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D15C 30
AIDS Assignment - 1

Q (1) What is AI, How did AI help during covid-19

=> AI is the simulation of human intelligence in machines to perform tasks such as reasoning, problem solving etc.

Applications during covid-19 include

(1) Help in process of discovering potential treatments.

(2) Tracking and face recognition to monitor spread.

(3) Optimization of distribution of medical supplies.

Q (2) What are AI agents terminology

=> Types of AI agents.

(1) Simple Reflex: Acts on current situation

(2) Model based reflex: Uses internal memory to store past states.

(3) Goal based: Chooses actions to achieve a goal.

(4) Utility based: Maximizes a utility function

(5) Learning agent: Improves its performance over time.

Q (3) How is ai used to solve 8 piece problem.

(1) Uninformed

(a) BFS: Explores all possible moves, goaranteed shortest solution but its slow.

(b) DFS: Explores paths fully before backtr

(2) Informed search.

(a) A*: Uses both cost and heuristic

(b) Greedy BFS: uses heuristic only but not optimal.

Q (4) Write peas for

(1) Taxi driver

Performance: Safety speed, fuel efficiency

Environment: Road, traffic, passengers

Actuators: Steering, Accelerator, breaks

Sensor: Camera, GPS, Speedometer

(2) Medical diagnosis:

P: Accuracy, speed

E: Hospital, clinic, patients

A: Prescriptions, Displays.

S: Test results, symptoms.

(3) Music Composer
P: Originality, Genre accuracy.
E: Production studio
A: Sythesizer, workstation
S: Instrument sounds.

(4) Aircraft lander:
P: Landing smoothness, Safety
E: Airport, weather, runway
A: Flight controls.
S: Radar, Altimeter, GPS

(5) Essay evaluator
P: Accuracy, coherence, plagarism detection
E: Submissions, essays.
A: Correction Suggestion; scoring
S: Grammer Checker, Databases.

(6) Robot sentry.
P: Accuracy, Response time, Target recog
E: Laboratory
A: Rotating gun, targeting system.
S: Camera, motion sensor, thermal

Q (5) Categorize a shopping bot

Observability : Partially observable
Deterministic / stochastic : stochastic
Episodic vs sequential : sequential
Static / Dynamic : Dynamic
Discrete / continous : Discrete.
Single / multi agent : Single agent.

Q (6) Model based Utility based.

(1) considers current state and memory
(2) May struggle if model is incomplete
(3) Ex. Self driving car.

(1) Chooses actions that maximize long term benefits.
(2) Requires a well designed utility function
(3) Optimizing a route.

Q7 Architechure of knowledge based and learning based agents.

A. Knowledge based agents

(1) Knowledge base : Stores knowledge about the world
(2) Inference engine : Applies logical reasoning to derive facts.
(3) Perception : Collects information from the environment.
(4) Action executor : Takes actions.
(5) Knowledge updating module : Adds new knowledge

B. Learning based agent.

1. Learning element: Improves decision making
2. Performance element: Executes actions.
3. Critic: Evaluates performance.
4. Problem generator: Suggests exploratory actions to improve learning

Q9. Convert to predicates.

a. Anita travels by car otherwise by bus.
b. Bus goes via Andheri and Goregaon
c. Car has punchure.

Define the following predicats.

travels (x, y) : person x travels by y
available (y) : transport y is available
goes (y, z) : transport y goes via z
punchure (y) : transport y is punchured
~~notavailable(y))~~ : ~~transport y is not available~~

(a) $\forall x$ travels (anita, y) $\leftarrow$ available (y) $\wedge$ (y = car)
travels (anita, bus) $\leftarrow \neg$ available (car)

(b) goes (bus, andheri)
goes (bus, Goregaon)

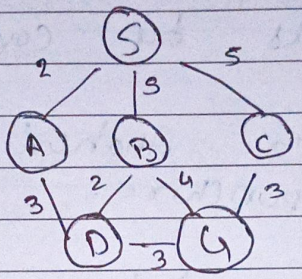
(c) punchure (car) $\rightarrow \neg$ Available (car)

Apply forward reasoning

① Puncture (car) → ¬ available (car) (false)
② use rule 2 from ①
→ travels (anita, bus)
③ goes (bus, Goregaon)

Thus anita will travel goregaon.

q10 find route from S → G with BfS



Path costs

	S	A	B	C	D	G
S	0	2	5	5	0	0
A	0	0	0	0	3	0
B	0	0	0	0	2	4
C	0	0	0	0	0	3
D	0	0	0	0	0	3
G	0	0	0	0	0	0

(we assume S → B = 5 as it is not given)

Queue

① Start from S [S]
② Expand S → {A, B, C}
③ Expand A → {B, C, D}
④ Expand B → {C, D, G}
⑤ Goal found : S → B → G.

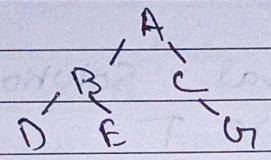
(4)

Q11 What do you mean by DLS, explain IDS with example.

(1) Depth limited search is a modified depth first search that has a depth limit. It explores nodes only up to the limit l

(2) Iterative deepening search combines bfs and DFS. It runs DLS with increasing limits.

Ex



(1) $l = 1$ → checks A
(2) $l = 2$ → checks A → B, C
(3) $l = 3$ → checks A → B, C → D, E, G

Q12 Explain hill climbing, drawbacks and limitations of steepest ascent hill climbing.

⇒ Hill climbing is a local search algorithm moving in the direction of increasing value.

Drawbacks.

(1) Local maxima: Gets stuck at a peak that is not the highest
(2) Plateau: A region where all neighbouring
(3) Ridges: Require a step down before going up.

④

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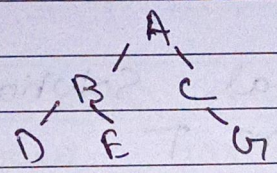

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limitations of steepest ascent hill climbing.

① It picks the best imidiate move.
② It gets stuck in local optima.

Q13 Explain simulated annealing with example.

⇒ Simulated annealing is a version of hill climbing that sometimes accepts worse moves to escape local maxima.

Algorithm.

1. Start with initial solution
2. Set a temperature T
3. While T > 0
   - Pick a neighbour
   - if its better move to it
   - if its worse accept it with probability $e^{(-\Delta E/T)}$
   - decrease T
4. Stop when system cools.

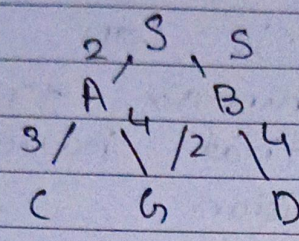
Q14 Explain A* with example.

A* is an optimal search algorithm that balances the cost so far (g) and estimated cost to the goal (h) using

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

(5)

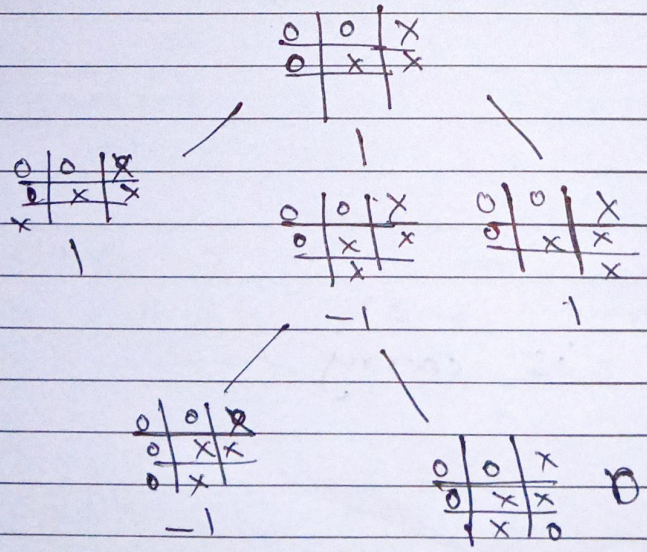
Example



(1) S → A (g=2, h=4) f=6
(2) S → B (g=5, h=2) f=7
(3) A → G (g=6, h=0) goal found.

Q15 Explain min, max, minimax algorithm and draw game tree for tic tac toe.

(1) max player tries to maximize the score
(2) min player tries to minimize the score.
(3) minimax is a decision making algorithm for turn based games.



Q16 Alpha beta pruning.

Alpha beta pruning is an optimization of the minimax tree that prunes branches that have no effect on the final decision

Q17 explain WUMPUS world problem with Peas

Wumpus world is a grid based AI environment where an agent must find gold while avoiding Wumpus (monster) and pits

P: Gold collected, steps, death penalties
E: Grid world
A: ~~Left~~ Move, grab gold.
S: Stench (wumpus.), breeze (pit), glitter (gold.

Q18

```
  S E N D
+ M O R E
---------
M O N E Y
```

M = 1 as it is carry

```
  S E N D
+ 1 O R E
---------
1 O N E Y
```

Let $E+0 = 10+N$

So S must be 8 or 9

but $S \neq 9$ $\therefore S = 8$ & $0 = 0$

but $E+0 = N$ $\therefore E = N$ which is not possible. $\therefore S = 9$.

```
 9END
 10RE
------
10NEY
```

$E+0 = N$ ~~N+R+1~~

$E+0+1 = N$ $\therefore$ N+R must generate carry.

$R \neq 9$ as $S = 9$ $\therefore D+E = Y+10$ $\therefore R = 8$

```
 9END
 108E
------
10NEY
```

now $N+8+1 = E+10$

$N - E = 1$

assume $E = 5$

$N = 6$

```
 956D
 1085
------
10657
```

$D+5 = Y = 10$

as 2, 3, 4 can't generate carry with 5 $D = 7$ $\therefore 7+5 = Y+10$ $Y = 2$

```
 9567      ∴ S = 9, E = 5, N = 6, D = 7
+1085      N = 1, O = 0, R = 8
------     Y = 2
10652
```

Q19

$G(x) \rightarrow$ x is graduating
$H(x) \rightarrow$ x is happy
$S(x) \rightarrow$ x is smiling

$\forall(x) \Rightarrow G(x) \rightarrow H(x)$
$\forall(x) = H(x) \rightarrow S(x)$
$\exists(x) = G(x)$

$\neg G(x) \vee H(x)$
$\neg H(x) \vee S(x)$
$G(x)$

consider x is not smiling
$\therefore \neg S(x) \rightarrow$ Goal
$\neg G(x) \vee H(x)$
$\neg H(x) \vee S(x)$
$\neg G(x) \vee S(x)$
$\neg G(x) \vee S(x)$
$S(x) \quad \neg S(x)$
$\{\phi\}$.

$\therefore$ our assumption is wrong
$\therefore$ someone is smiling.

(7)

Q20 Modus ponen is a fundamental rule of inference in propositional logic that allows us to deduce a conclusion from a conditional statement and its antecedent.

1) $P \rightarrow Q$

if P is true, Q is also true.

ex. if it rains the ground is wet.

Q21 forward chaining : starts with given facts and applies inference rules to derive new facts till goal is reached.

Backward chaining: starts with a goal and infers by checking what facts are needed to support it.

ex : patient has cold
patient has fever
prove patient has flu.

(1) forward chaining
patient has cough and fever
$\forall(x)$: fever(x) $\wedge$ cough(x) $\rightarrow$ flu(x)
if x satisfied patient has flu.

(2) backward chaining

$\forall x$ = fever(x) ∧ cough(x) → flu

if patient has flu, patient must have fever and cough.