# Heuristic calculation: example (I)

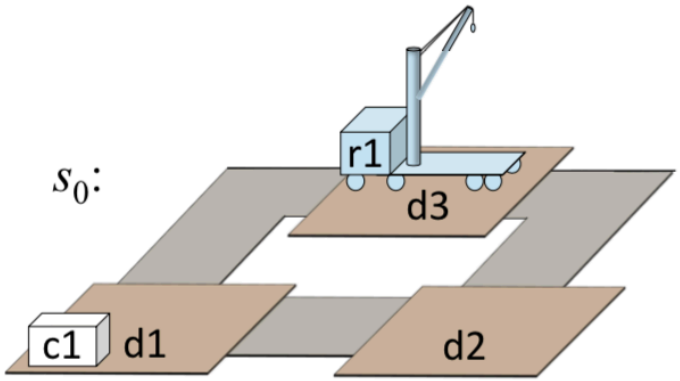
$$B = Robots \cup Docks \cup Containers \cup \{\mathsf{nil}\};$$
$$Robots = \{\mathsf{r}_1\};$$
$$Docks = \{\mathsf{d}_1, \mathsf{d}_2, \mathsf{d}_3\};$$
$$Containers = \{\mathsf{c}_1\}.$$

load$(r, c, l)$
pre: cargo$(r) = $nil, loc$(c) = l$, loc$(r) = l$
eff: cargo$(r) \leftarrow c$, loc$(c) \leftarrow r$
cost: 1

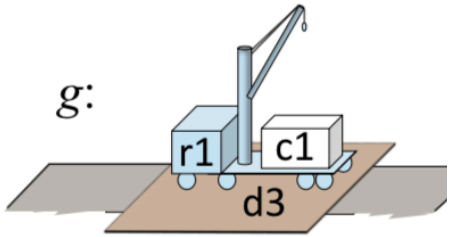
unload$(r, c, l)$
pre: cargo$(r) = c$, loc$(r) = l$
eff: cargo$(r) \leftarrow$ nil, loc$(c) \leftarrow l$
cost: 1

move$(r, d, e)$
pre: loc$(r) = d$
eff: loc$(r) \leftarrow e$
cost: 1

$s_0$:



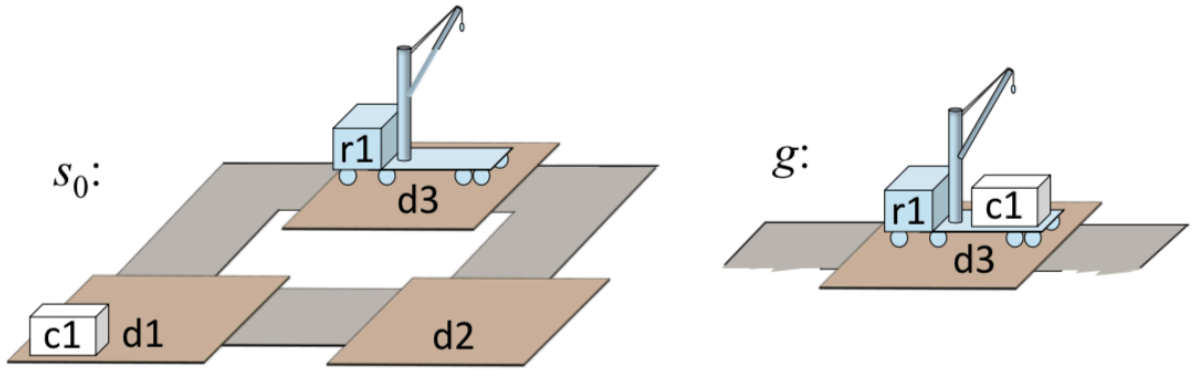

$g$:




$$s_0 = \{\mathsf{loc(r1)} = \mathsf{d3}, \mathsf{cargo(r1)} = \mathsf{nil}, \mathsf{loc(c1)} = \mathsf{d1}\};$$
$$g = \{\mathsf{loc(r1)} = \mathsf{d3}, \mathsf{loc(c1)} = \mathsf{r1}\}.$$

# Heuristic calculation: example (II)

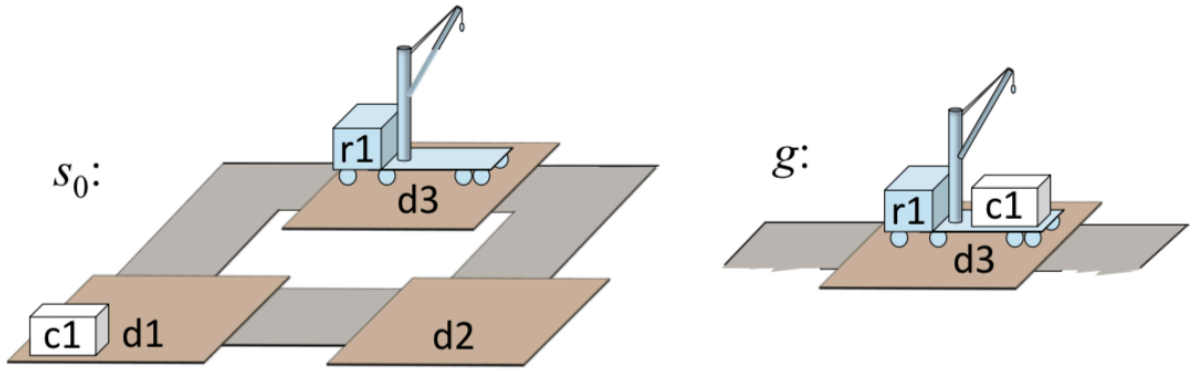
- Actions?
  - a1 = move (r1, d3, d1)
  - a2 = move(r1, d3, d2)




s1 = γ(s0, a1) = {loc(r1) = d1, cargo(r1) = nil, loc(c1) = d1}
s2 = γ(s0, a2) = {loc(r1) = d2, cargo(r1) = nil, loc(c1) = d1}

# Heuristic calculation: example (II)

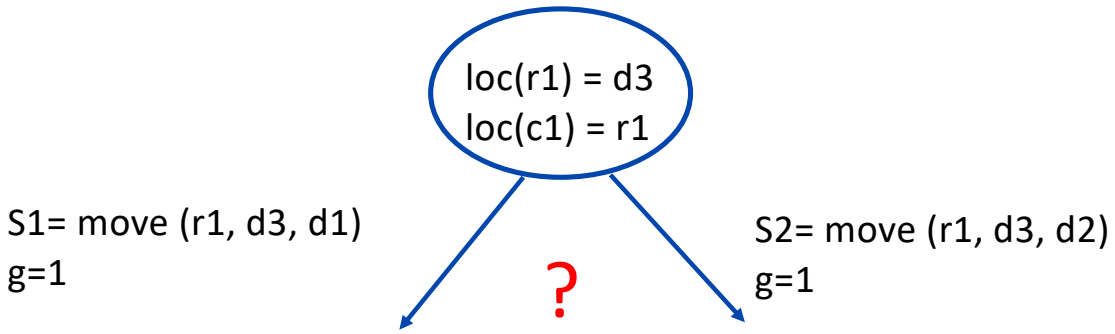
- Actions?
  - a1 = move (r1, d3, d1)
  - a2 = move(r1, d3, d2)




s1 = γ(s0, a1) = {loc(r1) = d1, cargo(r1) = nil, loc(c1) = d1}
s2 = γ(s0, a2) = {loc(r1) = d2, cargo(r1) = nil, loc(c1) = d1}

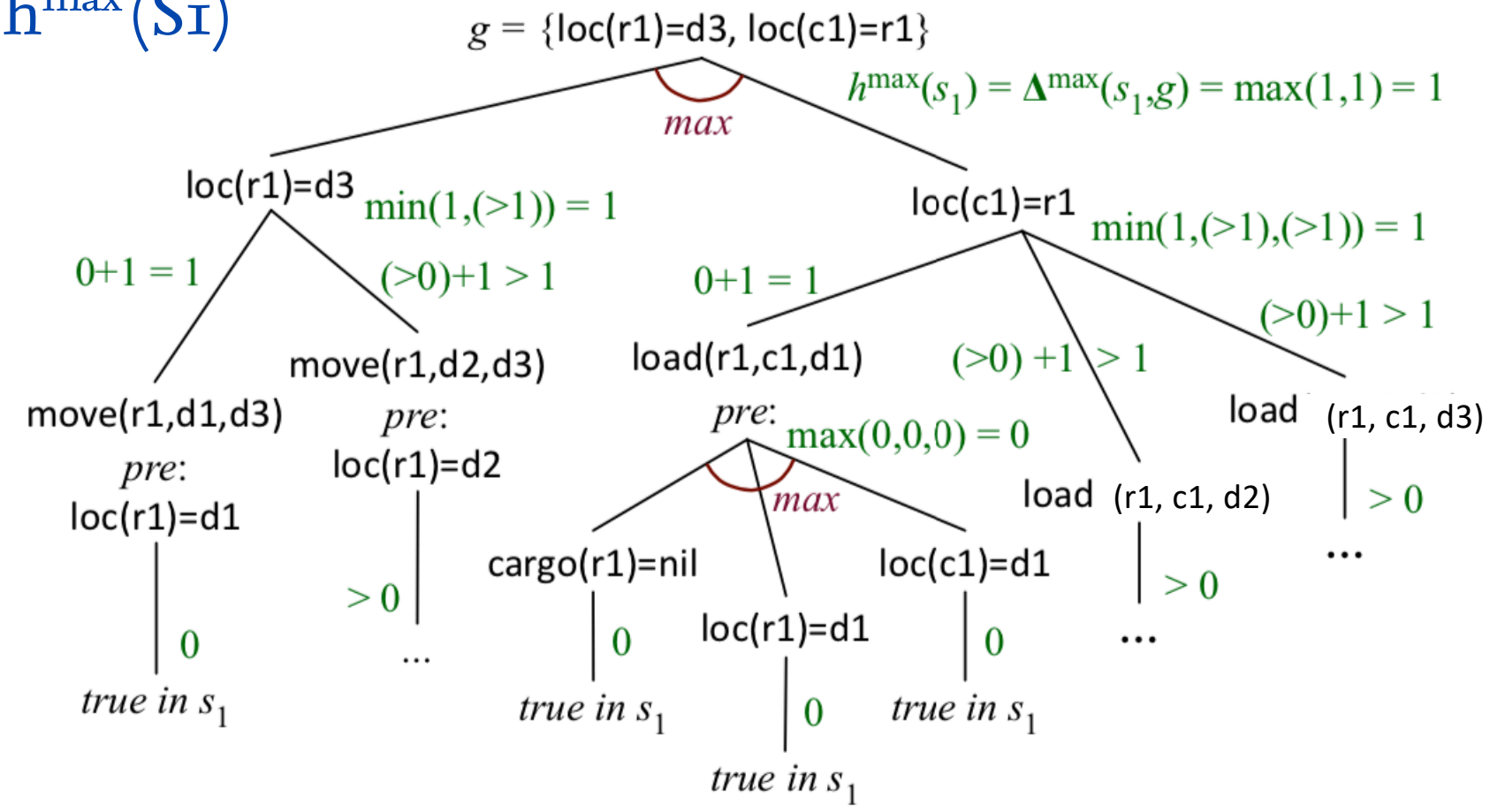
**Can you calculate the value of $h^{add}$ and $h^{max}$ for S2? We just calculate for S1**

# Search tree

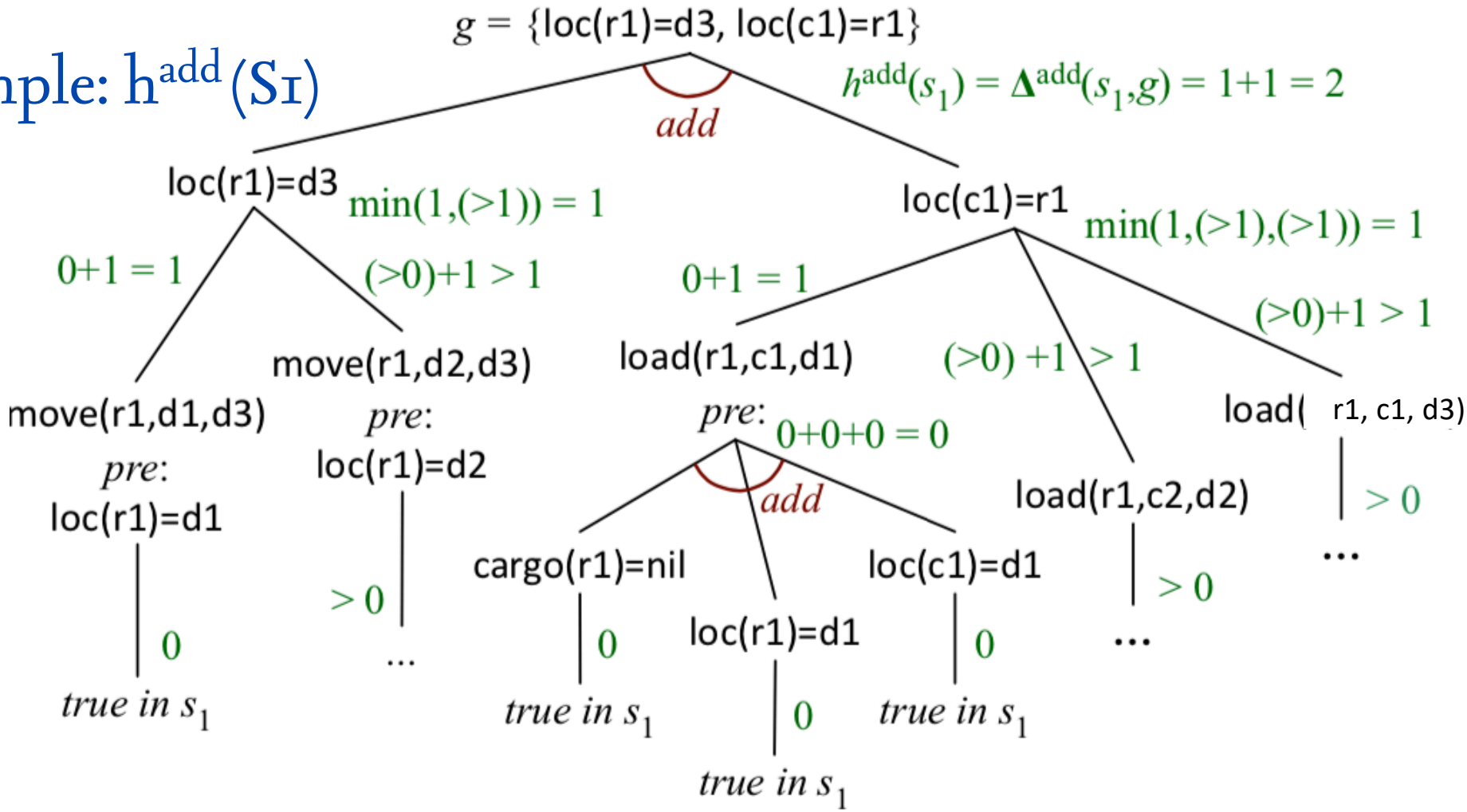



$$s_0 = \{\text{loc(r1)} = \text{d3}, \text{cargo(r1)} = \text{nil}, \text{loc(c1)} = \text{d1}\};$$
$$g = \{\text{loc(r1)} = \text{d3}, \text{loc(c1)} = \text{r1}\}.$$

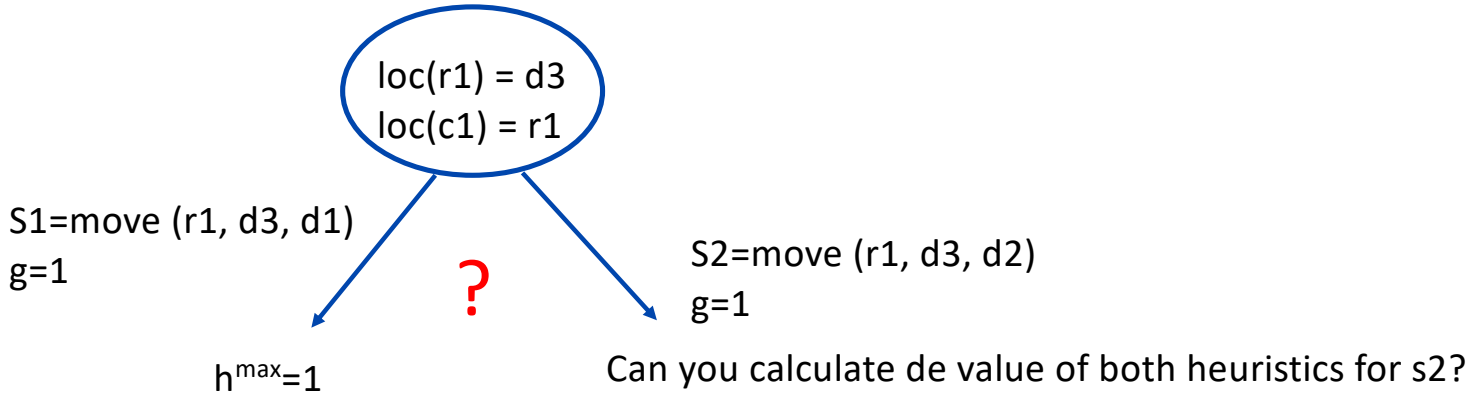
# Example: $h^{max}(S_1)$



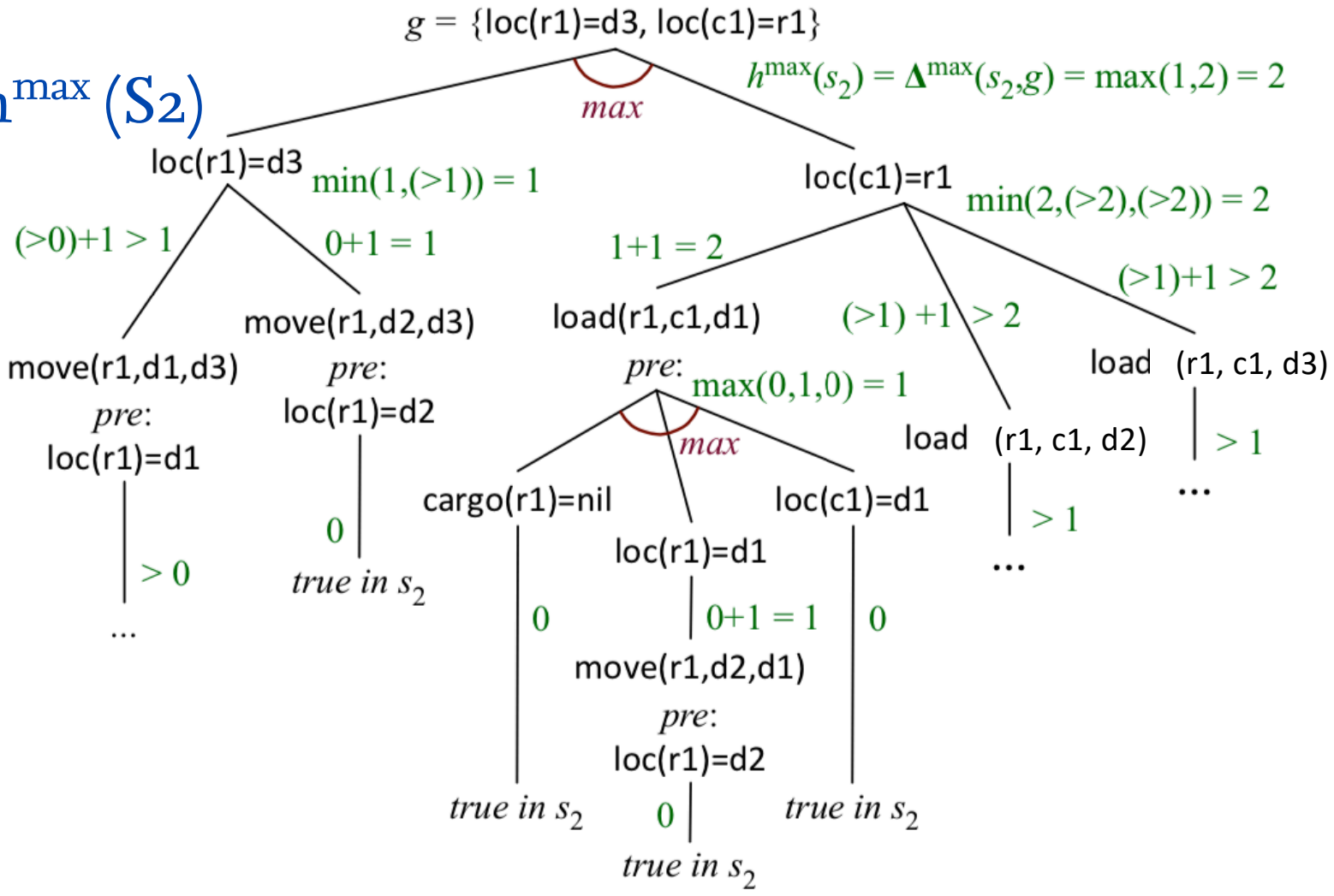
# Example: $h^{add}(S_1)$



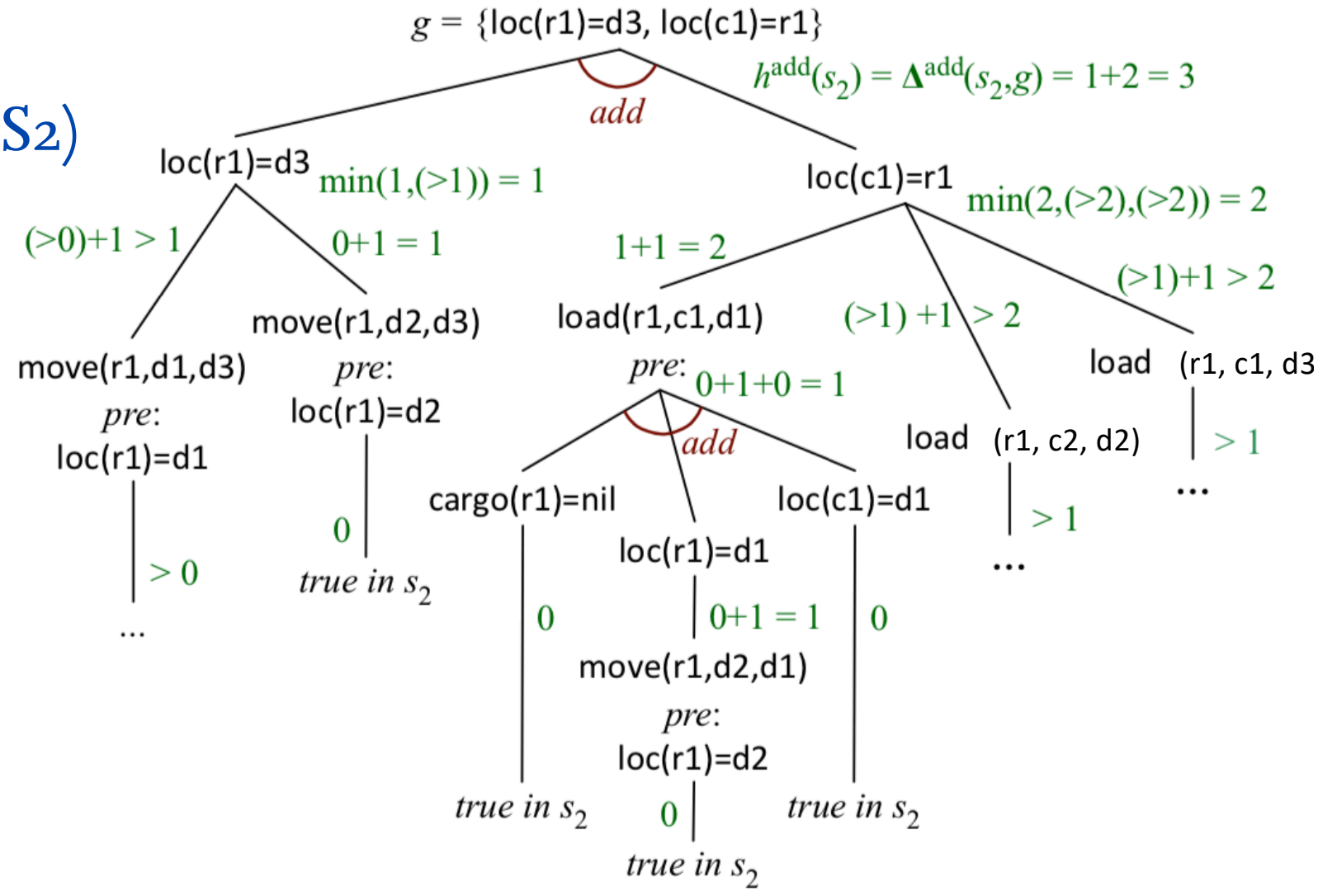
# Search tree


loc(r1) = d3
loc(c1) = r1
S1=move (r1, d3, d1)
g=1
?
S2=move (r1, d3, d2)
g=1
$h^{max}$=1
Can you calculate de value of both heuristics for s2?

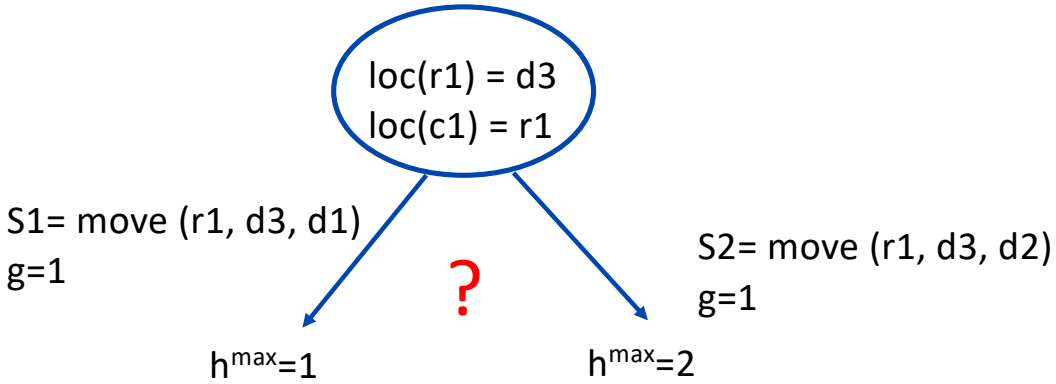
# Example: $h^{max}$ (S2)



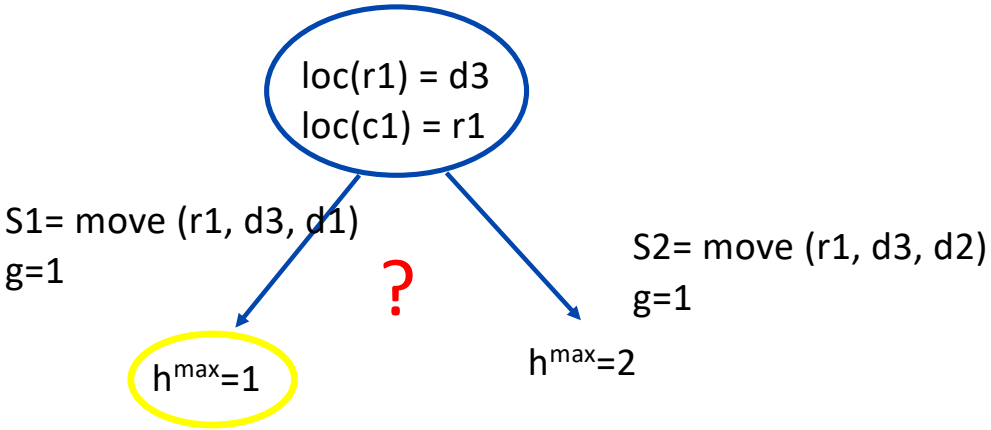
# Example: $h^{add}$ (S2)



# Search tree


loc(r1) = d3
loc(c1) = r1
S1= move (r1, d3, d1)
g=1
?
S2= move (r1, d3, d2)
g=1
h^max=1
h^max=2

# Search tree


loc(r1) = d3
loc(c1) = r1
S1= move (r1, d3, d1)
g=1
?
S2= move (r1, d3, d2)
g=1
h^max=1
h^max=2

# ToDo Example

- Calculate $h^+$ for the problem for the state S1 move (r1, d3, d1) and S2 move (r1, d3, d2)

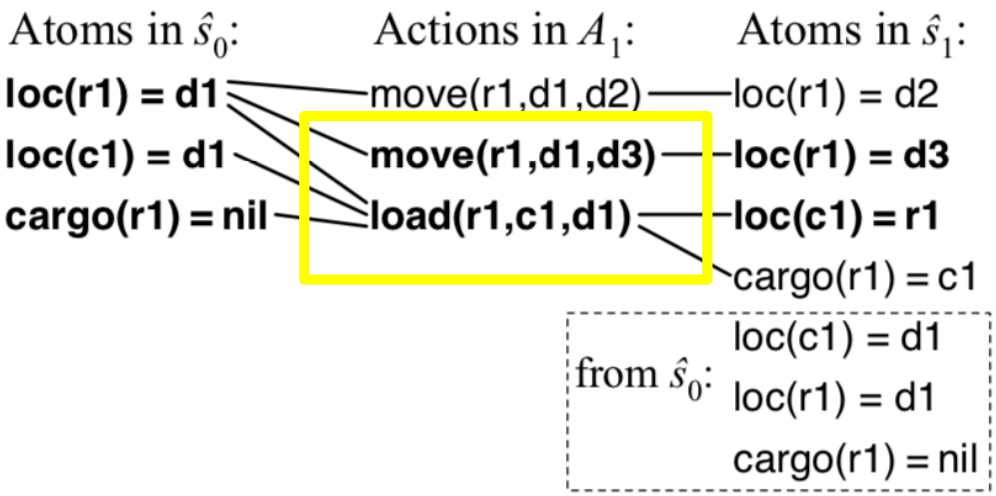
load$(r, c, l)$
pre: cargo$(r) =$ nil, loc$(c) = l$, loc$(r) = l$
eff: cargo$(r) \leftarrow c$, loc$(c) \leftarrow r$
cost: 1

unload$(r, c, l)$
pre: cargo$(r) = c$, loc$(r) = l$
eff: cargo$(r) \leftarrow$ nil, loc$(c) \leftarrow l$
cost: 1

move$(r, d, e)$
pre: loc$(r) = d$
eff: loc$(r) \leftarrow e$
cost: 1

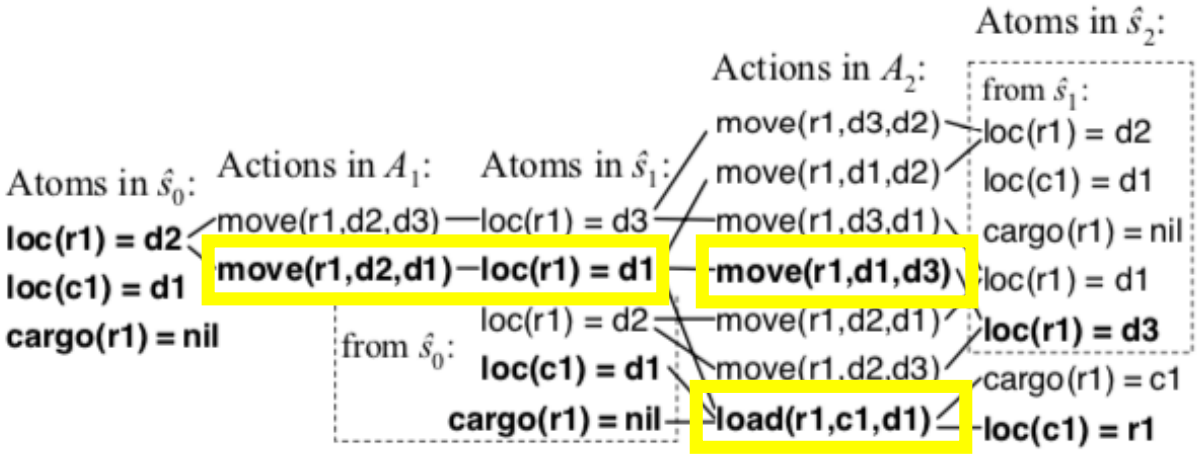
$s_0 = \{\text{loc(r1)} = \text{d3}, \text{cargo(r1)} = \text{nil}, \text{loc(c1)} = \text{d1}\};$
$g = \{\text{loc(r1)} = \text{d3}, \text{loc(c1)} = \text{r1}\}.$

# ToDo Example: Solution for S1




$h_{FF}^{+} = 2$

# ToDo Example: Solution for S2




$h_{FF}^{+} = 3$