Artificial and Computational Intelligence

AIMLCZG557

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M1 : Introduction &

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Artificial and Computational Intelligence

Disclaimer and Acknowledgement

- Few content for these slides may have been obtained from prescribed books and various other source on the Internet
- I hereby acknowledge all the contributors for their material and inputs and gratefully acknowledge people others who made their course materials freely available online.
- .I have provided source information wherever necessary
- This is not a full fledged reading materials. Students are requested to refer to the textbook w.r.t detailed content of the presentation deck that is expected to be shared over e-learning portal - taxilla.
- I have added and modified the content to suit the requirements of the class dynamics & live session's lecture delivery flow for presentation

- **Slide Source / Preparation / Review:**
- From BITS Pilani WILP**:** Prof.Raja vadhana, Prof. Indumathi, Prof.Sangeetha
- From BITS Oncampus & External : Mr.Santosh GSK

Course Plan

M1	Introduction to AI
M2	Problem Solving Agent using Search
M3	Game Playing
M4	Knowledge Representation using Logics
M5	Probabilistic Representation and Reasoning
M6	Reasoning over time
M7	Ethics in AI

Traveller's Problem

① Environment, Percept

S_1 : No Data/info/Map

④ Exploration phase

Locality :-

D :

⑤ J_1 ← MRD, MVD } Randomization ..

⑥ transition Model

$(J_1, MR) \rightarrow DE$

$(S_0, a_1) \rightarrow S_1$

⑦ Back propagation

J_1 ⑧ Feedback / Critic

Reward Penalty

f_1 :

memory — KB ← ⑨ Learnt info / fact

Traveller's Problem

$R_1 \ldots R_{50}$

R_{51} 8 to 7 : P_1, P_2, P_3

Envi / Map

R_1

ICB

fact

f_1 $(g \to a_1) \to J_1$

f_2 $(J_1, MR) \to DE$

f_3

f_1 $(J_1, ML) \to J_2$

$(J_2, MU) \to J_3$

$(J_3, MR \to Deg)$

P_1 (8-1-2-3-7) $\to R_1$

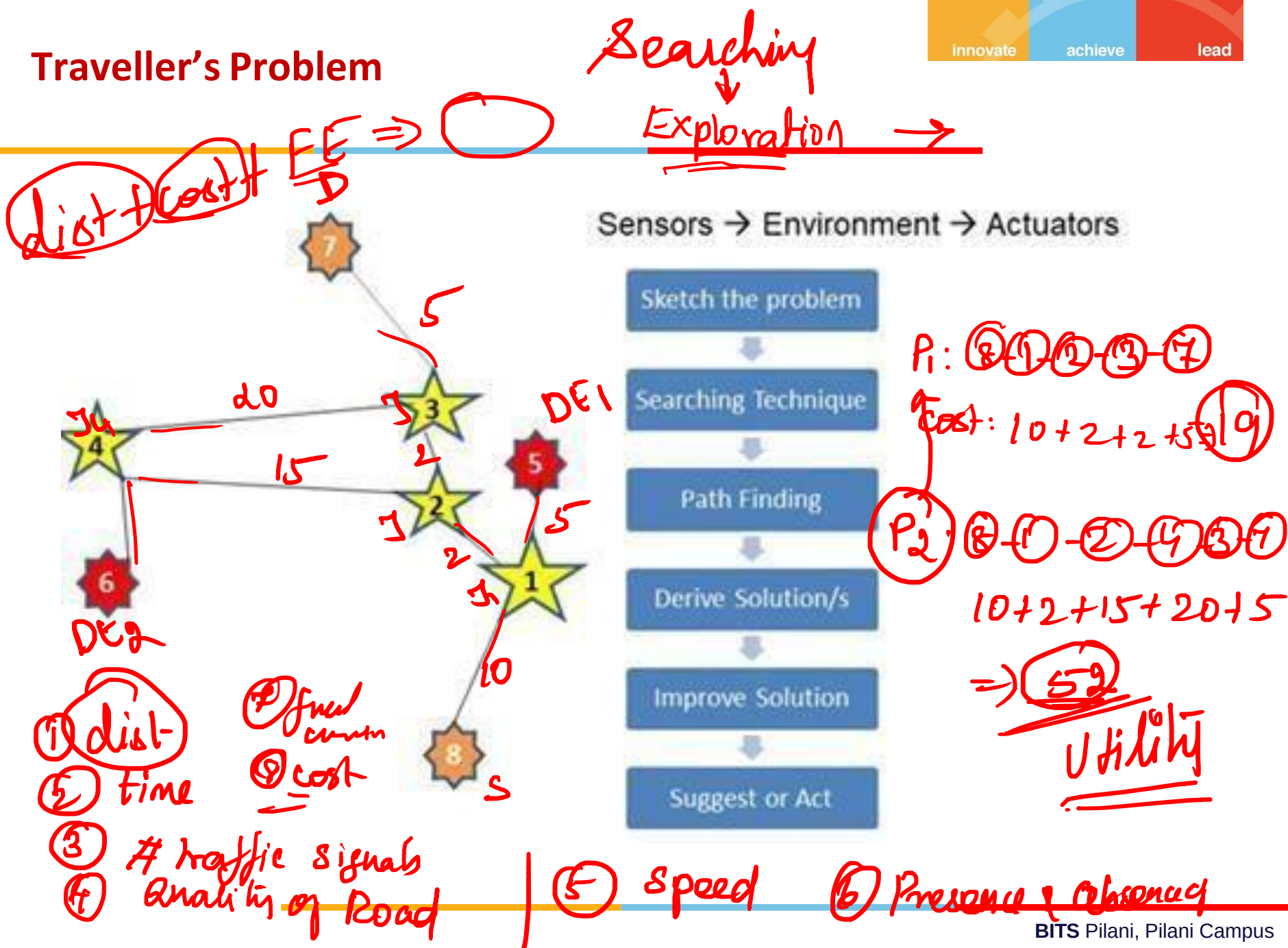
8 to 7 =

R_2 : $8 \to J_1$

Traveller's Problem

Traveller's Problem

Traveller's Problem



Traveller's Problem

Traveller's Problem

Observable event :- WC

WC → predict the Road Condn ?

D1 D2 D3 D4 D5

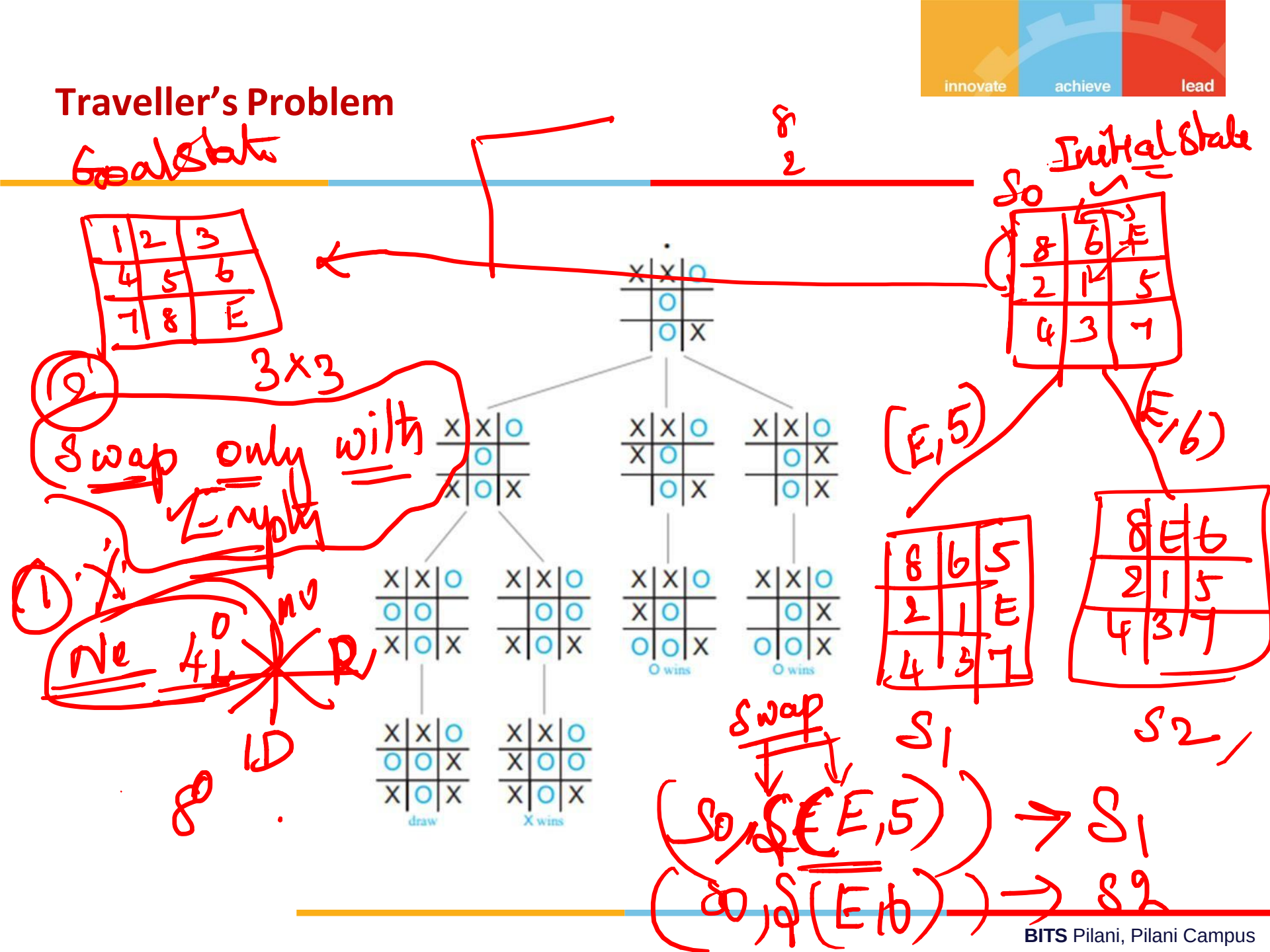
R S ? R R

RC Db

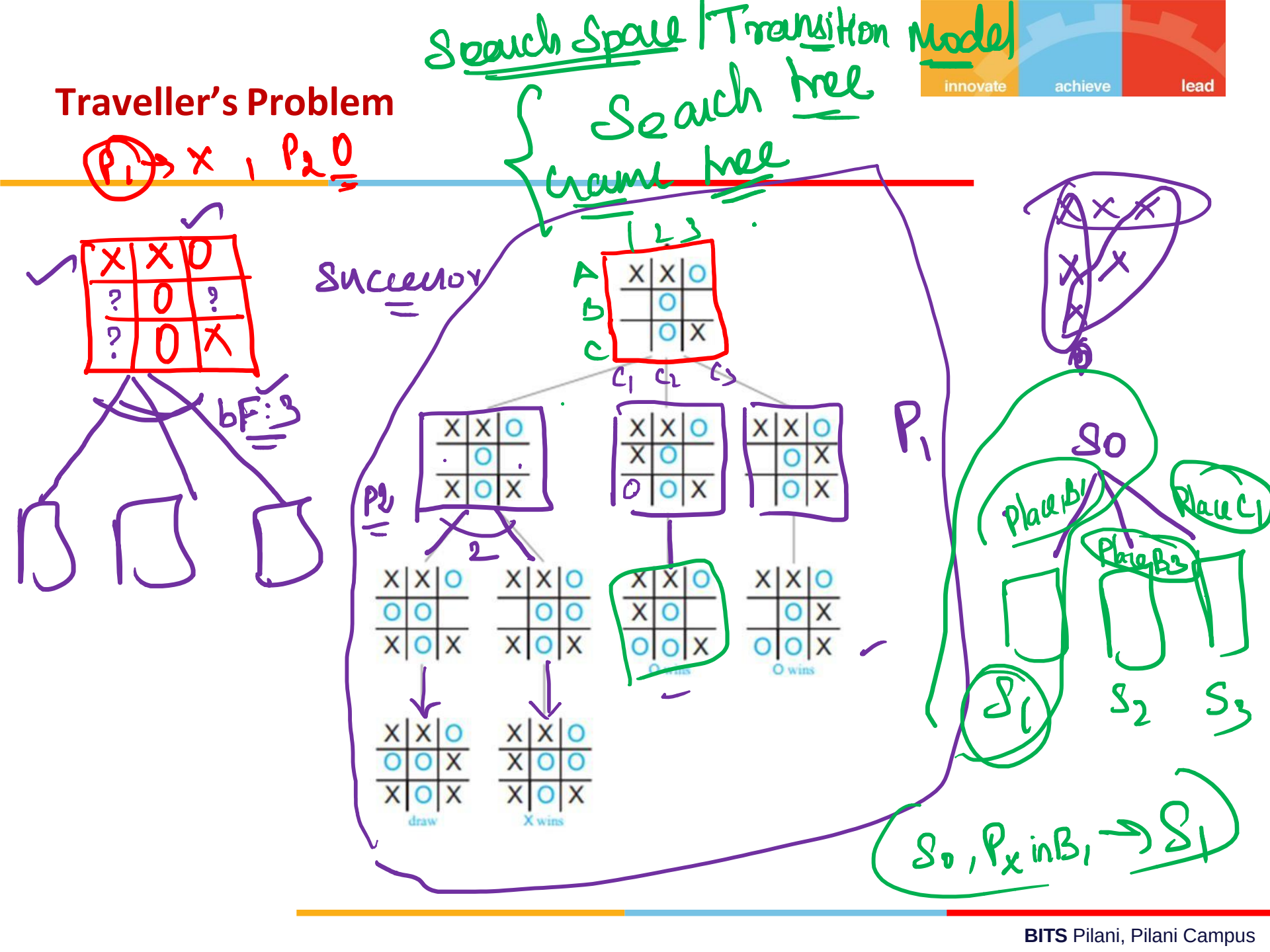
HMM

Hidden Markov Model

Traveller's Problem



Traveller's Problem



Rational Agents

Rational Agent

Design Principles & Techniques

	Thought / Reasoning	Acting
Human Performance	THINKING HUMANLY "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning, ... " (Bellman, 1978)	ACTING HUMANLY "The art of creating machines that perform functions that require intelligence when performed by people" (Kurzweil, 1990)
Rational Performance	THINKING RATIONALLY "The study of computations that make it possible to perceive, reason, and act" (Winston, 1992)	ACTING RATIONALLY "Computational intelligence is the study of the design of intelligent agents" (Poole et al., 1998)

Acting Rationally

The Rational Agent Approach

- An agent is an entity that perceives and acts

This course is about designing rational agents

- Abstractly, an agent is a function from percept histories to actions: [f: P* → A]
- For any given class of environments and tasks, we seek the agent (or class of agents) with the best performance
- Computational limitations make perfect rationality unachievable
- Design best program for given machine resources

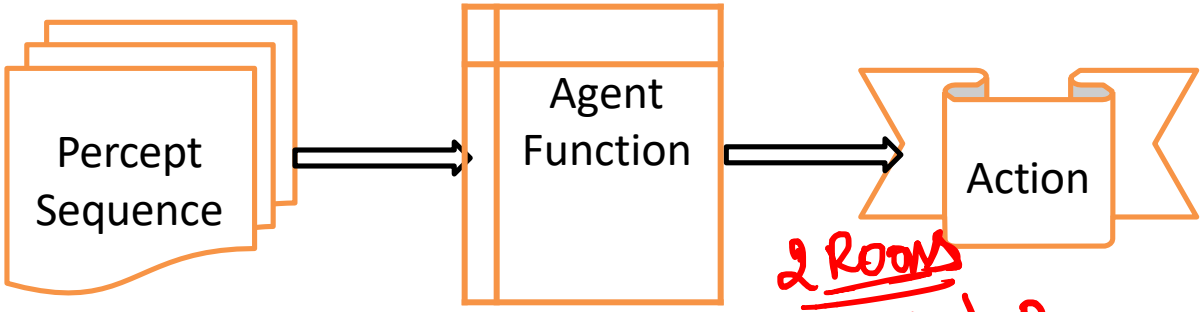
Properties of Rational Agent

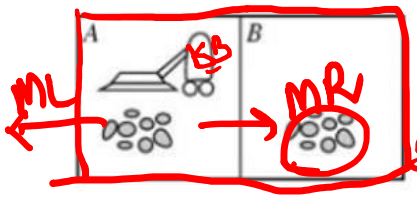
- Omniscience : Expected Vs Actual Performance
- Learning Capability : Apriori Knowledge
- Autonomous in decision making: An agent is autonomous if its behaviour is determined by its own experience (with ability to learn and adapt)

Intelligent Agent

Rational Agent is one that acts to achieve the best outcome or the best expected outcome even under uncertainty

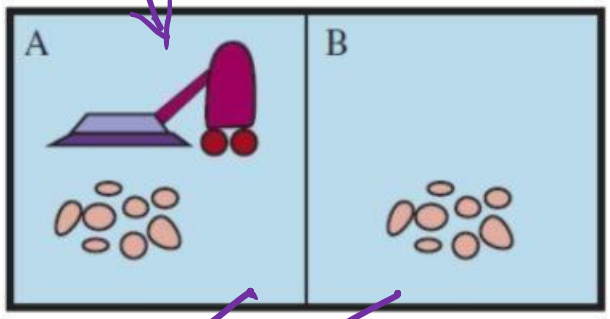
Maps / Tabulated / Programmed





Percept sequence	Action
[A,Clean]	Right
[A, Dirty]	Suck
[B, Clean]	Left
[B, Dirty]	Suck
[A, Clean],[A, Clean]	Right
[A, Clean],[A, Dirty]	Suck
...	...

Intelligent Agent



- Percepts: location and contents, e.g., [A, Dirty]
- Actions: *Left*, *Right*, *Suck*, *NoOp*

Performance measure: An objective criterion for success of an agent's behaviour

E.g., performance measure of a vacuum-cleaner agent
- amount of dirt cleaned up
- amount of time taken
- amount of electricity consumed
- amount of noise generated, etc.

P_1 P_2 P_3 P_4

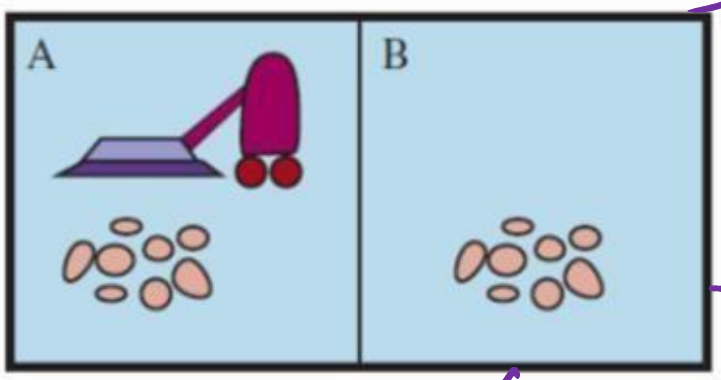
$P_1 + P_2$

$0.6\,P_1 + 0.4\,P_2$

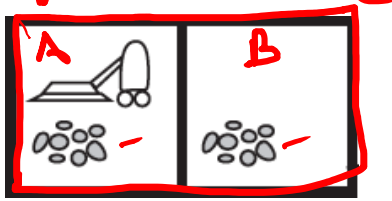
PEAS Design

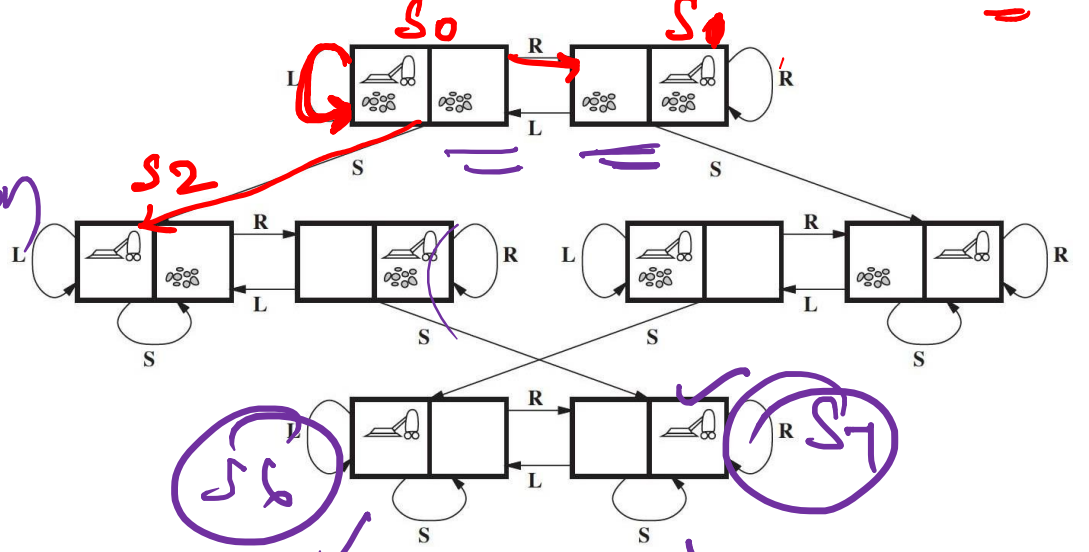
Intelligent Agent

Percept sequence	Action
[A, Clean]	Right
[A, Dirty]	Suck
[B, Clean]	Left
[B, Dirty]	Suck
[A, Clean], [A, Clean]	Right
[A, Clean], [A, Dirty]	Suck
⋮	⋮
[A, Clean], [A, Clean], [A, Clean]	Right
[A, Clean], [A, Clean], [A, Dirty]	Suck
⋮	⋮



Vacuum World Problem





	S_A	S_B	LR
S_0	1	1	1
S_0	1	1	0
S_0			

Dirt → 1

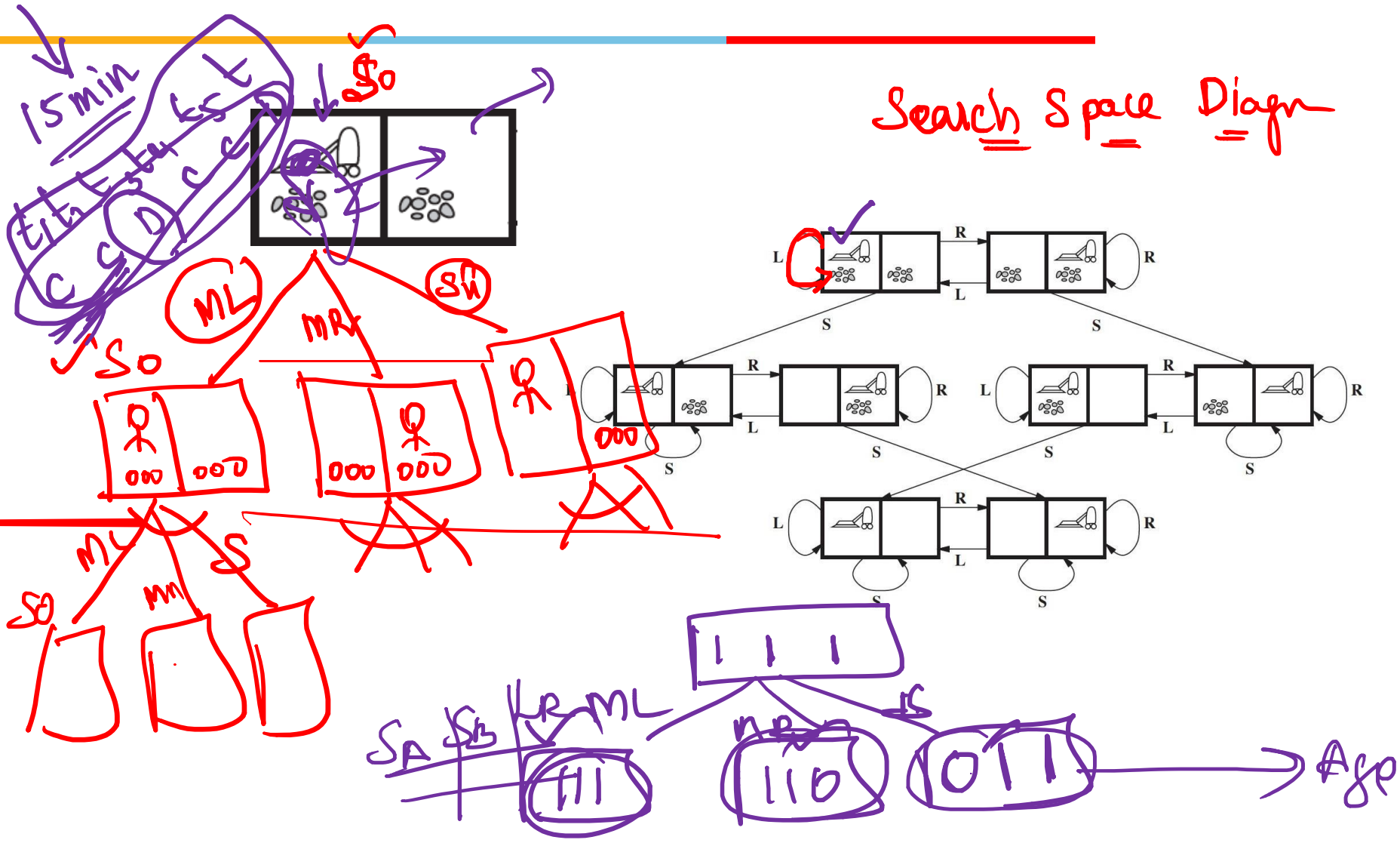
No Dirt → 0

Robot

Loc_A → 1

otherwise → 0

Vacuum World Problem



PEAS Environment

Design on what an application wants the agent to do in the environment

Agent	Performance	Environment	Sensors	Actuators
Medical diagnosis system	Healthy patient, reduced costs	Patient, hospital, staff	Keyboard entry of symptoms, findings, patient's answers	Display of questions, tests, diagnosis, treatments, referrals
Satellite Image analysis system	Correct image categorization	Downlink from orbiting satellite	Color pixel analysis	Display of scene categorization
Interactive English tutor	Student's score on test	Set of students, testing agency	Keyboard entry	Display of exercises, suggestions, corrections

Required Reading: AIMA - Chapter #2

Thank You for all your Attention

Note : Some of the slides are adopted from AIMA TB materials