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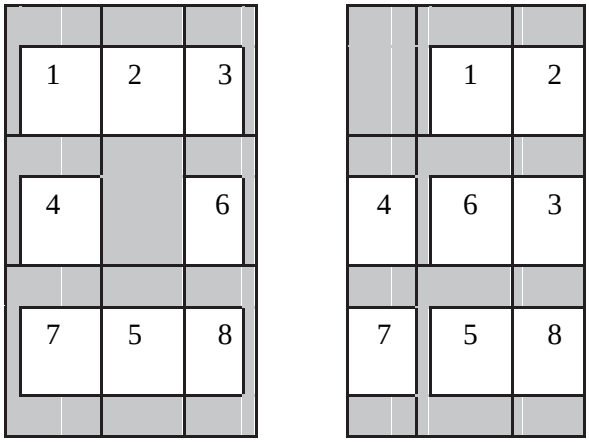
Internal Assessment Test 1 – March 2025

Sub:	**Artificial Intelligence**					Sub Code:	**BAD402**	Branch:	**AInDS**
Date:	**27/03/2025**	Duration:	**90 minutes**	Max Marks:	**50**	Sem/Sec:	**IV/ A & B**		**OBE**

		Answer any FIVE FULL Questions	**MARKS**	**CO**	**RBT**
1	a	Discuss the Turing Test in detail. What are the capabilities a computer must possess to meet the Turing test?	[4]	1	L2
	b	Define and compare DFS, BFS and IDFS with examples.	[6]	2	L2
2	a	Describe in detail the four approaches to AI.	[6]	1	L2
	b	Define the following terms concerning an intelligent agent: (i) Agent, (ii) Environment, (iii) Percepts, Percept sequence, (vi) Sensors, Actuators	[4]	1	L2
3	a	Define a rational agent and the concept of rationality. Also, illustrate the properties of the task environment in detail.	[4]	1	L3
	b	Explain and distinguish between four types of agent programs.	[6]	1	L2
4	a	There are three missionaries and three cannibals who want to cross a river using a boat that can carry at most two people. The problem imposes certain constraints to ensure the safety of the missionaries and prevent the cannibals from outnumbering the missionaries on either side of the river at any time.	[10]	2	L3
5	a	Describe PEAS. You are designing an agent for "Audio Books on the Internet". Identify PEAS for this.	[10]	2	L4
6	a	The start and goal states for the 8-puzzle sliding block are provided. Demonstrate how to reach the goal state from the start state using the depth-first search algorithm. Compute the total cost.  Start State Goal State	[10]	2	L3

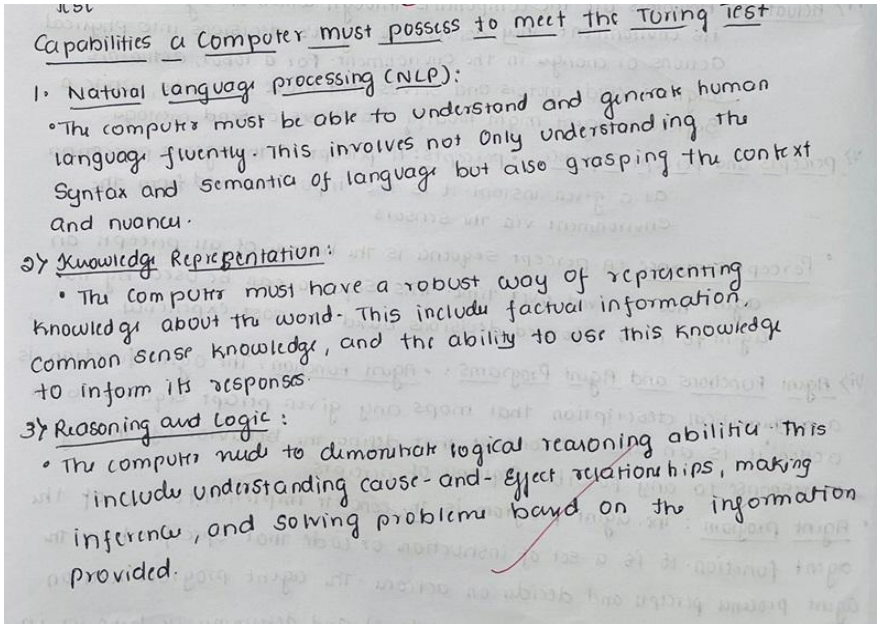
Course Instructor Signature **CCI Signature** **HOD**

Answer Key & Schema

1) **(a)** Discuss the Turing Test in detail (2). What are the capabilities a computer must possess to meet the Turing test (2)?

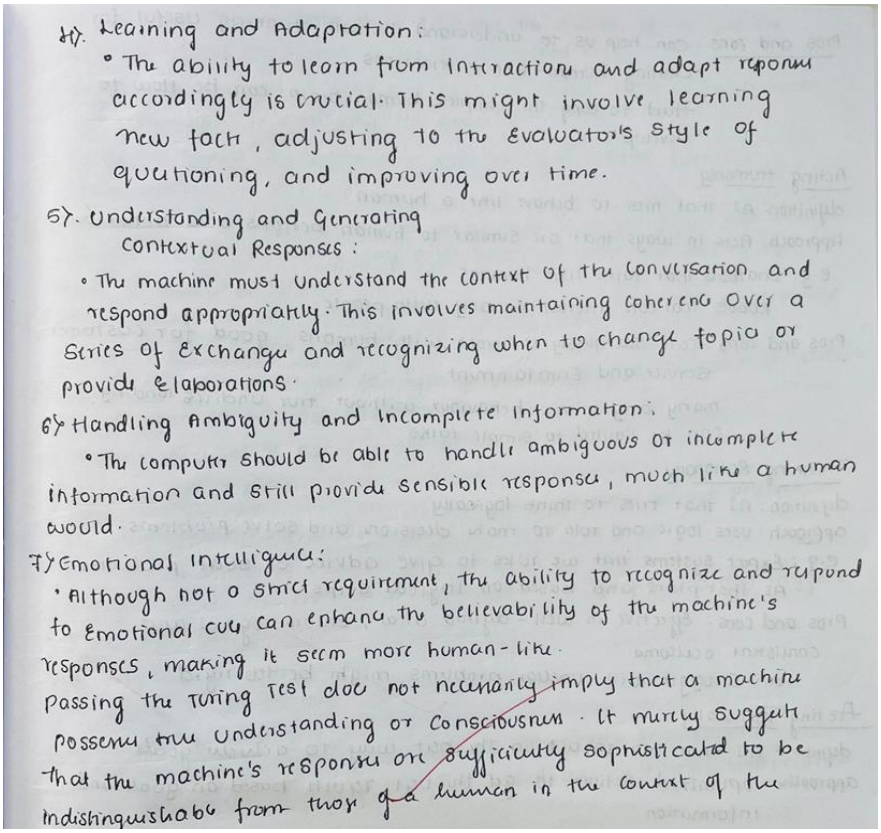
Ans.Turing Test:

- Three rooms contain a person, a computer, and an interrogator.
- The interrogator can communicate with the other two by 'teleprinter'.
- The interrogator tries to determine which is the person and which is the machine.
- The machine tries to fool the interrogator into believing that it is the person.
- If the machine succeeds, then we conclude that the machine can think.



Capabilities a Computer must possess to meet the Turing Test

1. Natural language processing (NLP):
   - The computer must be able to understand and generate human language fluently. This involves not only understanding the syntax and semantics of language but also grasping the context and nuance.
2. Knowledge Representation:
   - The computer must have a robust way of representing knowledge about the world. This includes factual information, common sense knowledge, and the ability to use this knowledge to inform its responses.
3. Reasoning and Logic:
   - The computer must be able to demonstrate logical reasoning abilities. This includes understanding cause-and-effect relationships, making inferences, and solving problems based on the information provided.



4. Learning and Adaptation:
   - The ability to learn from interactions and adapt responses accordingly is crucial. This might involve learning new facts, adjusting to the evaluator's style of questioning, and improving over time.
5. Understanding and Generating Contextual Responses:
   - The machine must understand the context of the conversation and respond appropriately. This involves maintaining coherence over a series of exchanges and recognizing when to change topics or provide elaborations.
6. Handling Ambiguity and Incomplete Information:
   - The computer should be able to handle ambiguous or incomplete information and still provide sensible responses, much like a human would.
7. Emotional Intelligence:
   - Although not a strict requirement, the ability to recognize and respond to emotional cues can enhance the believability of the machine's responses, making it seem more human-like.

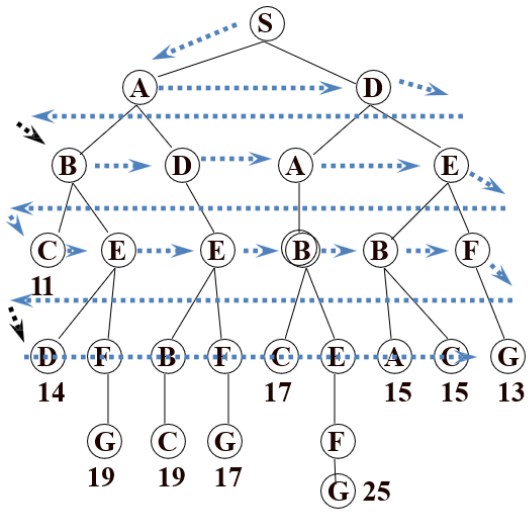
Passing the Turing Test does not necessarily imply that a machine possesses true understanding or consciousness. It merely suggests that the machine's responses are sufficiently sophisticated to be indistinguishable from those of a human in the context of the

(b) Define and compare DFS (2), BFS (2) and IDFS (2) with examples.

Ans.

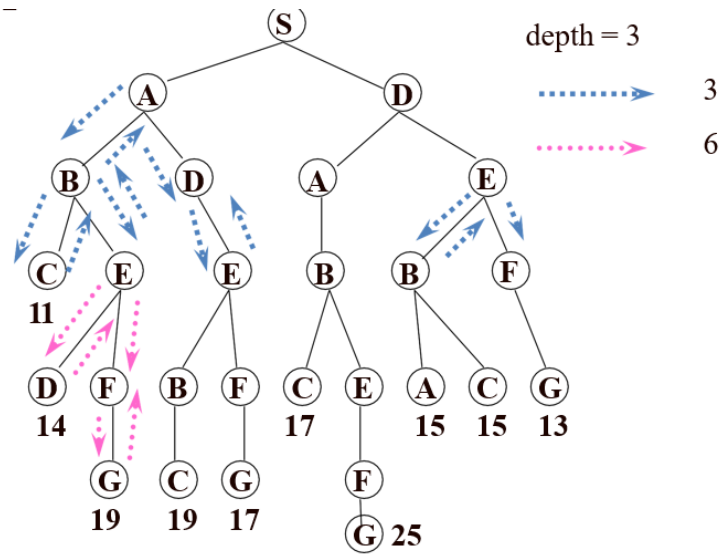
Breadth-first search-

- The root node is expanded first (FIFO)
- All the nodes generated by the root node are then expanded
- And then their successors and so on
- Expand shallowest unexpanded node
- *Frontier* (or fringe): nodes in queue to be explored
- *Frontier* is a first-in-first-out (FIFO) queue, i.e., new successors go at end of the queue.
- *Goal-Test* when inserted.



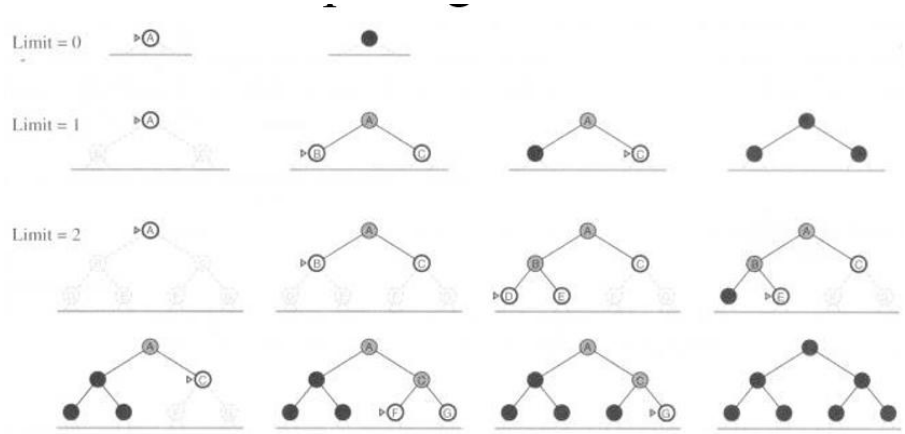
Depth-first search-

- Always expands one of the nodes at the ***deepest*** level of the tree
- Only when the search hits a dead end
  - Goes back and expands nodes at shallower levels
  - Dead end à leaf nodes but not the goal
  - Expand deepest unexpanded node
  - Implementation:
  - *frontier* = LIFO queue, i.e., put successors at front



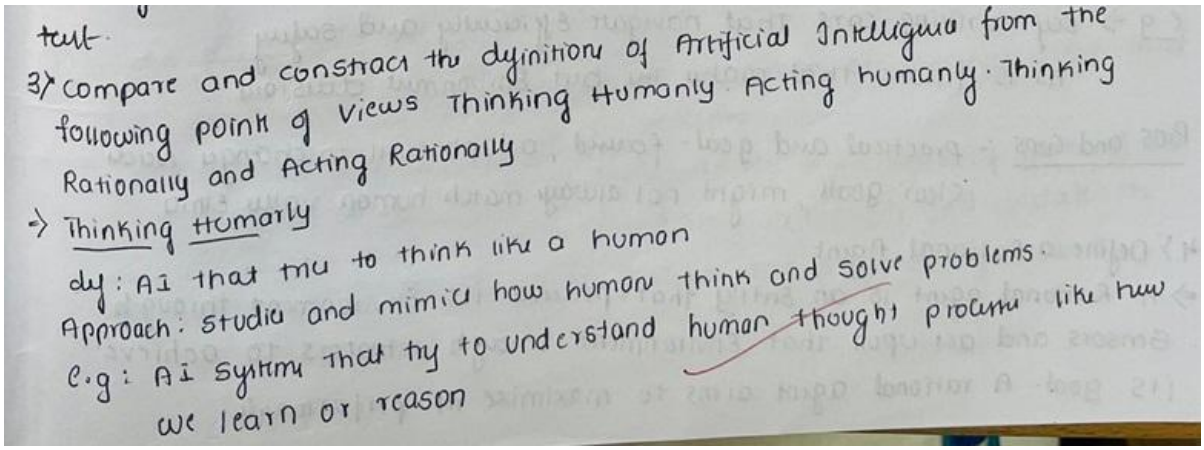
Iterative deepening search-

- No choosing of the best depth limit
- It tries all possible depth limits:
- First 0, then 1, 2, and so on
- Combines the benefits of depth-first and breadth- first search
- optimal
- complete
- Time and space complexities
- reasonable
- suitable for the problem
- having a large search space
- and the depth of the solution is not known



2) (a) Describe in detail the four approaches (1.5 each) to AI

Ans.



text.

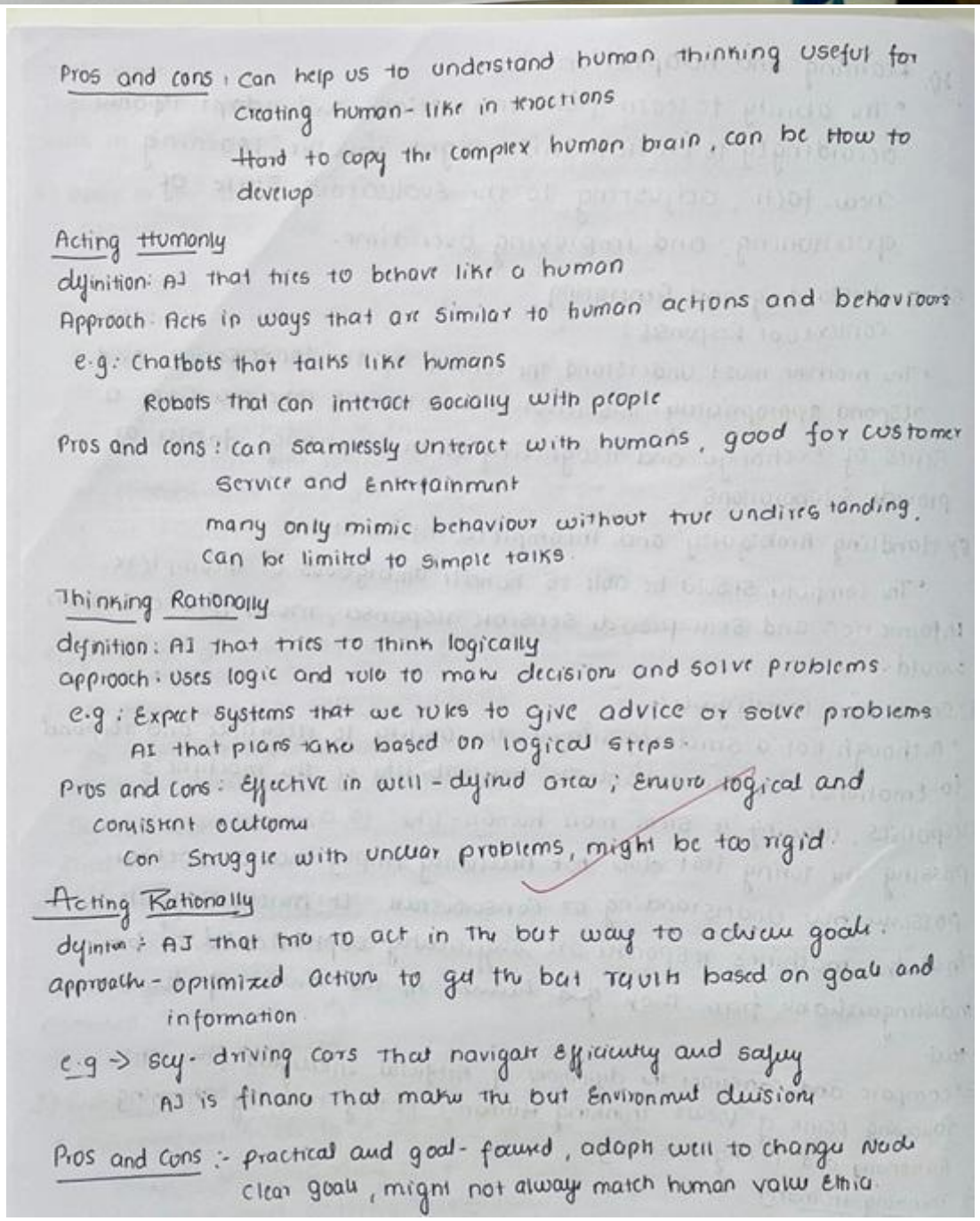
3) Compare and constract the dyinitions of Artificial Intelligence from the following point of views Thinking Humanly Acting humanly. Thinking Rationally and Acting Rationally

→ Thinking Humanly

dy: AI that tries to think like a human

Approach: studies and mimics how human think and solve problems.

e.g: AI systems that try to understand human thought process like how we learn or reason



Pros and cons: Can help us to understand human thinking useful for creating human-like interactions

Hard to copy the complex human brain, can be How to develop

Acting Humanly

dyinition: AI that tries to behave like a human

Approach: Acts in ways that are similar to human actions and behaviours

e.g.: Chatbots that talks like humans

Robots that can interact socially with people

Pros and cons: can seamlessly interact with humans, good for customer service and Entertainment

many only mimic behaviour without true understanding.

Can be limited to simple talks

Thinking Rationally

definition: AI that tries to think logically

approach: uses logic and rule to make decision and solve problems

e.g: Expert systems that use rules to give advice or solve problems

AI that plans take based on logical steps.

Pros and cons: Effective in well-dyined area; Ensure logical and consistent outcome

Can struggle with unclear problems, might be too rigid

Acting Rationally

dyinition: AI that tries to act in the best way to achieve goals.

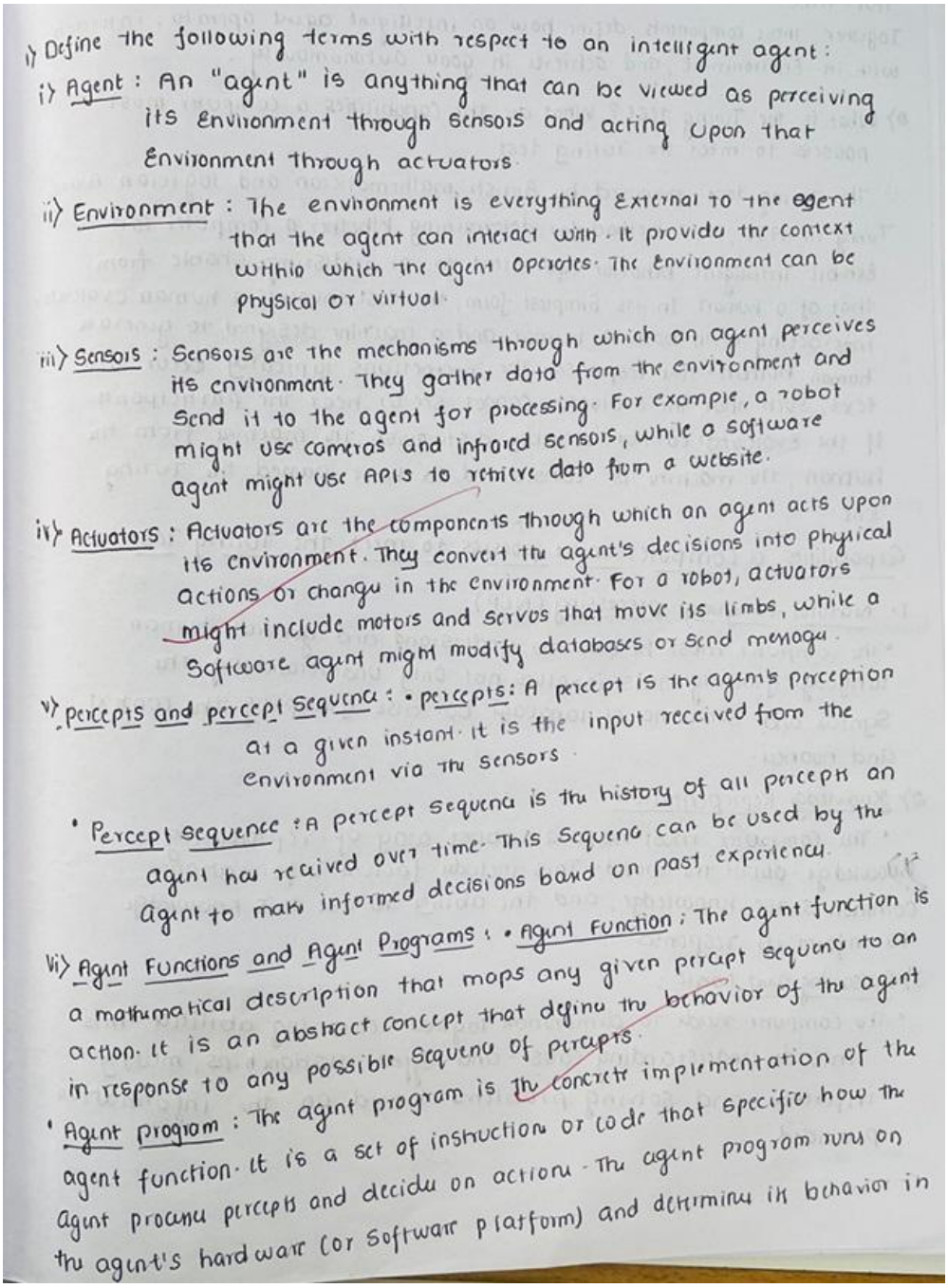
approach - optimized action to get the best result based on goals and information

e.g -> Self-driving cars that navigate efficiently and safely

AI is finance that make the best Environment decision

Pros and Cons: - practical and goal-focused, adapt well to change Needs clear goals, might not always match human value Ethics

(b) Define the following terms concerning an intelligent agent:
(i) Agent (1), (ii) Environment (1), (iii) Percepts, Percept sequence (1), (vi) Sensors, Actuators (1)
Ans.



1) Define the following terms with respect to an intelligent agent:

i) Agent : An "agent" is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators.

ii) Environment : The environment is everything external to the agent that the agent can interact with. It provide the context within which the agent operates. The environment can be physical or virtual.

iii) Sensors : Sensors are the mechanisms through which an agent perceives its environment. They gather data from the environment and send it to the agent for processing. For example, a robot might use cameras and infrared sensors, while a software agent might use APIs to retrieve data from a website.

iv) Actuators : Actuators are the components through which an agent acts upon its environment. They convert the agent's decisions into physical actions or change in the environment. For a robot, actuators might include motors and servos that move its limbs, while a software agent might modify databases or send messages.

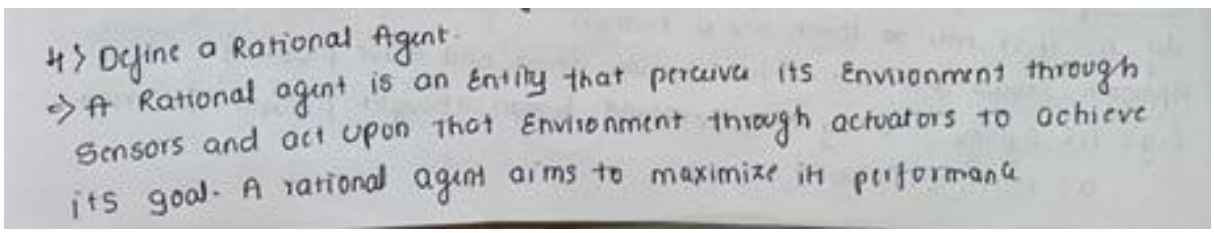
v) Percepts and percept sequence : • Percepts: A percept is the agent's perception at a given instant. It is the input received from the environment via the sensors.

• Percept sequence : A percept sequence is the history of all percepts an agent has received over time. This sequence can be used by the agent to make informed decisions based on past experience.

vi) Agent Functions and Agent Programs : • Agent Function : The agent function is a mathematical description that maps any given percept sequence to an action. It is an abstract concept that define the behavior of the agent in response to any possible sequence of percepts.

• Agent program : The agent program is the concrete implementation of the agent function. It is a set of instruction or code that specific how the agent process percepts and decide on actions. The agent program runs on the agent's hardware (or software platform) and determine its behavior in

3) (a) Define a rational agent (1) and the concept of rationality (1). Also, illustrate the properties of the task environment in detail (2).
Ans.

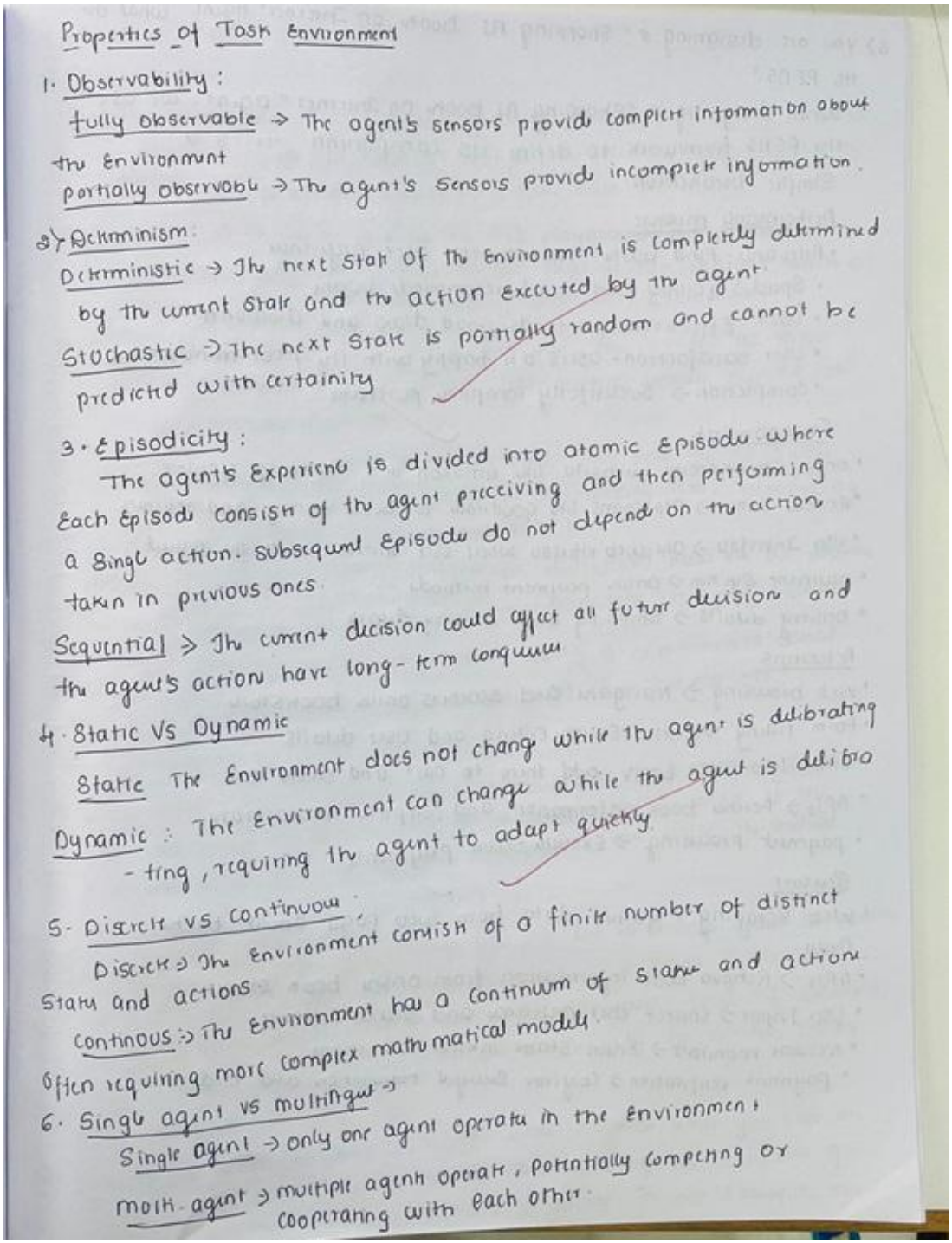


4) Define a Rational Agent.

=> A Rational agent is an Entity that perceive its Environment through Sensors and act upon that Environment through actuators to achieve its goal. A rational agent aims to maximize its performance

Concept of Rationality: A rational agent is one that "does the right thing", i.e. the table for the agent function is filled out "correctly." What is rational at any given time depends on (at least) four things:

- The performance measure that defines the criterion of success
- The agent's prior knowledge of the environment
- The actions the agents can perform
- The agent's percept sequence to date.



Properties of Task Environment

1. Observability :

fully observable → The agent's sensors provide complete information about the environment

partially observable → The agent's sensors provide incomplete information.

2) Determinism

Deterministic → The next state of the environment is completely determined by the current state and the action executed by the agent

Stochastic → The next state is partially random and cannot be predicted with certainity

3. Episodicity :

The agent's experience is divided into atomic episodes where each episode consists of the agent perceiving and then performing a single action. Subsequent episodes do not depend on the actions taken in previous ones

Sequential → The current decision could affect all future decision and the agent's actions have long-term consequences

4. Static Vs Dynamic

Static The Environment does not change while the agent is deliberating

Dynamic : The Environment can change while the agent is deliberating, requiring the agent to adapt quickly

5. Discrete vs continuous

Discrete → The environment consists of a finite number of distinct states and actions

Continous → The environment has a continuum of states and actions often requiring more complex mathematical models

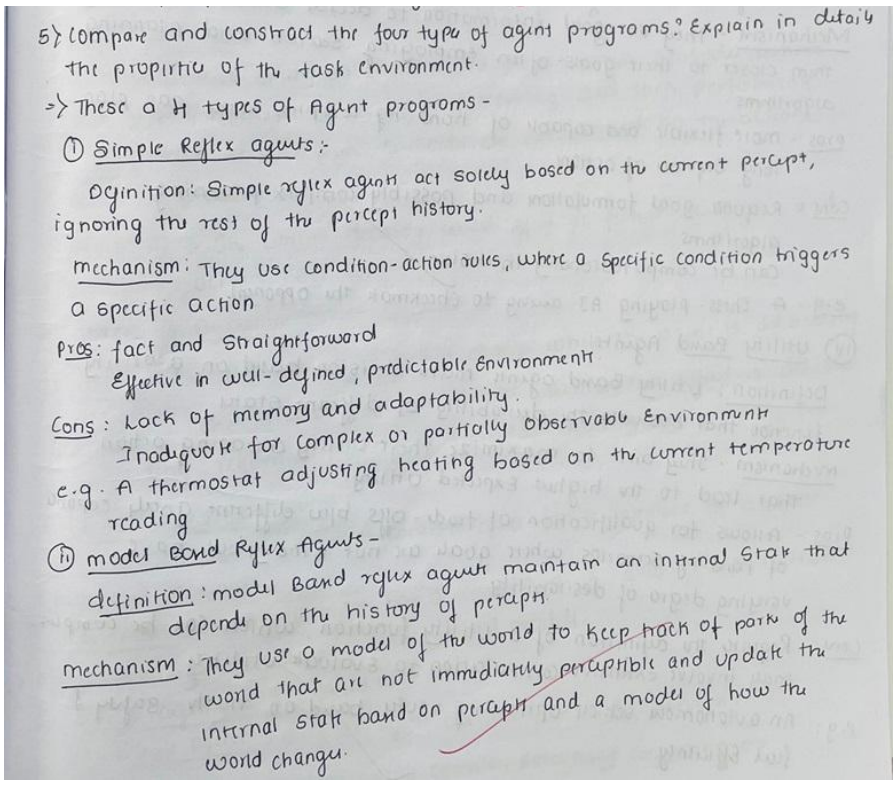
6. Single agent vs multiagent →

Single Agent → only one agent operates in the environment

multi-agent → multiple agents operate, potentially competing or cooperating with each other

(b) Explain and distinguish between four types of agent programs (1.5 each).

Ans.



5) Compare and constract the four type of agent progroms? Explain in dutail the propirtie of the task environment.

=> There a H types of Agent progroms -

① Simple Reflex agents :-

Oginition: Simple rylex agint act solely based on the current percept, ignoring the rest of the percept history.

mechanism: They use condition-action rules, where a specific condition triggers a specific action

Pros: fact and Straightforward
Effective in well-defined, predictable environmenth

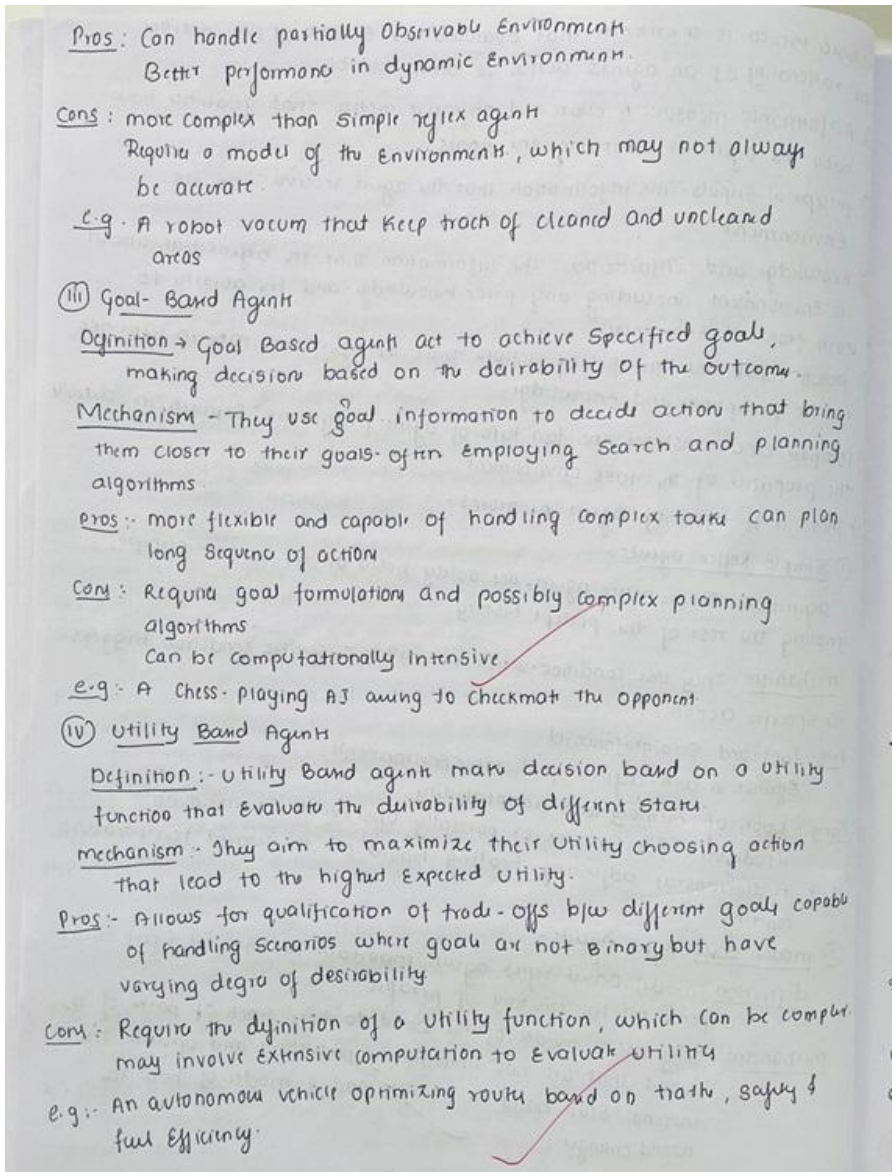
Cons: Lack of memory and adaptability.
Inadequate for complex or partially observable environmenth

e.g. A thermostat adjusting heating based on the current temperature reading

② model Based Rylex Agents -

definition: model Based rylex agent maintain an internal stat that depends on the history of peraph

mechanism: They use a model of the world to keep track of parts of the world that are not immediately perceptible and updat the internal stat based on peraph and a model of how the world changes.



Pros: Can handle partially Observable Environments
Better performance in dynamic environment.

Cons: more complex than simple rylex agint
Requires a model of the environmenth, which may not always be accurate

e.g. A robot vacum that keep track of cleaned and uncleaned areas

③ Goal- Based Agint

Oginition → Goal Based agint act to achieve Specified goals, making decision based on the dairability of the outcomes.

Mechanism - They use goal information to decide action that bring them closer to their goals- often employing search and planning algorithms

Pros :- more flexible and capable of handling complex tasks can plan long Sequence of action

Cons: Require goal formulations and possibly complex planning algorithms
Can be computationally Intensive

e.g :- A Chess-playing AI aming to checkmat the opponent

④ Utility Based Agints

Definition :- Utility Based agint make decision based on a utility function that Evaluate the dairability of different state

mechanism - They aim to maximize their utility choosing action that lead to the highest Expected utility.

Pros :- Allows for qualification of trade-offs b/w different goals capable of handling Scenarios where goals are not Binary but have varying degree of desirability

Cons: Require the dfinition of a utility function, which can be complex may involve extensive computation to Evaluate utility

e.g :- An autonomous vehicle optimizing route based on traffic, safety & fuel Efficiency.

4) There are three missionaries and three cannibals who want to cross a river using a boat that can carry at most two people. The problem imposes certain constraints to ensure the safety of the missionaries and prevent the cannibals from outnumbering the missionaries on either side of the river at any time (10).

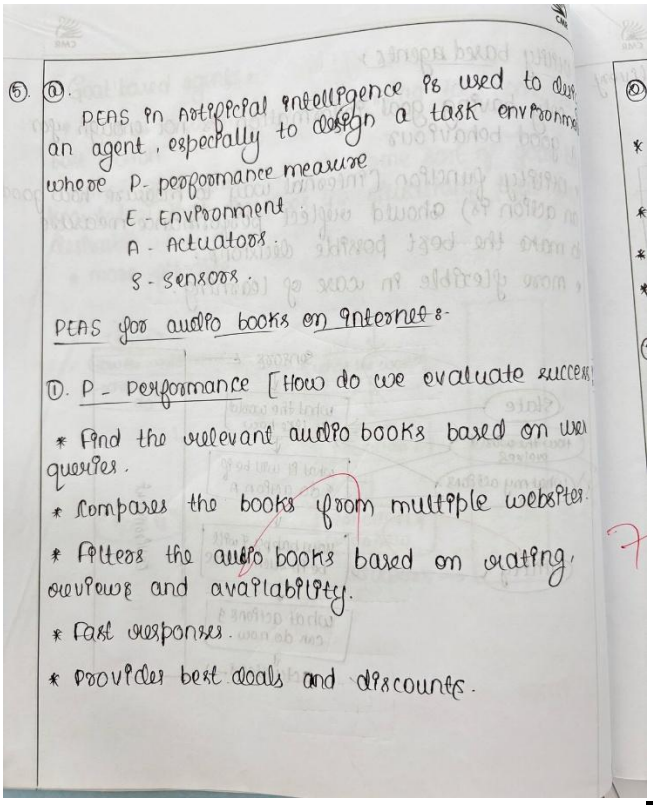
Ans.

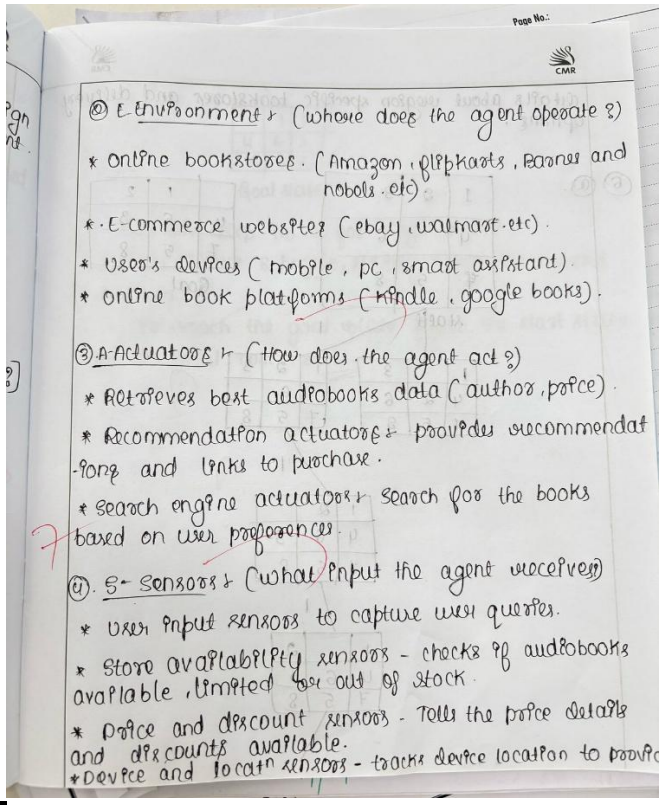
Let's denote the sides as L (left) and R (right). Initially, the state is (3M, 3C, L).

1. Move 2C from L to R. New state: (3M, 1C, R).
2. Move 2C back from R to L. New state: (3M, 3C, L).
3. Move 2M from L to R. New state: (1M, 3C, R).
4. Move 1M and 1C from R to L. New state: (2M, 2C, L).
5. Move 2C from L to R. New state: (2M, 0C, R).
6. Move 2C back from R to L. New state: (2M, 2C, L).
7. Move 2M from L to R. New state: (0M, 2C, R).
8. Move 1M and 1C from R to L. New state: (1M, 3C, L).
9. Move 1M from L to R. New state: (0M, 3C, R).
10. Move 1C back from R to L. New state: (0M, 2C, L).
11. Move 2C from L to R. New state: (0M, 0C, R).

5) Describe PEAS (4). You are designing an agent for "Audio Books on the Internet". Identify PEAS for this (6).

Ans.





6) The start and goal states for the 8-puzzle sliding block are provided. Demonstrate how to reach the goal state from the start state using the depth-first search algorithm (8). Compute the total cost (2).

1	2	3
4		6
7	5	8

Start State

	1	2
4	6	3
7	5	8

Goal State

Ans.