze, stench.

- A percept sequence is the history of all observations (percepts) the agent has received. The agent perceives sensory inputs from its current location.

1. Agent start (1, 1)
   No Wumpus, No pit → percept: {Nothing}

2. Moves near a pit (1, 2)
   Senses Breeze percept → {Breeze}

3. Moves near Wumpus at (2, 1)
   percept → {stench}

4. Finds gold (3, 3)
   percept {glitter}

Each percept guides agent's decision making.

Q18] Solve SEND + MORE = MONEY

→ Step 1:

M must be 1, sum of 2 four digit numbers cannot be greater than 10000

```
  SEND
+ MORE
------
 MONEY
```

Step 2

S must be 8 as there is 1 carry over from column. O must be 0 if S = 8

Step 3

E < 9 and therefore S = 9 because 9 + M = 10.

Step 4:

No carry N + R = 10 + (N − 1) = N + 9

R = 9

But 9 is taken

Carry N + R + 1 = 9

R = 8.

S(9)	E(5)	N	D
M(1)	O(0)	R(8)	E(5)
M(1)	O(0)	N	E(5)	Y

Step 5:

N + 8 + 1 = 15 N = 6

S(9)	E(5)	N(6)	D
M(1)	O(0)	R(8)	E(5)
M(1)	O(0)	N(6)	E(5)	Y

Step 6:
Digits left are 7, 4, 3 & 2.
D=7 4=2

```
  9 5 6 7
+ 1 0 8 5
-------
  6 6 5 2
```

19] i) FOL

a. $\forall x$ [Graduating (x) $\rightarrow$ Happy (x)]

b. $\forall x$ [Happy (x) $\rightarrow$ Smiling (x)]

c) $\exists$ (Graduating (x))

ii) Conversion to clause
Eliminate implications, then convert to clause form

$\forall x$ ($\neg$ Graduating (x) $\vee$ Happy (x))
$\forall x$ ($\neg$ Happy (x) $\vee$ Smiling (x))
$\exists x$ (Graduating (x))

$\neg$ Graduating (x) $\vee$ Happy (x)
$\neg$ Happy (x) $\vee$ Smiling (x)
Graduating (a)

Q20 Explain Modus ponen with example.

(3) Prove someone is smiling

⇒ {¬Q(x), H(x)}
{¬H(x), S(x)}
{Q(a)}

⇒ {Q(x), H(x) with 13) {Q(a)}
x = a,
{¬Q(a), H(a)}
we have Q(a),
{H(a)}
Resove (2) {¬H(x), S(x)} with {H(a)}
x = a,
{¬H(a), S(a)}
resolving gives {S(a)}

Ans 20] Modus ponen is a fundamental rule of inference in propositional logic that allows us to deduce a conclusion from a conditional statement and its antiecdent.

It follows:
P → Q (If P then Q)
P is true
Q must be true

Example:
If it rains, ground will be wet.
P → I + rains
Q → Ground is wet

P → Q

Ans 24] Forward chaining: It starts with given facts and applies inference rule to derive new facts until goal is reached.

Example: diagnosing a disease
Rules:
1. If a person have fever & cough, they might have flu.
2. If a person has sore throat, they might have cold.

Facts:
The patient has fever
The patient has cough.

Inference:
1. Fever + cough → flu.
2. Patient might have flu.

Backward chaining: It starts with goal and works backwards by checking what facts are needed to support it.

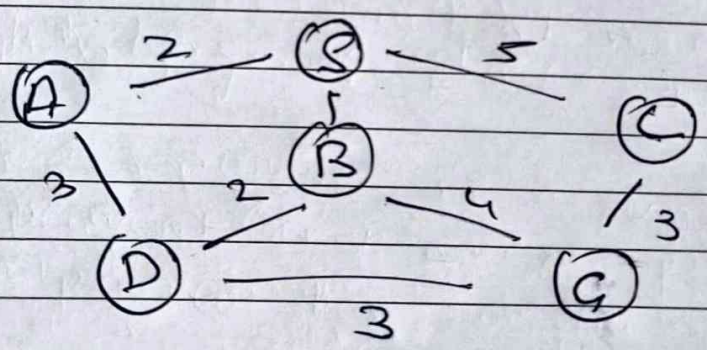
9: Goal: determine if patient has flu.

1. Fever ∧ (cough) → flu.
2. (sore throat ∧ fever) → cold

Process:

1. (Fever ∧ cough) → flu
2. We check if patient has fever and cough
3. Based on known facts:
   - Patient has fever
   - Patient has cough.
4. Flu is true.

10]



1. Start at S
   Queue (S)
2. Deque S and explore neighbours
   Queue [A, B, C]
3. Deque A and explore
   Queue [B, C, D]

4. Deque B
   Q [C, D, G]

5. Deque C and explore
   Queue [D, G]

6. Deque D
   Queue [G]

7. Dequeue [G]

Route : S → B → G