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D15C

AIDS Assignment 1

Q1) What is AI ? How did it help in COVID - 19 pandemic?

→ Artificial intelligence is when computers can think, learn and make decisions like humans. It helps solve problems, recognize patterns, and automate tasks.

During covid - 19 pandemic, AI played a big role :-

i) Healthcare : AI helped doctors detect covid - 19 from x - rays and find treatments faster.

ii) Remote work and online learning : AI tools made work from home and online classes easier.

iii) Contact Tracing : AI powered apps tracked virus spread and warned people about the exposure.

iv) Robots and automation : AI - powered robots cleaned hospital, delivered medicines, and even assisted patients.

Q 2) What are AI Agents terminology ? explain with examples ?

→ An AI agent is a system that observes its environment using sensors, processes information, and takes action using actuators to achieve a goal.

Types of AI agents :-

i) Simple agent - acts on fixed rules.
eg: a thermostat turns heating on / off

based on temperature.

ii) Model based agent: uses memory to make better decisions.
Ex: a self driving car remembers road conditions.

iii) Goal based agent: works toward a specific goal.
ex: a chess AI plans moves to win.

iv) Utility based agent: chooses the best action based on value.
ex: netflix recommends shows based on what you like.

v) Learning agent: improves over time by learning.
ex: Siri gets better at understanding your voice.

Q3) How AI technique is used to solve 8 puzzle problem.

→ 8 puzzle problem is a sliding puzzle with 8 numbered tiles and one empty space. The goal is to arrange the tiles in order by moving them. AI uses algorithm to solve it :-

i) Uninformed Search :-
- Breadth first search - explores all possible moves step by step.
- Depth first search - goes deep in one path before backtracking.

ii) Informed Search :-
- A* Algorithm: uses a formula to find the best path to the solution.

- Greedy best-first search - chooses moves that seem closest to the goal.

Q4) What is PEAS descriptor? Give PEAS description for the following.

→ PEAS (performance, environment, actuators, Sensors) is a way to describe how AI system works. It defines :-

- Performance Measure - what makes AI succesful.
- Environment - where the AI operates.
- Actuators - what actions the AI takes.
- Sensors - what inputs the AI uses to make decisions.

PEAS for different AI system :-

i) Taxi Driver AI

- Performance - safe driving, reaching the destination, fuel efficiency.
- Environment - roads, traffic, weather, passengers.
- Actuators - steering, brakes, acceleration.
- Sensors - GPS, Cameras, Speedometer.

ii) Medical diagnosis System

- Performance - accurate diagnosis, correct treatment.
- Environment - patient records, symptoms
- Actuators - displaying reports, prescribing medicine.
- Sensors - patient data, medical tests.

iii) Music composer AI.

- Performance: creativity, originality, good sound
- Environment: music rules, trends, user preferences.
- Actuators: generating notes, creating sounds.
- Sensors: user feedback, existing music data.

iv) Aircraft autolander

- Performance: safe and smooth landing.
- Environment: weather, runaway conditions, altitude.
- Actuators: flaps, brakes, landing gear
- Sensors: GPS, altimeter, wind sensors.

v) Essay Evaluator AI

- Performance: proper feedback, accurate grading.
- Environment: student essays, grammer rules.
- Actuators: displaying scores, giving corrections.
- Sensors: text input, spelling and grammer checks.

vi) Robotic Sentry Gun

- Performance: detects threats accurately, avoid false alarms.
- Environment: Lab perimeter, lightning conditions.
- Actuators: rotating gun, alarm system.
- Sensors: Motion sensors, thermal cameras.

Q5) Categorise a Shopping bot for an offline bookstore according to each of the six dimensions.

→ A Shopping bot is a offline bookstore helps customers find books and check availability.

i) Partially observable - the bot may not know real-time stock levels or customer preferences fully.

ii) Stochastic - book availability and customer choices can be unpredictable.

iii) Sequential - each customer interaction affects future recommendations.

iv) Dynamic - The bookstore environment changes

v) Discrete - The bot deals with a limited set of books, queries, and responses.

vi) Multi-agent - It interacts with multiple customers and other system (inventory, payment).

Q6) Model vs utility based agent.

	Model based	utility based.
i)	Uses internal memory	chooses best action.
ii)	Predicts environment	Maximise benefit
iii)	works with past data	compares outcomes.

iv)	Handles complex tasks	Focuses on best results
v)	Ex: self driving car	Ex: movie recommendation

Q7) Architecture of knowledge based agent and learning agent

→ i) Knowledge based agent uses stored knowledge to make decisions. It follow these steps :-

- Perception : collects data from the environment
- Knowledge base : stores facts and rules.
- Inference Engine : applies logic to make decisions.
- Action - executes the best action based on knowledge.

Ex: a medical diagonosis system that suggests treatment based on patient system.

ii) Learning agent improves over time by learning from experience. Has 4 parts -

- ~~Performance~~ Learning : learns from past actions.
- Performance element - makes decisions based on current knowledge.
- Critic - evaluates the agent's performance.
- Problem generator - tries new strategies to improve

Ex : a voice assistant like Siri gets better at understanding accents over time.

Q8) convert the following into predicates

a) Anita travels by car if available otherwise travels by bus.

→ Travels (Anita, Car) ← available (car)

b) Bus goes via Andheri and goregaon

→ Goes via (Bus, Andheri)
Goes via (bus, Goregaon)

c) Car is puncture so not available

→ ¬ Available (car)

d) Yes, Anita will travel via goregaon.

Q9) Find the route from S to G using BFS.

→ i) Start at S → Queue : S

ii) S→E visit neighbours of S → Queue : A, B, C

iii) A→ Visit neighbour D → Queue : B, C, D

iv) Expand B → visit neighbors D, G → Queue : C, D, G

v) Expand C → visit neighbour G_1 → Queue : D, G_1

vi) Expand D → no new nodes → Queue : G_1

vii) Expand G_1 → goal reached.

The path found is : S → B → G_1.

Q10) What do you mean by depth limited search? Explain iterative deepening search with example.

→ Depth limited search (DLS) is a variation of DFS that limits how deep the search can go. It helps prevent infinite loops in graphs with cycles. However, if the goal is beyond the depth limited, DLS will fail.

Iterative deepening search (IDS) solves the drawback of DLS by repeadtly increasing the depth limited search step by step. It combines DFS and BFS, ensuring completeness and efficiency. Eg:-

Depth 0: check the start node
Depth 1: explore nodes at depth 1
Depth 2: explore nodes at depth 2.
Continues increasing the depth until goal is found.

Q11) Explain hill climbing and its drawbacks in detail with example. Also state limitations.

→ Hill climbing is a heuristic search algorithm that always move towards the highest value in the search space. Eg:-
Imagine a robot trying to climb a mountain. It always moves upward but might get struck if it reaches a small peak. instead of a highest one.

Drawbacks:-

i) Local Maxima: gets struck at suboptimal peaks.
ii) Pleateau: stagnates if all neighbours have same value
iii) Ridges: struggles with solutions.

Steepest - Ascent hill climbing limitations:-

- Always pick the best immediate move.
- Missing better long-term solutions.

Q12) Explain the simulated anneling and write algorithm.

→ Simulated annealing allows temporary downward moves to escape local maxima. It uses temperature parameter that decreases over time.

Algorithm:-

- Start with an initial solution.

- Pick a random neighbor.
- Move to it if it's better; otherwise move with probability based on temperature.
- Reduce temperature and repeat until convergence.

Q13) Explain A* algorithm with an example.

→ A* algorithm is used for finding the shortest path from a starting point to goal. It improves upon using heuristic function to prioritise path that seems more promising.

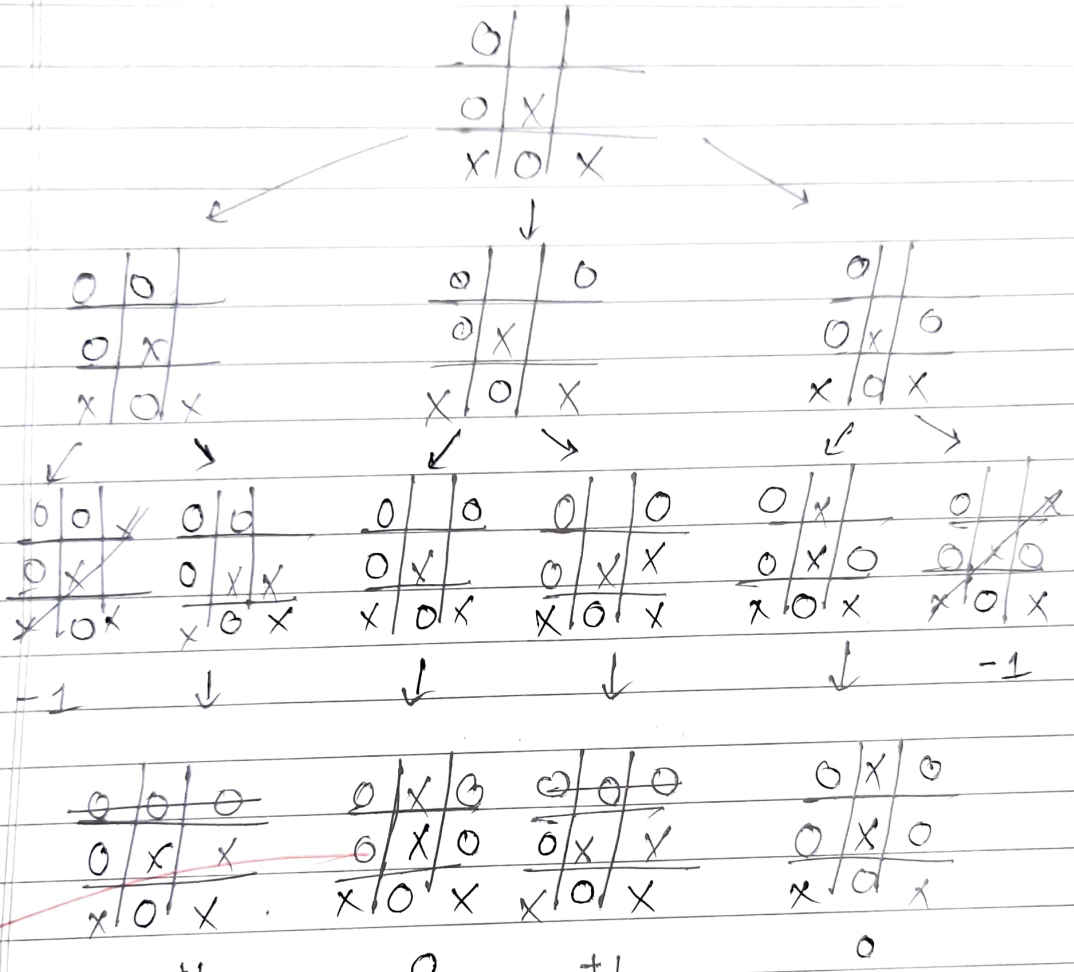
- Uses a function $f(n) = g(n) + h(n)$
  $g(n)$ = cost from the start node to n.
  $h(n)$ = estimated cost from n to goal.
- Expands the most promising node based on $f(n)$

Eg: google maps shortest route calculation.

Q14) Explain Min Max Algorithm and draw game tree from Tic Tac Toe.

→ Minmax is a decision making algorithm used in two-player games like chess and Tic Tac Toe.
It assumes:-
Max player (tries to maximize score)
Min player (tries to minimise score)

O - Max player
X - Min player



Q.15) Explain Alpha beta purning algorithm for adversarial search with example.

→ Alpha beta purning is an optimisation for Minimax that skips evaluating unnecessary nodes, improving efficiency.

Alpha (α) : Best value MAX can guarantee.
Beta (β) : Best value MIN can guarantee.

Ex: If a MAX node finds a better move earlier, it prunes remaining branches, as they won't affect the decision.

Q16) Explain WUMPUS world environment giving its PEAS description.

→ A 4×4 grid based environment where an agent must:

- Find gold
- Avoid pits and the Wumpus monster.

PEAS.

- performance : get gold, avoid dangers.
- Environment : 4×4 grid with hazards.
- Actuators : Move, grab, shoot.
- Sensor : perceive breeze (pits) and stench (wumpus)

Each move generates a percept sequence.
(e.g stench detected → wumpus ~~easily~~ nearby)

Q17) Cryto arithmetic SEND + MORE = MONEY

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  SEND
+ MORE
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MONEY
```

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

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

Q18) Consider the following axioms:-

i) All graduating people are happy
$\forall x$ & graduating $(x) \rightarrow$ happy (x)

ii) All happy people are smiling
$\forall x$ happy $(x) \rightarrow$ smiling (x)

iii) Someone is graduating
$\exists x$ graduating (x)

Clause form:-

i) $\neg$ Graduating $(x) \vee$ happy (x)
ii) $\neg$ happy $(x) \vee$ smiling (x)
iii) Graduating (A) (for some A)

Resolution proof
Graduating $(A) \rightarrow$ happy (A) (from axiom i)
happy $(A) \rightarrow$ smiling (A) (from axiom 2)
So smiling $(A) \rightarrow$ yes, someone is smiling.

Q19) Modus Ponens with example.

→ Modus Ponens is a basic rule of logic that helps us make correct conclusions based on given statements.

i) If P happens, then Q will happen ($P \rightarrow Q$)

ii) P happens

iii) Therefore, Q must happen

Eg: i) If it rains, the ground will be wet ($P \rightarrow Q$)

ii) It is raining (P is true)

Conclusion: The ground is wet (Q is true)

Q20) Forward and backward chaining.

Forward chaining: starts with known facts and applies rules to derive conclusions.

Eg: Fact - It is raining

Rule - If it rains, the ground will be wet

Conclusion - The ground is wet.

Backward chaining: Starts with goal and works backward to find supporting facts,

Eg: goal: is the ground wet?

checks: did it rain?

If yes, conclude the ground is wet.