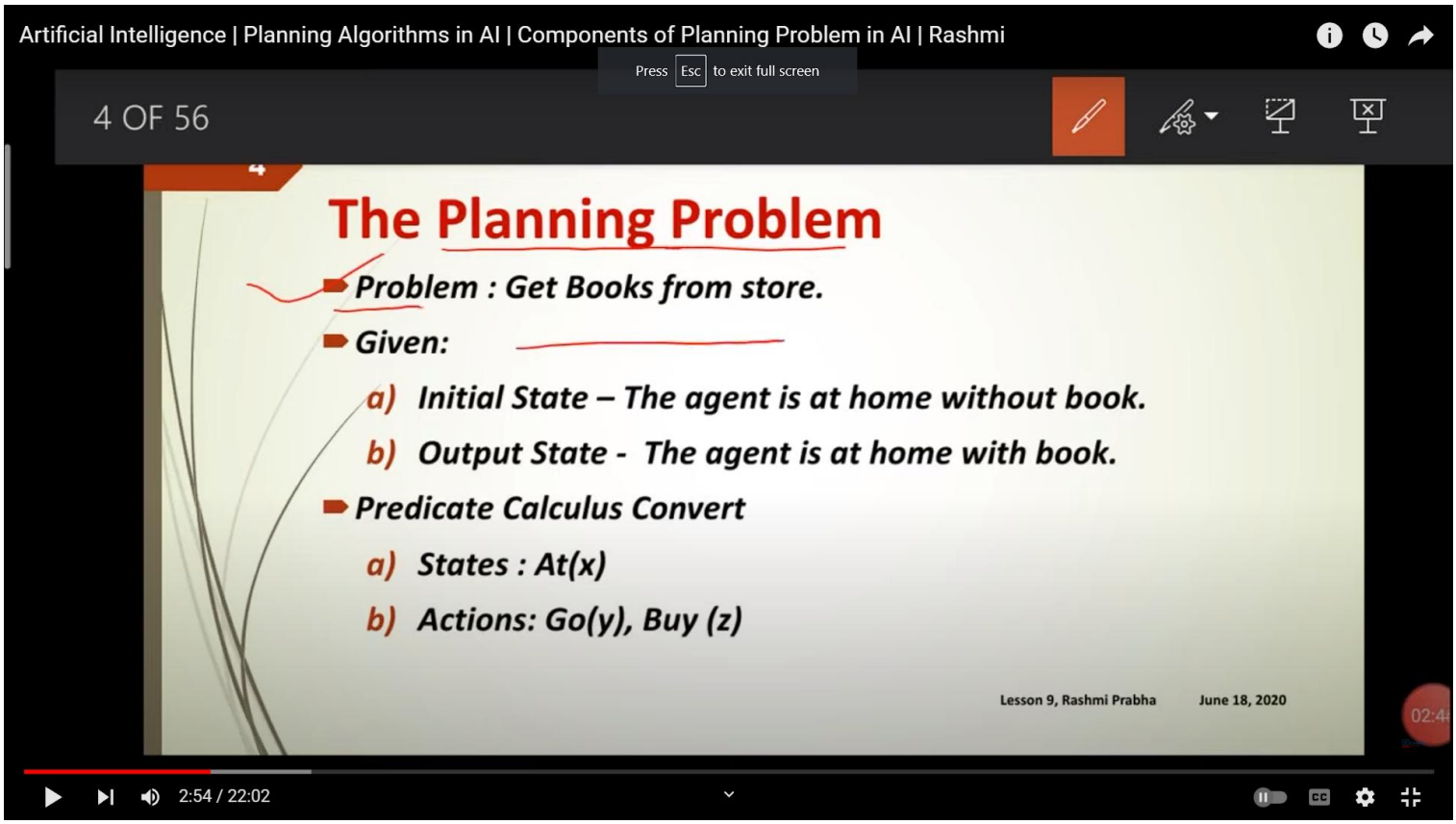
Artificial Intelligence | Planning Algorithms in AI | Components of Planning Problem in AI | Rashmi
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4 OF 56
The Planning Problem
Problem : Get Books from store.
Given:
a) Initial State – The agent is at home without book.
b) Output State - The agent is at home with book.
Predicate Calculus Convert
a) States : At(x)
b) Actions: Go(y), Buy (z)
Lesson 9, Rashmi Prabha June 18, 2020
2:54 / 22:02

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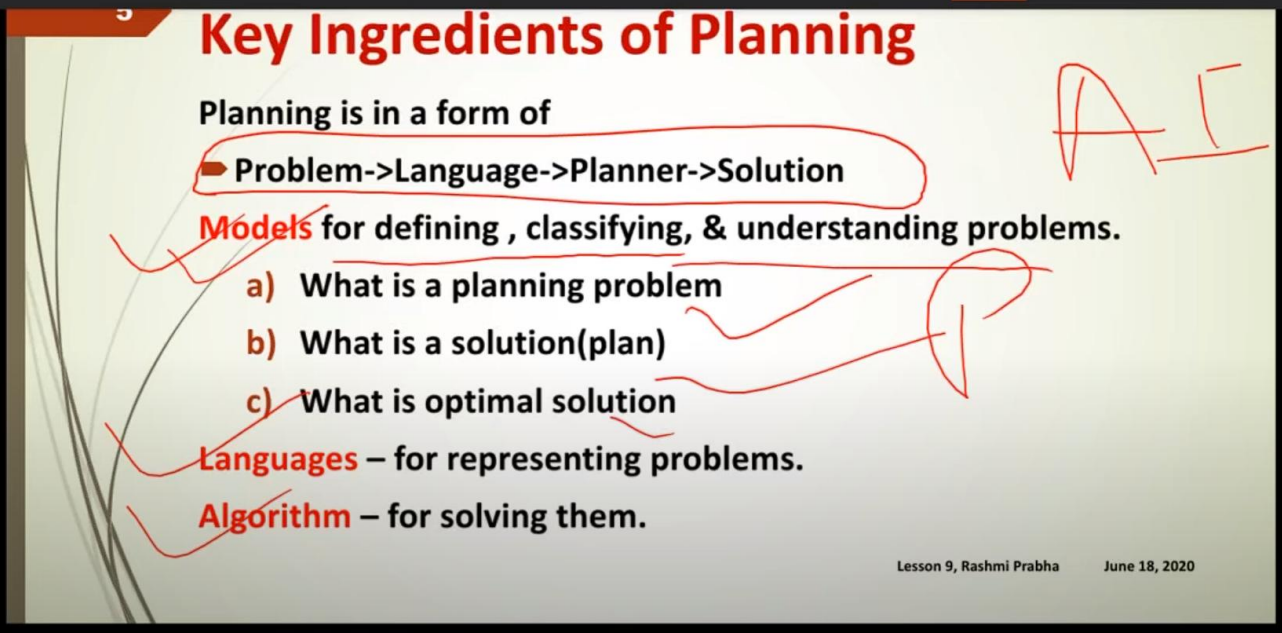
5 OF 56



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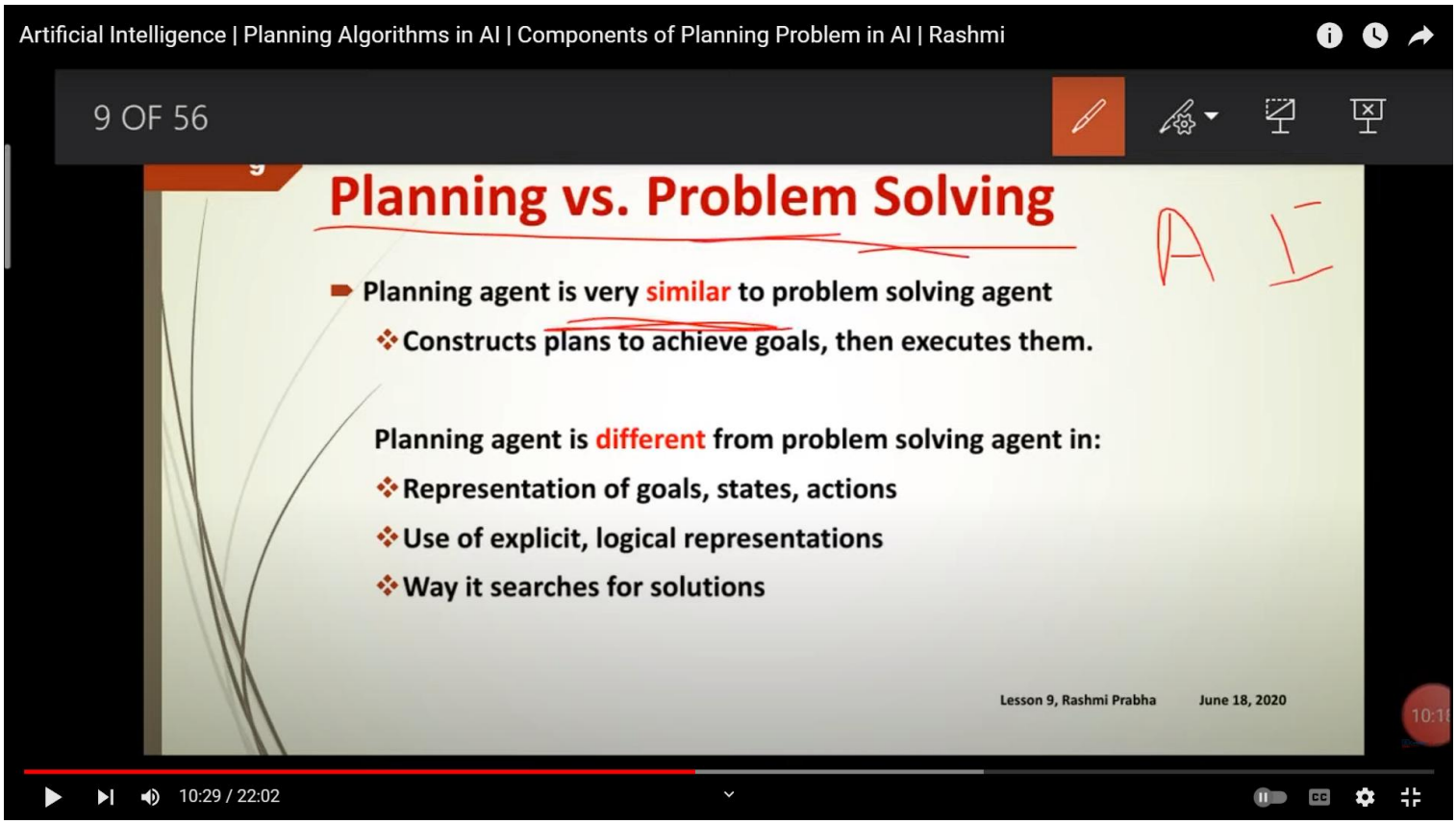
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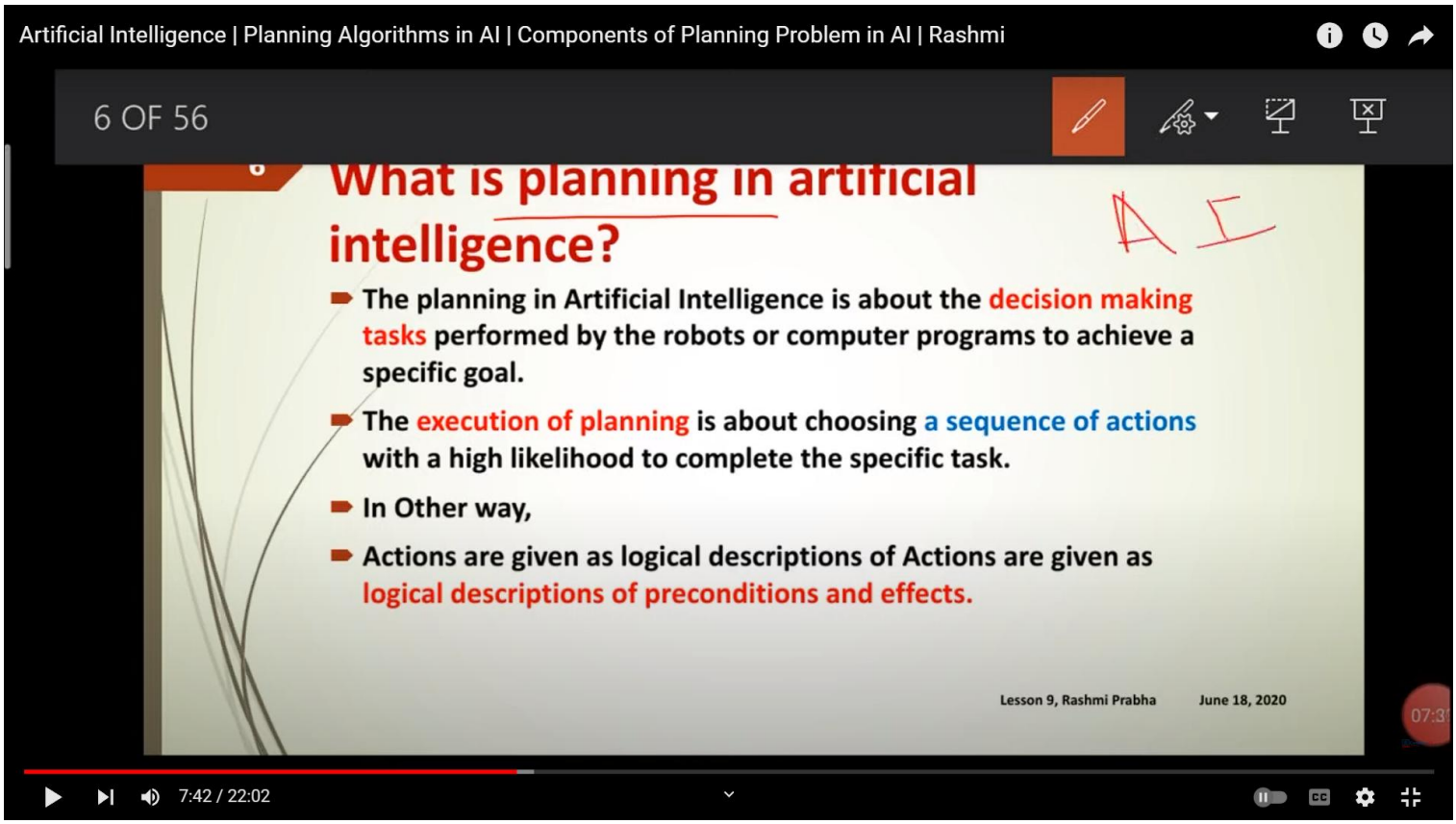
9 OF 56
Planning vs. Problem Solving
Planning agent is very similar to problem solving agent
Constructs plans to achieve goals, then executes them.
Planning agent is different from problem solving agent in:
Representation of goals, states, actions
Use of explicit, logical representations
Way it searches for solutions
Lesson 9, Rashmi Prabha June 18, 2020
10:29 / 22:02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What is planning in artificial intelligence?
AI
The planning in Artificial Intelligence is about the decision making tasks performed by the robots or computer programs to achieve a specific goal.
The execution of planning is about choosing a sequence of actions with a high likelihood to complete the specific task.
In Other way,
Actions are given as logical descriptions of Actions are given as logical descriptions of preconditions and effects.
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7:42 / 22:02

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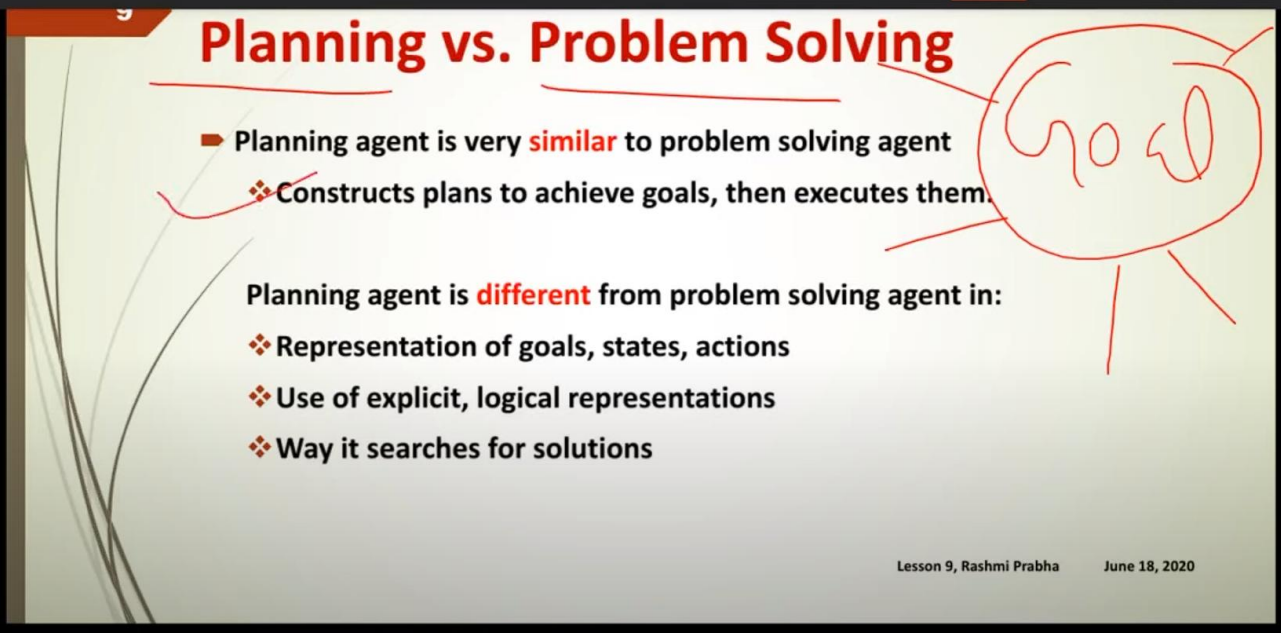
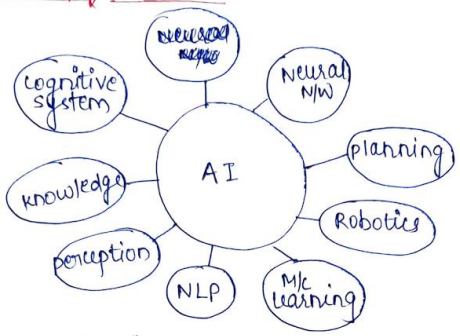
9 OF 56



11:00 / 22:02

PLANNING PROBLEM



Types of planning :

1) Hierarchical planning - a prob. is divided into smaller sub-problems, & each sub prob. is solved one at a time. It's often used in Robotics app^n where a Robot needs to figure out how to complete a task by breaking it down into smaller steps.

2) Non Hierarchical planning - a prob. is not divided

Types of planning :

1) Hierarchical planning - a prob. is divided into smaller sub-problems, & each sub prob. is solved one at a time. It's often used in Robotics appⁿ where a Robot needs to figure out how to complete a task by breaking it down into smaller steps.

2) Non-Hierarchical planning - a prob. is not divided into smaller sub problems. Instead, the AI sys. tries to find a single plan that will solve the entire prob. It's often used in Games where a comp. player needs to figure out the best way to win the game.

3) Reactive planning - is a type of planning that is used in situations where the environ. is changing & the AI sys needs to be able to respond quickly.

entire prob. It's often used in Games where a comp. player needs to figure out the best way to win the game.

3) Reactive planning - is a type of planning that is used in situations where the environ. is changing & the AI sys needs to be able to respond quickly.

It's often used in Robotics appⁿ where a Robot needs to be able to avoid obstacle or respond to changes in the environ.

What is planning problem ?

PP in AI are problems that arise when an AI sys. is trying to plan its next move or course of action. These problems can be difficult to solve bcoz the AI sys. must take into a/c all of the possible outcomes of its actions & choose the one that will lead to the best results.

components of Planning System

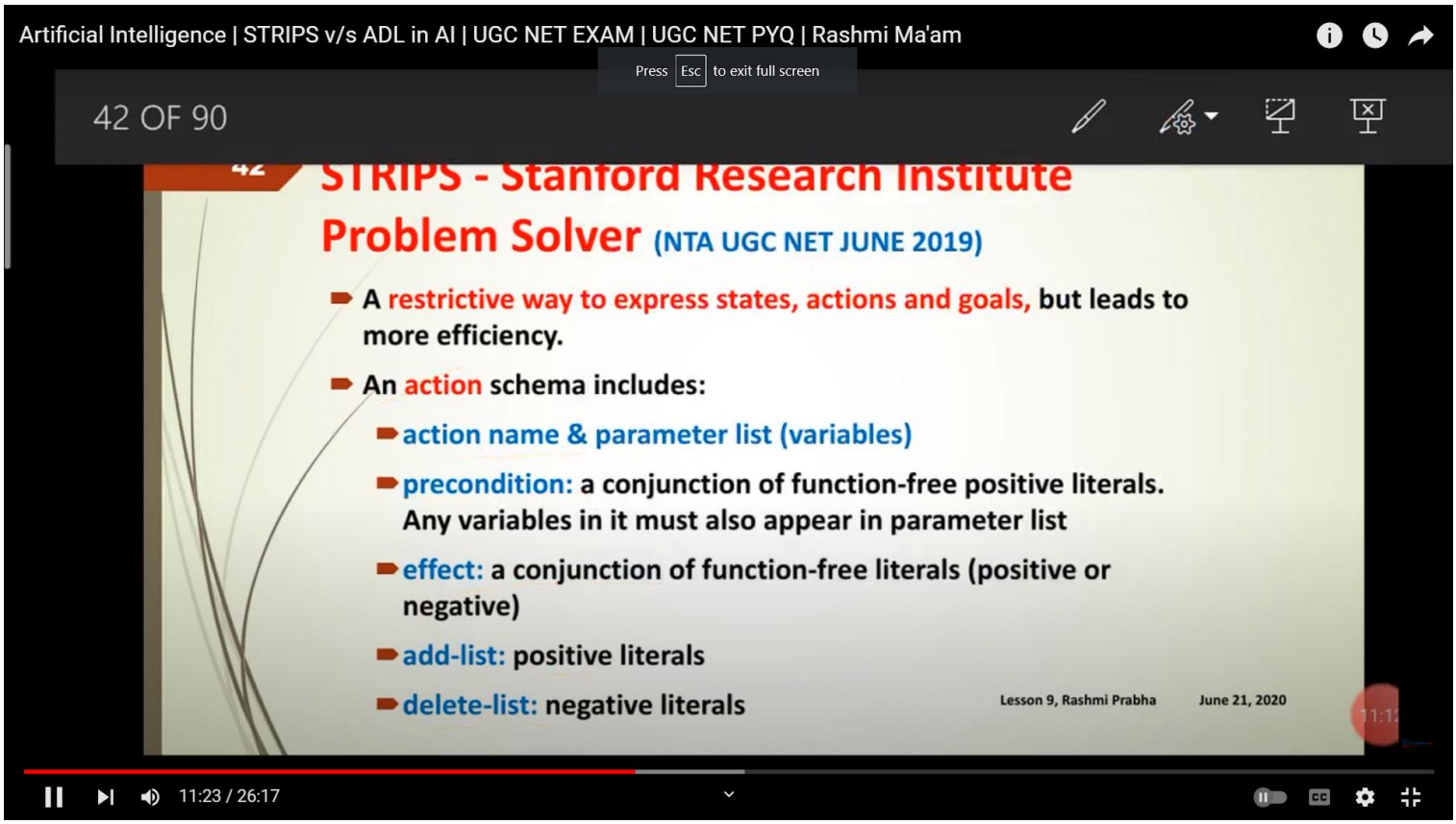
1) choose the best rule based upon Heuristics (selection of simple subject it's based on past experience or i/p from the seniors or lecture attended)

2) Apply this rule to create a new state (studying of the subject, so as to achieve next stage)

3) Detect when a solution is found (a position is reached where he can score more than cut-off marks)

4) Detect dead ends so that they can be avoided. (find the difficult topic & avoid them)

5) Detect when a nearly solved state occurs & use special methods to make it a solved state. (In position to get more than cut-off marks in all subjects except Maths & then apply strategies to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42 OF 90
42
STRIPS - Stanford Research Institute Problem Solver (NTA UGC NET JUNE 2019)
A restrictive way to express states, actions and goals, but leads to more efficiency.
An action schema includes:
action name & parameter list (variables)
precondition: a conjunction of function-free positive literals. Any variables in it must also appear in parameter list
effect: a conjunction of function-free literals (positive or negative)
add-list: positive literals
delete-list: negative literals
Lesson 9, Rashmi Prabha June 21, 2020
11:23 / 26:17

STRIPS

- Example : *Problem : Get Books from store.*
- An action schema includes:
  - action name : Buy (x)
  - parameter list : (variables : x)
  - precondition: a conjunction : At (p)
  - effect: a conjunction of function-free literals (positive or negative) Have(x)
  - add-list: positive literals
  - delete-list: negative literals

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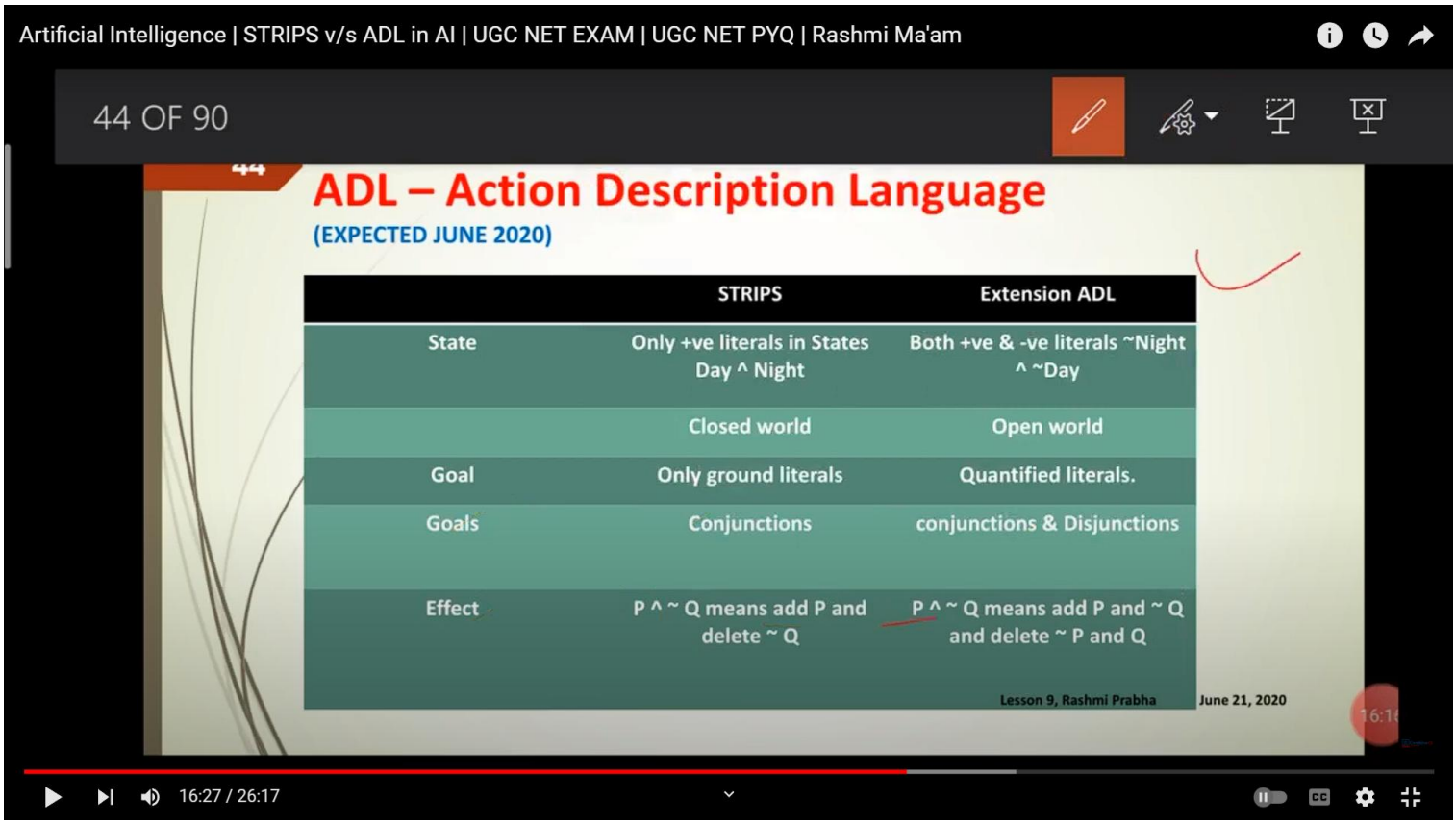

L44: Blocks World Problem in Artificial Intelligence with Solution | AI Lectures in Hindi

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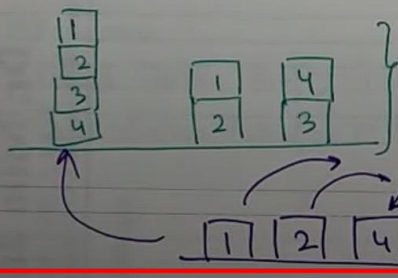
BLOCKS WORLD PROBLEM:-

↳ There are 'N' number of Blocks resting on table with specified Sequence.

↳ GOAL is to arrange in desired Sequence.

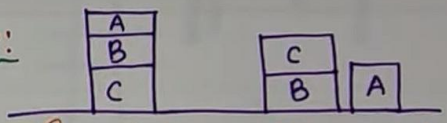
↳ Available Moves → Put a Block on table
→ Put a Block on another Block Top.

State is represented using a Sequence of blocks in Current pos".



Try to place each block individually on table.

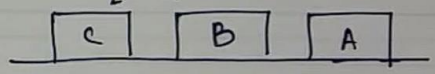
Example:



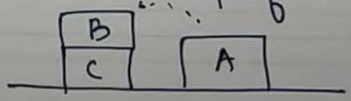
GOAL State START State

intermediate States.

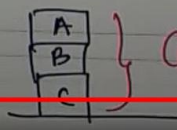
(i) Putting 'C' on table top



(ii) Put 'B' on top of 'C'



(iii) Put 'A' on top of 'B'



Goal State

4:34 / 4:55

BLOCKS WORLD

* also known as Sussman Anomaly
* In this prob., 3 blocks labeled as 'A', 'B', 'C' are allowed to rest on the flat surface. The given condⁿ is that only one block can be moved at a time to achieve the goal.

It's consist of following :

1) table 2) Identical blocks with unique letters on them
3) Blocks are put one to another in stack form
4) stack is built with a robot arm. The arm can perform opⁿs of lifting a single block at a time & placing it.

Example predicate used to describe states in block world are :

1. On (A, table) : Block A is on the table

4 placing ...

Example predicate used to describe states in block world are :

1. On (A, table) : Block A is on the table
2. On (B, table) : " B " "
3. On (B, A) : Block B is on Block A
4. Clear (A) : Block A has nothing on it.
5. Clear (B) : " B " "
6. Holding (B) : Robot arm is holding B
7. Empty-Arm : arm is not holding anything

State Representation -

Initial state : On (A, table) ∧ On (B, table) ∧ Clear (A) ∧ Clear (B) ∧ Empty Arm

Goal state : On (A, table) ∧ On (B, A) ∧ Clear (B) ∧ Empty Arm

4 action (op°) used to describe states in Block world are :

clear(B) ∧ Empty Arm

Goal state : On(A, table) ∧ On(B, A) ∧ Clear(B) ∧ Empty Arm

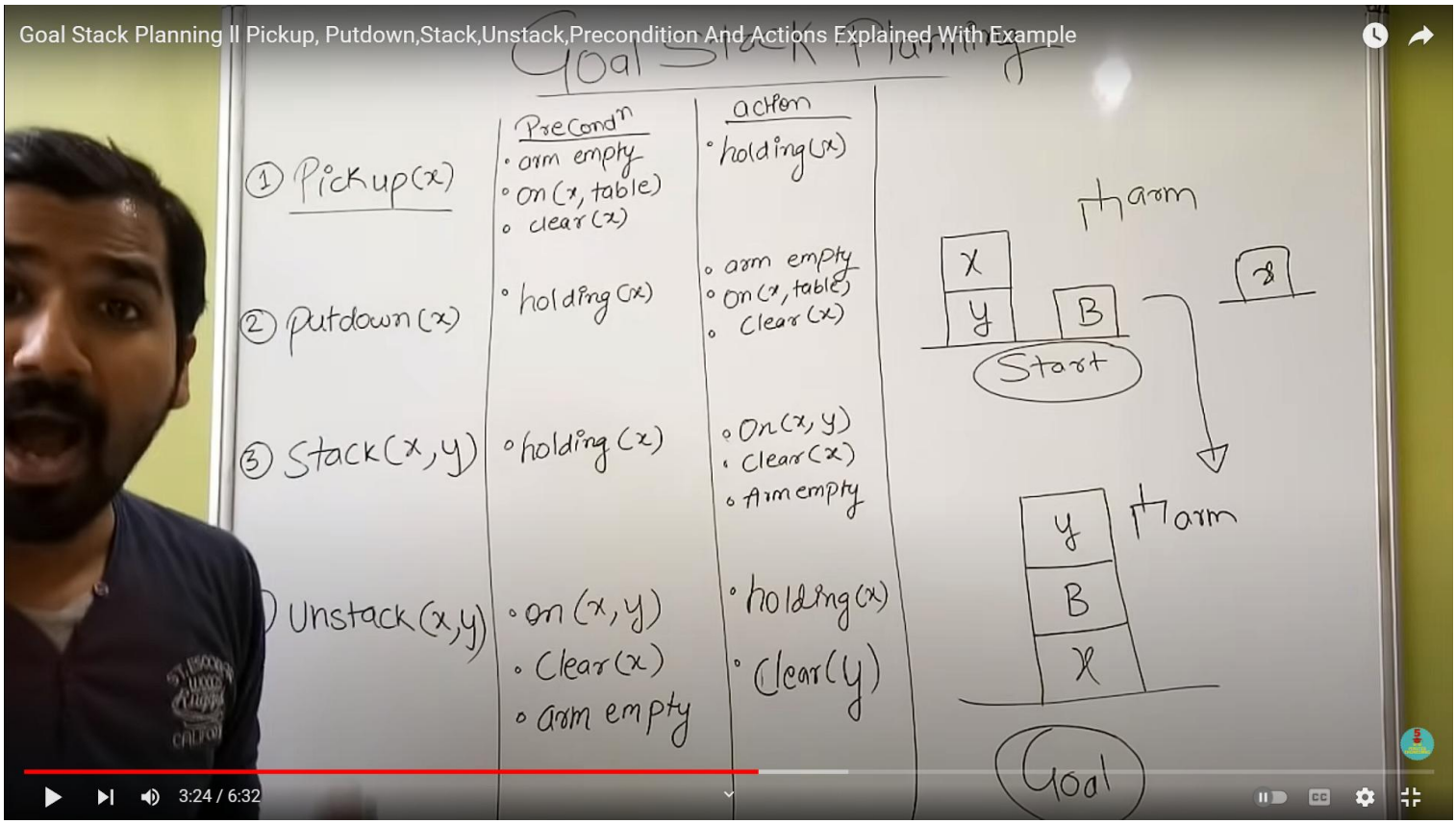
4 action (op°) used to describe states in Block world are:

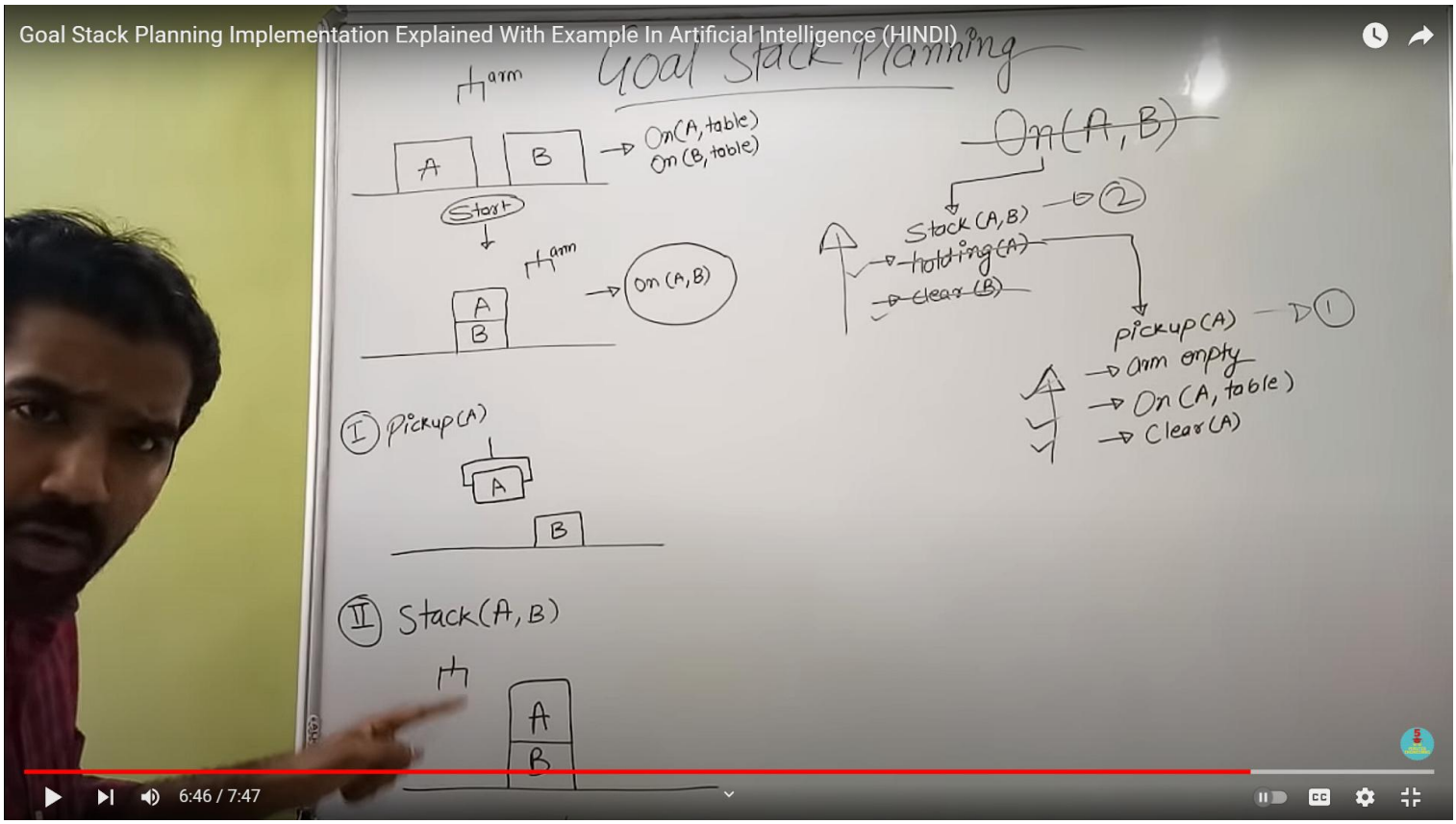
1. UNSTACK(B,A) : to lift block B from A
2. Stack(B,A) : To place block B on A
3. Lift(B): to lift the block B from the table

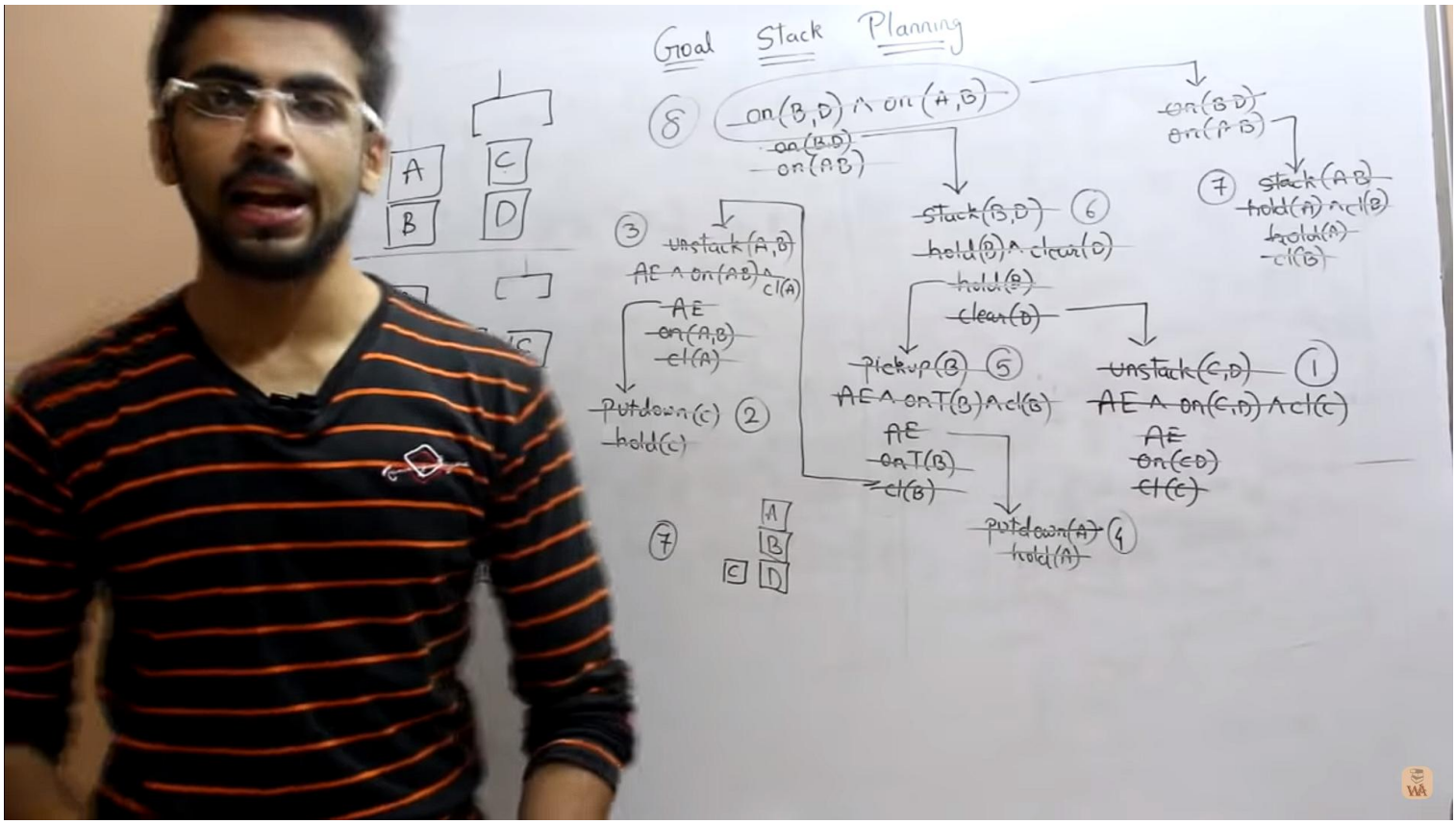
4. Place(B): to put the block B on the table. 6

The Blocks world is chosen because:

* It's sufficiently simple & well-behaved
* easily understood
* provides a good sample environ. to study planning : problems can be broken into nearly distinct subproblems.


Goal Stack Planning
Goal Stack Planning II Pickup, Putdown,Stack,Unstack,Precondition And Actions Explained With Example
Precondn
action
① Pickup(x)
• arm empty
• on(x, table)
• clear(x)
• holding(x)
② Putdown(x)
• holding(x)
• arm empty
• on(x, table)
• clear(x)
③ Stack(x,y)
• holding(x)
• On(x, y)
• clear(x)
• Arm empty
Unstack(x,y)
• on(x,y)
• Clear(x)
• arm empty
• holding(x)
• clear(y)
arm
X
y
B
Start
arm
y
B
X
Goal
3:24 / 6:32


Goal Stack Planning Implementation Explained With Example In Artificial Intelligence (HINDI)
Goal Stack Planning
arm
A
B
On(A, table)
On(B, table)
Start
On(A, B)
Stack(A, B)
holding(A)
clear(B)
pickup(A)
arm empty
On(A, table)
Clear(A)
I Pickup(A)
II Stack(A, B)
6:46 / 7:47


Goal Stack Planning
A
B
C
D
on(B,D) ∧ on(A,B)
on(B,D)
on(A,B)
unstack(A,B)
AE ∧ on(A,B) ∧ cl(A)
AE
on(A,B)
cl(A)
Putdown(C)
hold(C)
Stack(B,D)
hold(B) ∧ clear(D)
hold(B)
clear(D)
Pickup(B)
AE ∧ onT(B) ∧ cl(B)
AE
onT(B)
cl(B)
unstack(C,D)
AE ∧ on(C,D) ∧ cl(C)
AE
on(C,D)
cl(C)
Putdown(A)
hold(A)
on(B,D)
on(A,B)
Stack(A,B)
hold(A) ∧ cl(B)
hold(A)
cl(B)

means end analysis

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Mean End Analysis in AI:
-Means Ends analysis is a problem solving technique.
-Allows both backward and forward searching.
-computing the current state to a goal state by computing their difference.
-To reduce the difference between current and goal state we will use operator.

To perform means-ends analysis,

· 1. Until the goal is reached or no more procedures are available,
- Describe the current state, the goal state, and
the difference between the two.
- Use the difference between the current state and goal state,
possibly with the description of the current state or goal state,
to select a promising procedure.
- Use the promising procedure and update the current state.

·2. If the goal is reached, announce success; otherwise,
announce failure.

****

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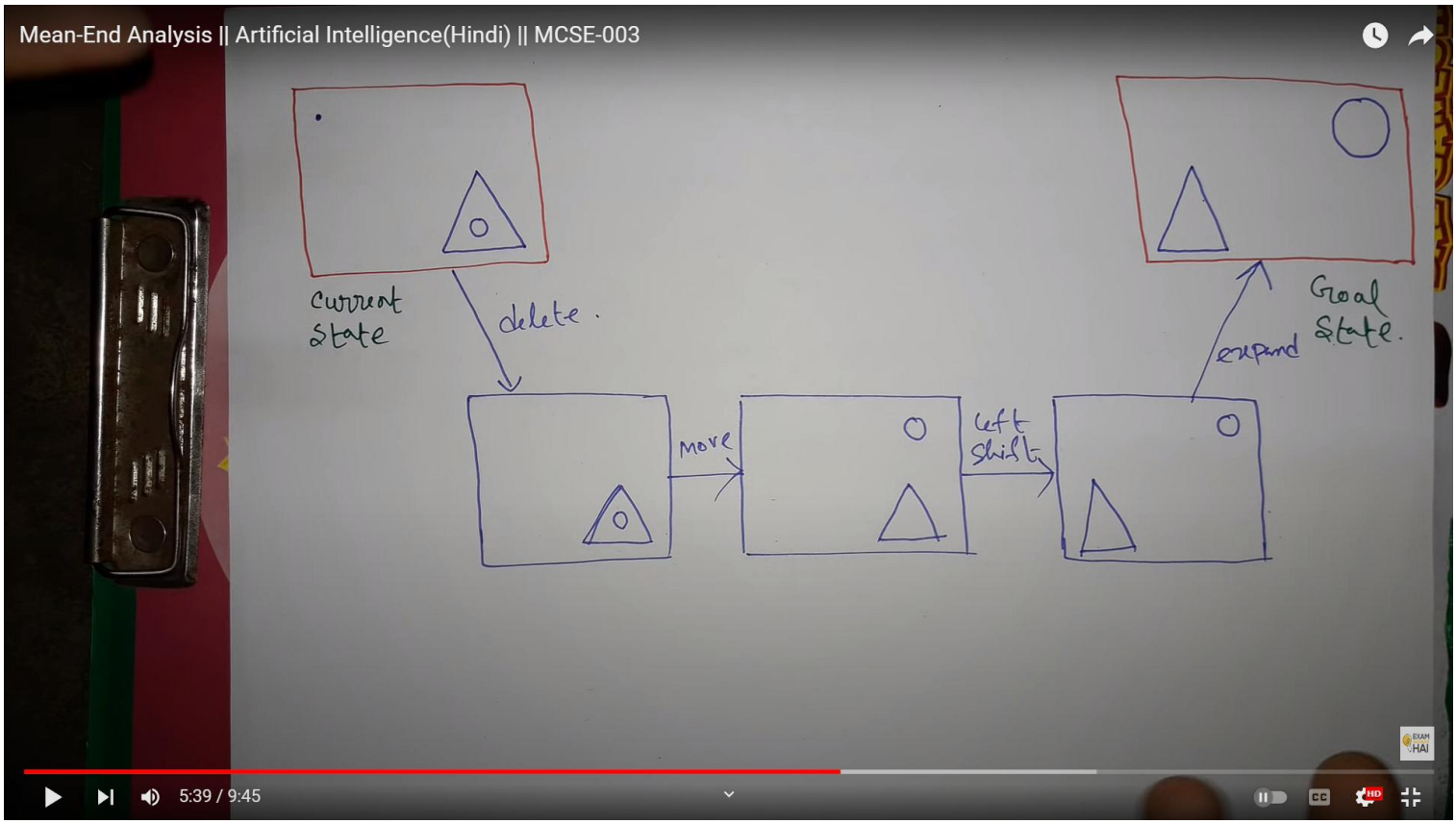
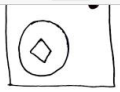
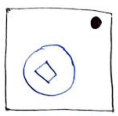
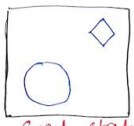

Mean-End Analysis || Artificial Intelligence(Hindi) || MCSE-003
current state
delete.
Goal State.
expand
move
Left Shift
5:39 / 9:45



Apply the concept of MEA to establish whether there are any adjustments needed. The first step is to evaluate the initial state & compare it with the end goal to establish whether there are any diff. b/w the two states.



Initial State



Goal state

Above images shows that there is a diff. b/w current & the target state, this indicates that there is a need to make adjustments to the current state to reach the end goal.

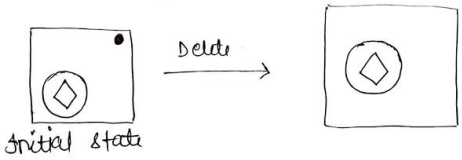
The goal can be divided into sub-goals that are ... executable actions or ops.

Above images shows that there is a diff. b/w current & the target state, this indicates that there is a need to make adjustments to the current state to reach the end goal.

The goal can be divided into sub-goals that are linked with executable actions or op^rcs).

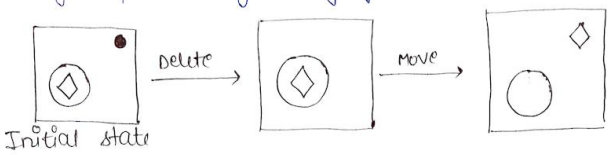
The follo. are the 3 operators that can be used to solve the problem.

1. Delete operator - dot symbol at the top right corner in the initial state doesn't exist in goal state. The dot symbol can be removed by applying the delete operator.

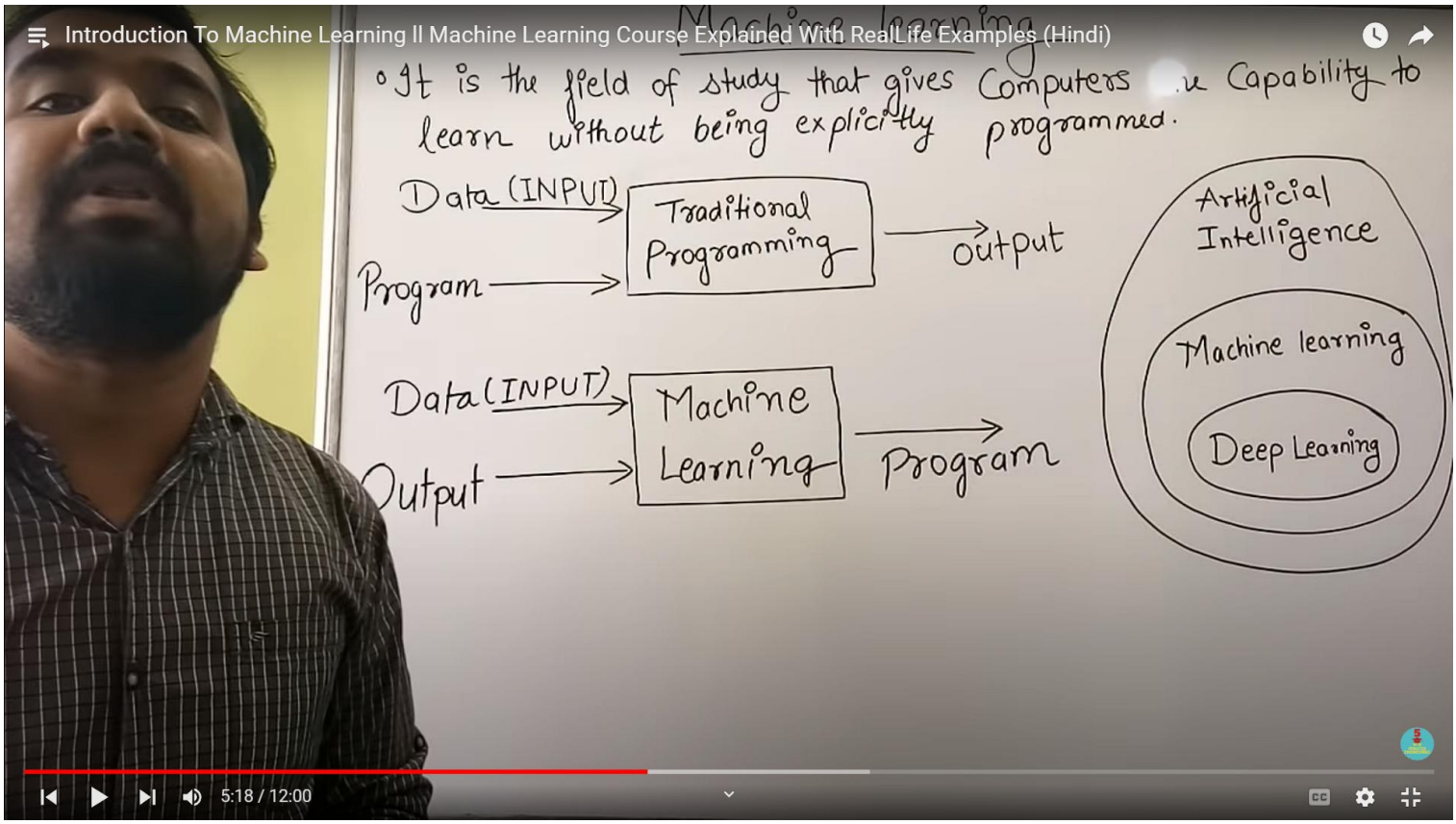


Initial state

2. Move operator - Now, compare the new state with the end state. The diamond in the new state is inside the circle while in the end state, it's at the top right corner, move this diamond symbol to the right position by applying the move operator.



3. Expand Operator - after evaluating the new state generated in step 2, find that the diamond symbol is smaller than the one in the end state, we can ↑ the size of the symbol by applying expand operator.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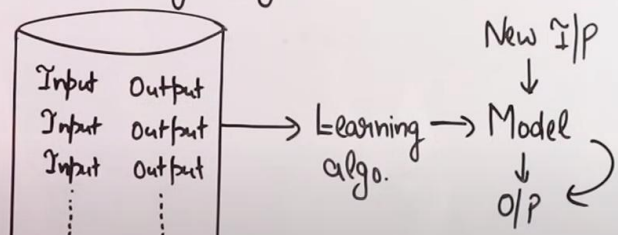
Machine learning
• It is the field of study that gives Computers the Capability to learn without being explicitly programmed.
Data (INPUT)
Program
Traditional Programming
output
Data (INPUT)
Output
Machine Learning
Program
Artificial Intelligence
Machine learning
Deep Learning
5:18 / 12:00

Supervised, Unsupervised and Reinforcement Learning in Artificial Intelligence in Hindi

Supervised Learning

- ⇒ Training Data
- ⇒ Both Inputs & outputs
- → Classification
- → Naive Bayes algo.

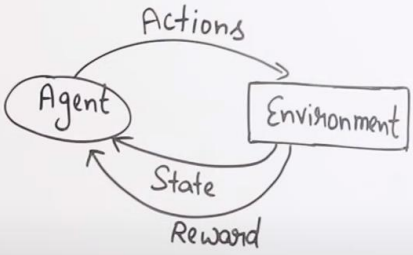


Unsupervised Learning

- ⇒ Only Inputs
- → Clustering
- → K-Mean

Reinforcement Learning

- ⇒ Reward / Penalty
- → Q-Learning



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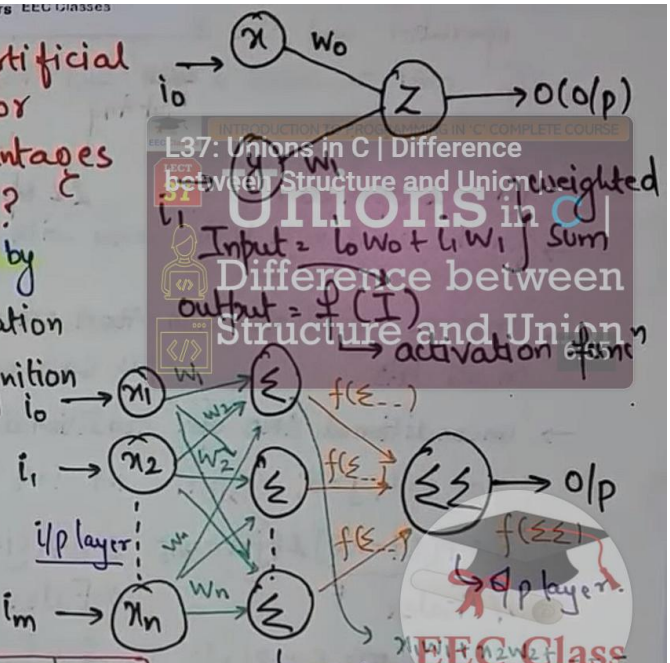
Ques:- Draw and explain architecture of Artificial Neural N/W. what is output and input for Artificial Neural N/W? what are the advantages of Neural N/W over conventional computers?

(ANN) is an info" processing paradigm that is inspired by the way of biological nervous system.

- Configured for specific appl" → i) Data classification, ii) Pattern Recognition
- MODEL → i) Interconnections, ii) Activation Function, iii) Learning Rules

Characteristics of ANN:

- i) Neurally implemented mathematical model.
- ii) Huge no. of interconnected processing elements called neurons for processing.
- iii) i/p signals arrive at processing elements through Conn" and Connected weights.



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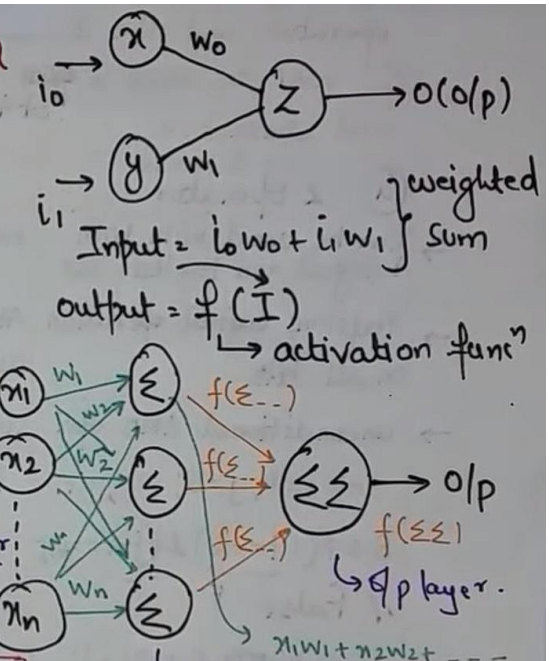

Advantages:

→ i) Ability to learn and model non-linear and complex relationship.

ii) Easy Generalization.

iii) No Restriction on i/p Vari