

* Task-1

$$\text{UNIFY}(\alpha, \beta) = \theta$$

$$\text{if } \alpha\theta = \beta\theta$$

- ① $\text{Taller}(x, \text{John}); \text{Taller}(\text{Bob}, y)$
 $\{x/\text{Bob}, y/\text{John}\}$
- ② $\text{Taller}(y, \text{mother}(x)); \text{Taller}(\text{Bob}, \text{mother}(\text{Bob}))$
 $\{x/\text{Bob}, y/\text{Bob}\}$
- ③ $\text{Taller}(\text{Sam}, \text{Mary}); \text{Shorter}(x, \text{Sam})$
 $\{x/\text{Mary}\}$
- ④ $\text{Shorter}(x, \text{Bob}); \text{Shorter}(y, z)$
 $\{x/y, z/\text{Bob}\}$
- ⑤ $\text{Shorter}(\text{Bob}, \text{John}); \text{Shorter}(x, \text{Mary})$
 - unifier does not exist for this pair of predicate

* Task-2
 \Rightarrow Semantics:-
 \rightarrow (Initial State)
Pre-conditions:-

$(\text{on-left } x): x \text{ is on left}$
 $(\text{on-right } x): x \text{ is on right}$
 $(\text{is-child } x): x \text{ is a child}$
 $(\text{is-adult } x): x \text{ is an adult}$
 $(\text{is-boat } x): x \text{ is a boat}$
 $A_1, A_2: \text{Adults}$
 $C_1, C_2: \text{children}$
 $B: \text{Boat}$

$(\text{on-left } A_1)$
 $(\text{on-left } A_2)$
 $(\text{on-left } C_1)$
 $(\text{on-left } C_2)$
 $(\text{is-Adult } A_1)$
 $(\text{is-Adult } A_2)$
 $(\text{is-child } C_1)$
 $(\text{is-child } C_2)$
 $(\text{is-boat } B)$
 $(\text{on-left } B)$

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⇒ Goal state:-

* Actions:-

(on-right A1)

(on-right A2)

(on-right c1)

(on-right c2)

⇒ Actions: 1

- Action: Move One To Right (x, y)

- Precondition: (on-left x) \wedge

(on-left y) \wedge

(is-boat y)

⇒ Actions: 2

- effect: NOT (on-left x) \wedge NOT
(on-left y) \wedge (on-right x)

- Action: Move One To Left
(x, y)

\wedge (on-right y)

- Precondition: (on-right x) \wedge (on-right y) \wedge (is-boat y)

- Effect: NOT (on-right x) \wedge NOT (on-right y) \wedge (on-left x)
 \wedge (on-left y)

⇒ Action: 3

- Action: Move Two To Right (x, y, z)

- Precondition: (on-left x) \wedge (on-left y) \wedge (on-left z) \wedge
(is-child x) \wedge (is-child y) \wedge (is-boat z)

- Effect: NOT (on-left x) \wedge NOT (on-left y) \wedge NOT (on-left z)
 \wedge (on-right x) \wedge (on-right y) \wedge (on-right z)

⇒ Action: 4

- Action: Move Two To Left (x, y, z)

- Precondition: (on-right x) \wedge (on-right y) \wedge (on-right z) \wedge
(is-child x) \wedge (is-child y) \wedge (is-boat z)

- Effect: NOT (on-right x) \wedge NOT (on-right y) \wedge NOT (on-right z)
 \wedge (on-left x) \wedge (on-left y) \wedge (on-left z)

* Plans:-

Move Two To Right (c1, c2, B)

move one to Left (c1, B)

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move one to Right (A₁, B)
move one to Left (C₂, B)
move Two to Right (C₁, (2, B)
move one to Left (C₁, B)
move one to Right (A₂, B)
move one to Left (C₂, B)
move Two to Right (C₁, (2, B)

* Task-3

Predicates = 3, Arguments = 4, Constants = 5

Combination of Arguments = $5^4 = 625$

Total value = $3 \times 625 = 1875$

or Total no. of world states = 2^{1875}

min:- Predicates with 1 arg = $3 \times 5^1 = 15$

max:- " " 4 arg = $3 \times 5^4 = 1875$

⇒ Total no. of ways to argument all the constants
= [min no. of PDDL states, max n of PDDL states]
= [15, 1875]

⇒ Tight bound on the no. of unique states in the

* Task-4 JUNGLE world = [15, 1875]

⇒ Execution monitoring / online Replanning

- The actions are unchanged. The plan is generated as though it is a deterministic world.

- Only when executing the plan we monitor what happens if necessary.

⇒ Conditional planning:-

The actions move one to Right, move one to Left have to be modified.

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Miracle

Pg.No :

Date: / / 201

Action:- move one to right (x, y)

Precondition:- $(\text{on-left } x) \wedge (\text{on-left } y) \wedge (\text{is-boat } y)$

Effect:- $[(\text{on-left } x) \wedge (\text{on-left } y)] \vee [(\text{on-right } x) \wedge (\text{on-right } y) \wedge \text{NOT}(\text{on-left } x) \wedge \text{NOT}(\text{on-left } y)]$

Action:- move one to left (x, y)

Precondition:- $(\text{on-right } x) \wedge (\text{on-right } y) \wedge (\text{is-boat } y)$

Effect:- $[(\text{on-right } x) \wedge (\text{on-right } y)] \vee [(\text{on-left } x) \wedge (\text{on-left } y) \wedge \text{NOT}(\text{on-right } x) \wedge \text{NOT}(\text{on-right } y)]$