



# UNIT – 1

## ARTIFICIAL INTELLIGENCE CS6659

**Means End Analysis**

# MEANS-ENDS ANALYSIS (MEA)

- It centers around the detection of difference between current and goal states.
- Once such a difference is isolated, an operator that can reduce the difference must be found.
- The action is performed on the current state to produce a new state.
- The process is recursively applied to this new state and the goal state
- It is quite possible that chosen operator can not be applied to the current state immediately



# EXAMPLE

- Assume S and G are start and goal states

**S**

**B\_\_\_\_C**

**G**

**Start**

**Operator**

**Goal**

- By solving B to C, difference between S, B and C, G is reduced.
- Order in which the differences are considered is critical.
- Important that significant difference be reduced before less significant otherwise great deal of effort may be wasted.
- This method is not adequate for solving complex problems, since working on one difference may interfere with the plan of reducing another.

# *CONT...*

- Reduce the difference between S & B and similarly between C & G.
- MEA also relies on a set of rules just like in other problem solving techniques.
- These rules are usually not represented with complete state description on each side.
- Instead they are represented as
  - left side that describes preconditions and
  - right side that describes those aspects of the problem state that will be changed by application of the rule.



# *EXAMPLE: HOUSE HOLD ROBOT*

- Find a sequence of actions robot performs
  - **Move desk with two things on it from one location S to another G.**
- Operators are: PUSH, CARRY, WALK, PickUp, PutDown and PLACE.
- Main difference :
  - Change of location of desk from initial position to goal position
- Here objects on top must also be moved.
- Data structure called 'Difference Table' indexes the rules by the differences that they can be used to reduce.

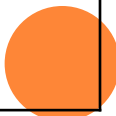


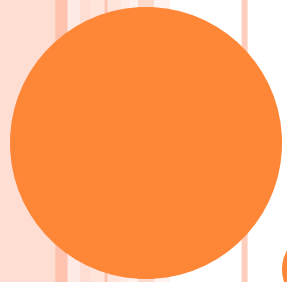
# CONT...

Operator	Pre-conditions	Result
<b>PUSH(obj, loc)</b>	<b><math>\text{At}(\text{robot}, \text{obj}) \wedge \text{Large}(\text{obj}) \wedge \text{Clear}(\text{obj}) \wedge \text{AE}</math></b>	<b><math>\text{At}(\text{obj}, \text{loc}) \wedge \text{At}(\text{robot}, \text{loc})</math></b>
<b>CARRY(obj, loc)</b>	<b><math>\text{At}(\text{robot}, \text{obj}) \wedge \text{Small}(\text{obj})</math></b>	<b><math>\text{At}(\text{obj}, \text{loc}) \wedge \text{At}(\text{robot}, \text{loc})</math></b>
<b>WALK(loc)</b>	<b>None</b>	<b><math>\text{At}(\text{robot}, \text{loc})</math></b>
<b>PU(obj)</b>	<b><math>\text{At}(\text{robot}, \text{obj})</math></b>	<b>Hold(obj)</b>
<b>PD(obj)</b>	<b>Hold(obj)</b>	<b><math>\sim \text{Hold}(\text{obj})</math></b>
<b>PLACE(Obj1, obj2)</b>	<b><math>\text{At}(\text{robot}, \text{obj2}) \wedge \text{Hold}(\text{obj1})</math></b>	<b><math>\text{On}(\text{obj1}, \text{obj2})</math></b>

# ***DIFFERENCE TABLE***

	<b>PUSH</b>	<b>CARRY</b>	<b>WALK</b>	<b>PU</b>	<b>PD</b>	<b>PLACE</b>
<b>Move object</b>	*	*				
<b>Move robot</b>			*			
<b>Clear object</b>				*		
<b>Get obj1 on obj2</b>						*
<b>Get arm empty</b>					*	*
<b>Hold object</b>				*		





**THANK YOU**