NAME : KAUSHAL S GALAV

DISC 11 04/03 Teacher Ravita Mam

AIDS Assignment 1

Q.1] What is AI? How AI helped During Covid 19

AI refers to machines simulating human intelligence to perform tasks like learning, problem-solving, and decision-making.

AI applications during COVID 19.

- Healthcare: AI-assisted diagnosis (eg. CT scan analysis for COVID 19 detection).
- Vaccine Development: AI helped speed up dru discovery.
- Robotics: AI powered robots assisted in hospitals and sanitization.
- Chatbots: Provided Covid 19 guidelines and and answered queries.
- Remote Work & Education: AI improve online learning and virtual meeting.

Q.2] What are AI Agents terminology, explain with examples.

An AI agent perceives the environment and takes action to achieve goal.

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. Simple Reflex Agent: Traffic light system.
. Model Based Agent: Google Maps.
. Goal Based Agent: Chess AI.
. Utility Based Agent: Autonomous
. Learning Agent: AI personal assistants.

Q.3] How AI techniques is used to solve 8 sum problem.

The 8 puzzle is solved using search algorithms.

. Breadth First Search (BFS): Explores all possible moves level wise.
. Depth First Search: (DFS): Explores paths deeply before backtracking.
. A*C. Algorithm: Uses heuristics function to find the shortest path efficiently.

Q 4] What is PEAS descriptor? Give PEAS descripter for the following.

Taxi Driver.
Performance: Safe, timely trips.
Environment: Roads, traffic.
Actuators: Steering, brakes.
Sensors: Cameras, GPS.

Medical Diagnosis System.

P: Correct diagnosis.

E: Patient data.

A: Display reports.

S: Symtoms, test results.

· Music Composer.
P: Melodius output
E: Music notes.
A: Sound synthesis.
S: User input, music trends

Aircraft Autolander
P: Smooth landing
E: Airport
A: Flaps, brakes.
S: Altimeter, radar.

Essay Evaluator.

P: Accuracy, coherence.
E: Essays.
A: Text processing.
S: NLP techniques.

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Robotic Sentry Gun.

P: Accuracy, safety
E: Lab premises.
A: Gun, alarms
S: Motion sensors.

Q.5] Categorise a shopping bot for an offline bookstore according to each of the six dimensions (fully/partially observable, deterministic/stochastic, episodic/sequential, static/dynamic, discrete/continuous, single/multi agent).

Ans: 1) Fully observable - Can acess stock availability.

2) Deterministic - Stock updates happen predictability.

3) Sequential - Each action affects future choices.

4) Dynamic: Stock and customer queries change in real time.

5) Discrete: Limited actions (search, buy, suggest)

6) Multi agent: Interacts with customer and supplier.

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(c) Differentiate Model based and Utility based Agent

- Model Based Agent
  - Maintains an internal representation of the environment
  - Uses past observations to update its model and predict future states

  Example: A self driving car uses a map and sensor data to predict traffic conditions.

- Utility Based Agent
  - Chooses action based on a utility function that quantifies performance
  - Tries to maximise expected utility rather than just achieving goal.

  Example: A recommendation system suggests products based on customer preferences to maximise engagement.

Q.7] Explain the architecture of a knowledge based agent and learning agent.

- knowledge - Based Agent
  - Uses knowledge Base that stores facts, rules, and logic
  - Uses an Inference Engine to derive new knowledge.
- Components:

① Perceptual System: Collects data from the environment.

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(2) Knowledge Base: Stores facts and rules.

(3) Inference Engine: Applies logic to make decisions.

(4) Actuator: Executes actions based on reasoning.

Example: A medical diagnosis system that suggests treatments based on symptoms and medical knowledge.

- Learning Agent
  - Can improve its performance over time using feedback.

- Components.
  (1) Learning Agent: Modifies the knowledge base using new data.

  (2) Performance Element: Uses existing knowledge to make decisions.

  (3) Critic: Evaluates the performance of the agent.

  (4) Problem Generator: Suggest new experiences to learn from
  - Example: A speech recognition system that adapts to a user's voice over time.

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Q.8 What is AI? Considering the covid 19 pandemic situation, how AI helped to suerive and renovated our way of life with different applications)

AI played a crucial role in handling the pandemic across different sectors:

. Healthcare & Diagnosis
AI powered CT scans helped detect Covid 19 in seconds.
. Drug discovery using AI accelerated vaccine deployment.

. Predicting & Controlling Outbreaks.
- AI models (like BlueDot) predicted COVID 19 outbreaks before WHO alerts.
- AI based contact tracing apps helped track infections.
- Healthcare Automation.
  . AI powered chatbots provide medical advice and reduced hospital workload.
  . Robots assisted in disinfecting hospitals and delivering medicines.
- Remote Work & Education
  . AI driven virtual meeting platfors helped busines and schools operate remotely.
  . AI enhanced e-learning platforms adapted lessons based on user performance.

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. Drones and AI powered robots delivered essential supplies to remote areas.

(9) Convert the following to predicates.

A) Anita travels by car if available otherwise travel by Bus.

Step 1: Convert Sentences into Predicates.

(1) Anita travels by car if available, otherwise by Bus
- Travels (Anita, car) ← Available (car)
- Travels (Anita, Bus) → Available (car)

(2) Bus goes via Andheri and Goregaon
- Goes (Bus, Andheri)
- Goes (Bus, Goregaon)

(3) Car has a puncture, so it is not available
- Puncture (car) → → Available (car)
- Given: Puncture (car) is True.

Step 2: Apply forward Chaining / Reasoning.

(1) Puncture (car) → → Available (car) → True (car is not available)

(2) Since → Available (car), then Travels (Anita, Bus) is true.

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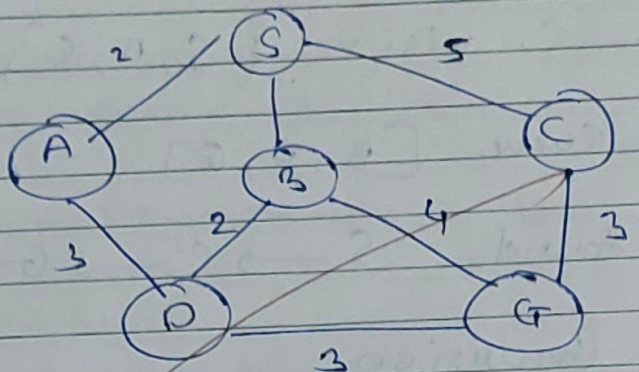
(3) Since Travels (Anita, Bus) and Bus goes via Goregaon, then Anita will travel via Goregaon

Conclusion: Yes, Anita will travel via Goregaon.

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




Step 1 Understanding the graph.

Nodes and edges with weights.

- S ⟶ A (2)
  S ⟶ C (5)
  A ⟶ D (3)
  B ⟶ D (2)
  B ⟶ G (4)
  C ⟶ G (3)

BFS does not considers weights. It explores all neighbours level by level

Step 2: Perform BFS traversal

Algorithm for BFS

(1) Start from node S, enqueue it in a queue.
(2) Visit its neighbours (A, C, B) and enqueue them
(3) Continue visiting and enqueuing neighbours until we reach G.

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Execution

① Start from S → Queue [S]

② Dequeue S, visit {S} → Enqueue its neighbours A, C, B
→ Queue [A, C, B]

③ Dequeue A, visit {S, A}
→ Queue [C, B, D]

④ Dequeue C, visit {S, A, C} → enqueue G
→ Queue [B, D, G]

⑤ Path found S → C → G

Step 3 Conclusion
BFS path from S to G S → C → G.

(11) What do you mean by depth limited search ? Explain iterative deepening search with example

Depth Limited Search (DLS)

- A variation of Depth First Search with a depth limit to avoid infinite recursion in deep trees.
- It avoids going beyond a specific limit.

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Iterative Deepening Search.
- Combines BFS and DFS. It runs DFS repeatedly with increasing depth limit
- Efficient for finding the shortest path in an uninformed search.
- Example: Finding a goal in a tree with increasing depth (0, 1, 2, 3..).

Q12] Explain Hill Climbing and its drawbacks in detail with example. Also state limitations of steepest ascent hill climbing

Hill Climbing Algorithm
- Greedy algorithm that moves towards increasing heuristic values.
- Stops when no further improvement is possible.

Drawbacks
- Local Maxima: Get stuck at peak that is not the global maximum.
- Plateau: No improvement in heuristic function.
- Ridges: A flat region with no clear gradient direction.

Steepest ascent Hill Climbing limitations.
- Always chooses the best possible move, which can lead to getting stuck in local maxima.

Q13] Explain Simulated Annealing & its Algorithm

Concept:
- Inspired by the annealing process in metals.
- Allows bad moves with decreasing probability to escape local maxima.

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Algorithm:
① Start with an initial solution
② Select a neighbour solution randomly
③ If the neighbour is better, move to it, otherwise, accept it with a probability that decreases over time.
④ Repeat until the system cools down.

Q.14] Explain A* Algorithm with example.
. Uses $f(n) = g(n) + h(n)$
where g is cost and h is heuristics.
. Guarantees the shortest path if h(n) is admissible.
Example
. Solving a shortest path problem in a grid or graph

Q.15] Explain Min Max Algorithm and draw game tree for Tic Tac Toe game.

Minimax is a decision making algorithm used in two-player adversial games like Chess & tic tac toe.
It assumes.
. One player (max) tries to maximise the score.
. The other player (MIN) tries to minimise the opponent's score.

Minimax Algorithm Steps.
① Generate the game tree upto terminal states.
② Assign values (win/loss/draw) at leaf nodes.

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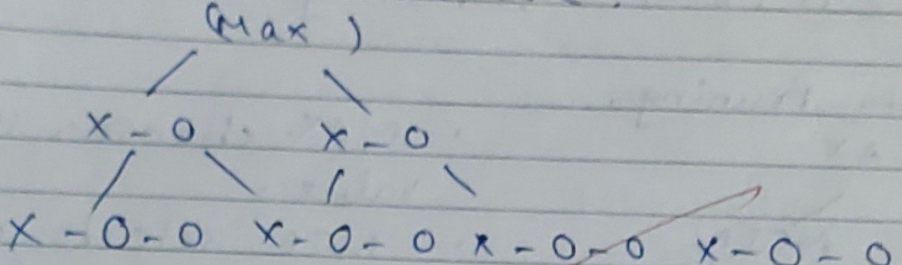
3. Backpropogate scores using
   . Max node: Chooses the maximum score from child nodes.
   . Min node: Chooses the minimum score from child nodes.

(4) The root node gets the best possible move.

Example Tic Tac Toe.




. Terminal nodes have value like +1 (win), 0 (draw), -1 (loss)

. The algorithm propogates these values to decide best move.

Why Minimax Important?
. Ensures best possible move for player.
. Used in AI powered bots for Chess, Tic-Tac-Toe, Checkers, etc.

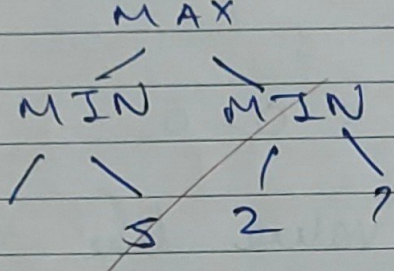
(6) Explain Alpha Beta pruning algorithms for adversial search with example.

Why Alpha-Beta Pruning?
. Optimise Minimax by eliminating unnecessary branches.

: Does not affect the final result but speed up computation.

Concept of α (Alpha) and β (Beta)
. α (Alpha): The best Max can guarantee so far.
. β (Beta): The best MIN can guarantee so far.
. If α ≥ β, stop exploring the branch

Alpha Beta Pruning.




. MAX chooses the highest value.
. MIN selects the lowest value from its children.
. If one branch already proves worse than an explored branch, we prune it.

Key Benifit: Reduces the number of nodes examined, speeding up adversial search.

Q.17] Wumpus World & PEAS Representation.

What is Wumpus World?

A grid based environment where an agent finds gold, avoids pits, and avoids the Wumpus.
. Uses percepts to decide moves.

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PEAS Representation.

| | |
|---|---|
| Performance | Finds gold, avoids dangers, minimizes steps. |
| Environment | A 4×4 grid with pits, Wumpus and gold. |
| Actuators | Move, grab, shoot. |
| Sensors | Breeze, Stench, Glitter |

Percept Sequence Generation.

- Agent perceives sensory data.

Example.

- If a Breeze is detected → A pit is nearby.
- If a Stench is detected → Wumpus nearby.

Q.18] Crypto Arithemetic SEND + MORE = MONEY.

Crypto-arithemetic problem involves mapping letters to unique digits (0-9) to satisfy equation.

$$\begin{array}{r} SEND \\ +\ MORE \\ \hline MONEY \end{array}$$

1. Each letter represents a unique digit
2. Carry proposition must be considered.
3. Solving leads to.

9567 + 1085 = 10652

S = 9, E = 5, N = 6, D = 7, M = 1, O = 0, R = 8, Y = 2.

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(19) First Order Logic & Resolution

Given Statements-

(1) All people who are graduating are happy.

. $\forall x (\text{Graduating}(x) \rightarrow \text{Happy}(x))$

(2) All happy people are smiling

. $\forall x (\text{Happy}(x) \rightarrow \text{Smiling}(x))$

(3) Someone is graduating

. $\exists x (\text{Graduating}(x))$

Conversion to Clause form

. Convert Implications → Remove universal quantifiers → Skolemization → Convert to CNF.

Resolution Proving Is Someone smiling

. Apply unification and resolution rule to infer that someone must be smiling

. Draw the resolution tree showing clause cancellation leading to proof.

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(20) Modus Ponens in propositional Logic

A fundamental rule in logic
If $A \rightarrow B$ and A is true then B must be true.

Example
(1) If it rains, the ground will be wet.
. Rain(x) → Wet(x).
(2) It is raining.
. Rain(A).
(3) Therefore ground is wet

(21) Forward Chaining & Backward Chaining.

Forward Chaining.
. Starts with facts → Applies rules → Derives new facts → Reaches conclusion.

. Example: Expert systems like MYCIN
. Rule: If fever & cough → Flu.
. Given: Patient has fever & cough.
. Conclusion: Patient has flu.

Backward Chaining.
. Starts with goal → Work backwards → Checks if facts support it.
. Example: Theorem proving in Prolog
. Goal: Prove "Flu"
. Check: Does patient has fever & cough.
. If yes, flu is confirmed.

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