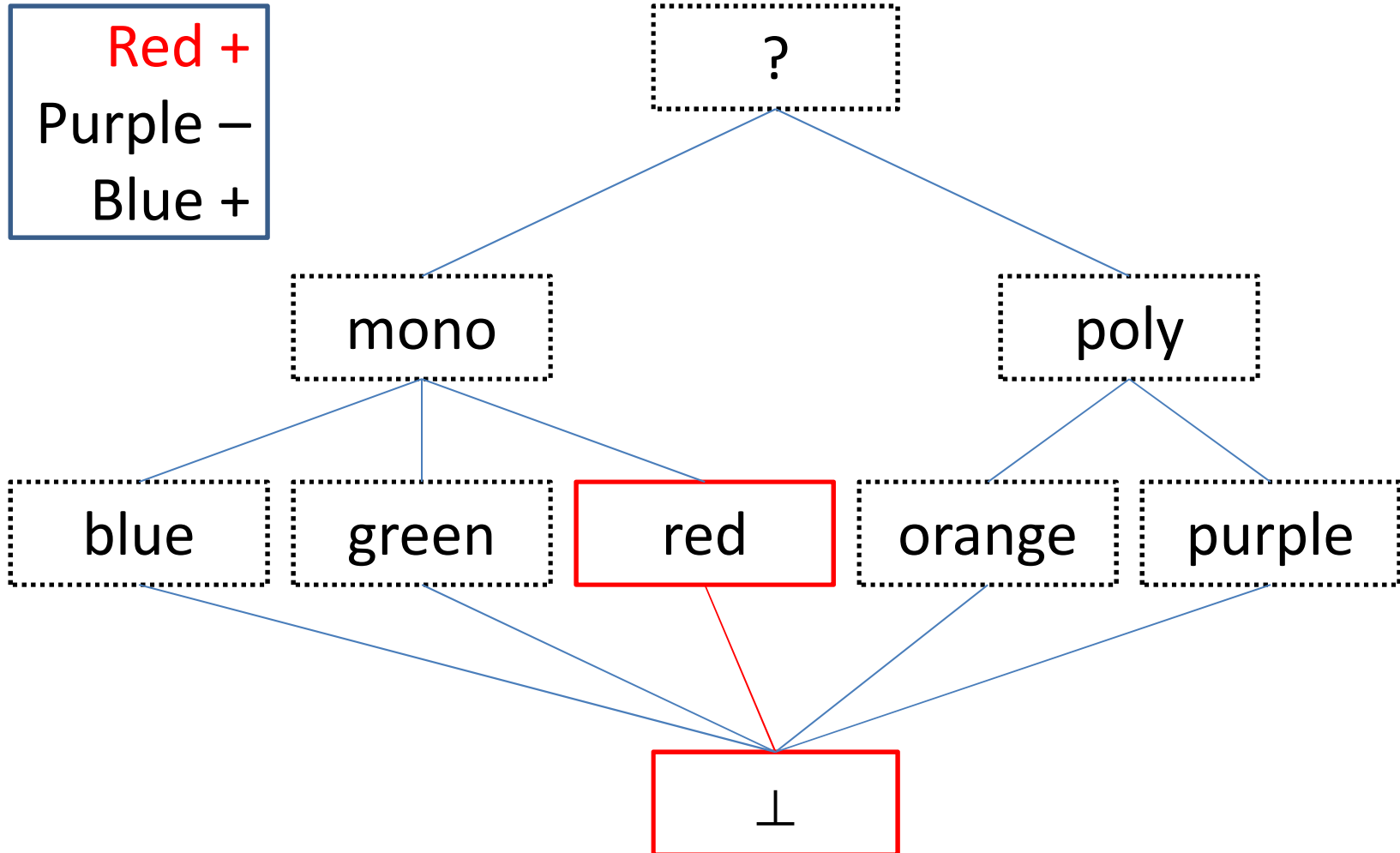


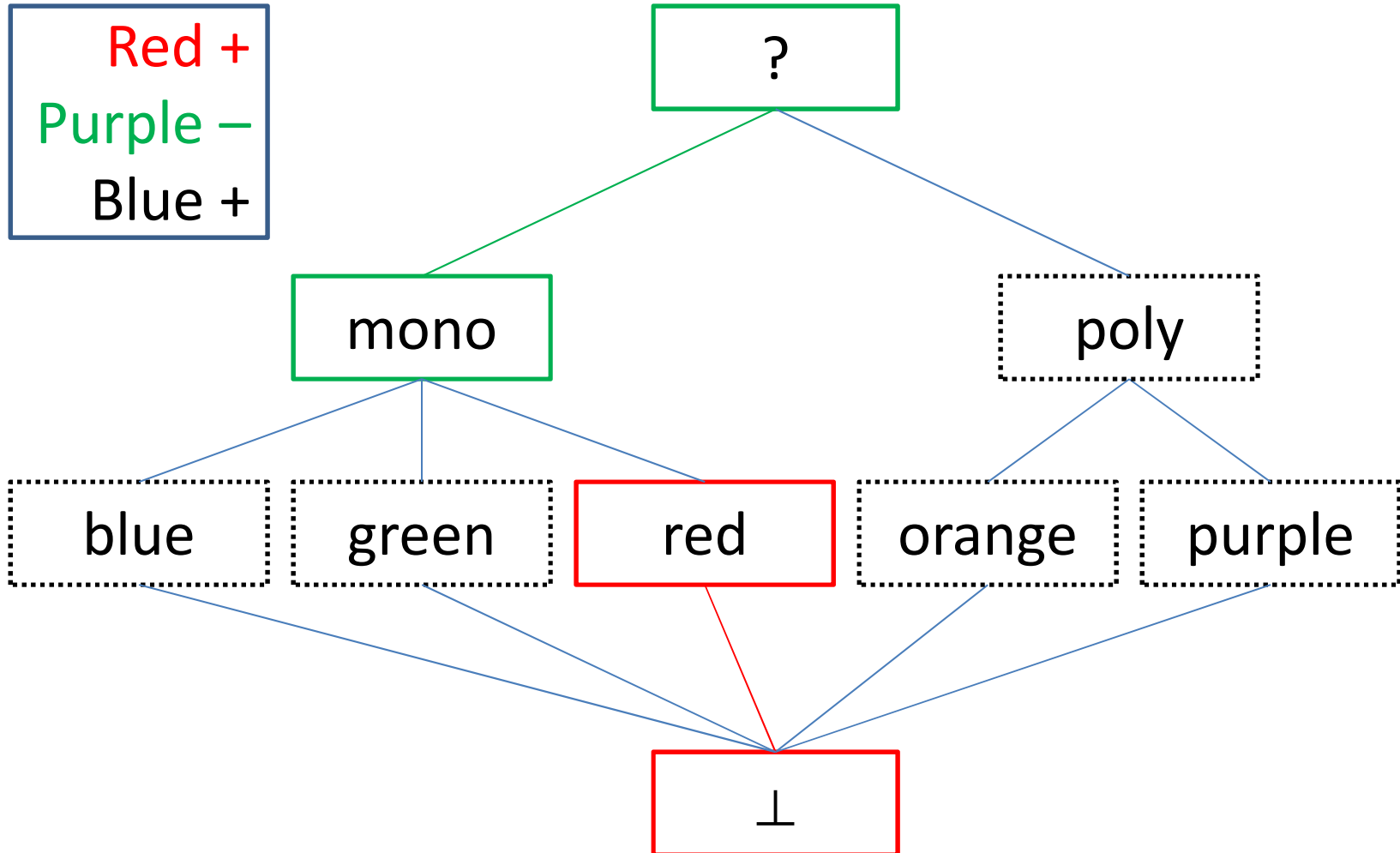
Exercises: Artificial Intelligence

Version Spaces: Colors

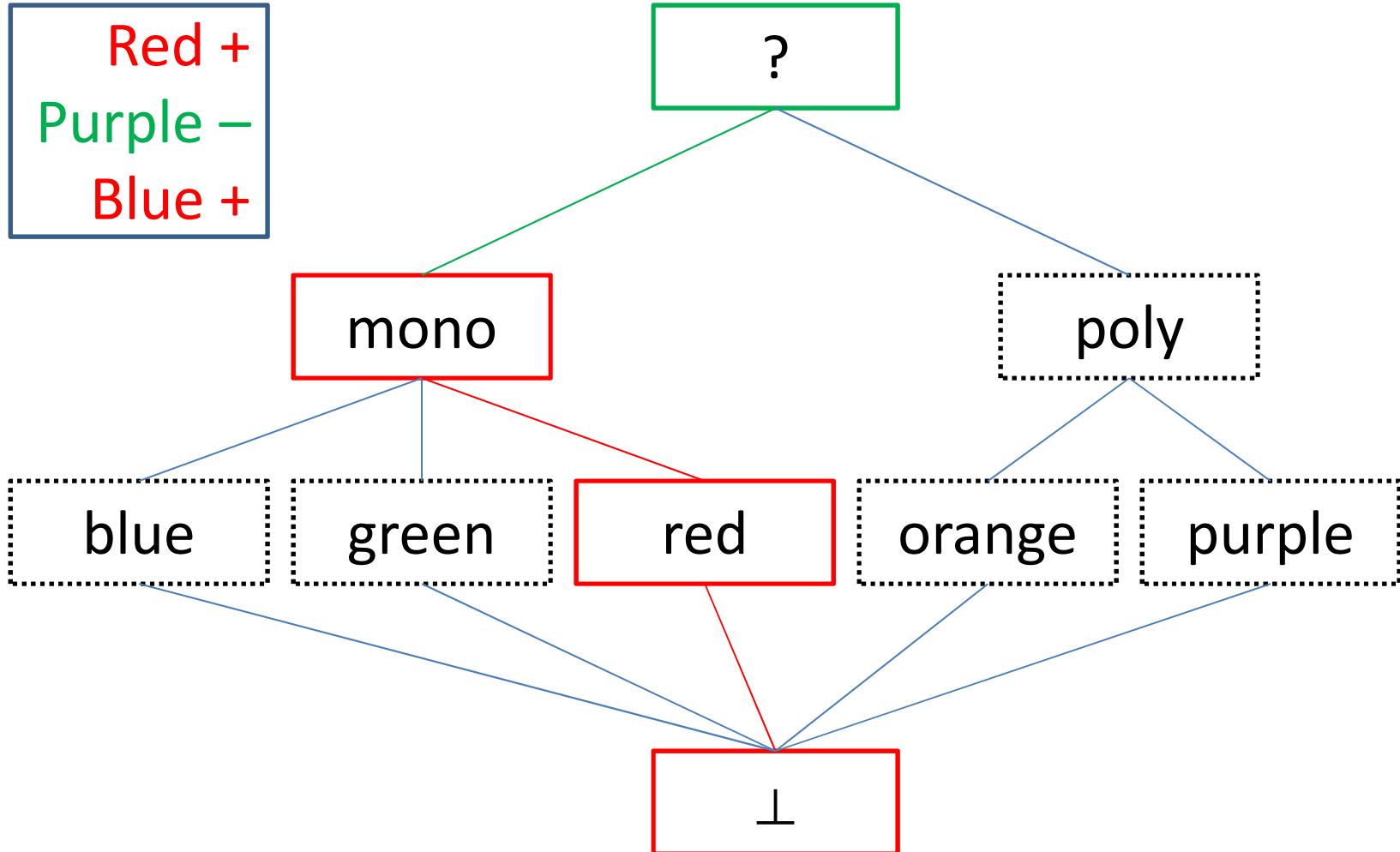
Version-Spaces Algorithm



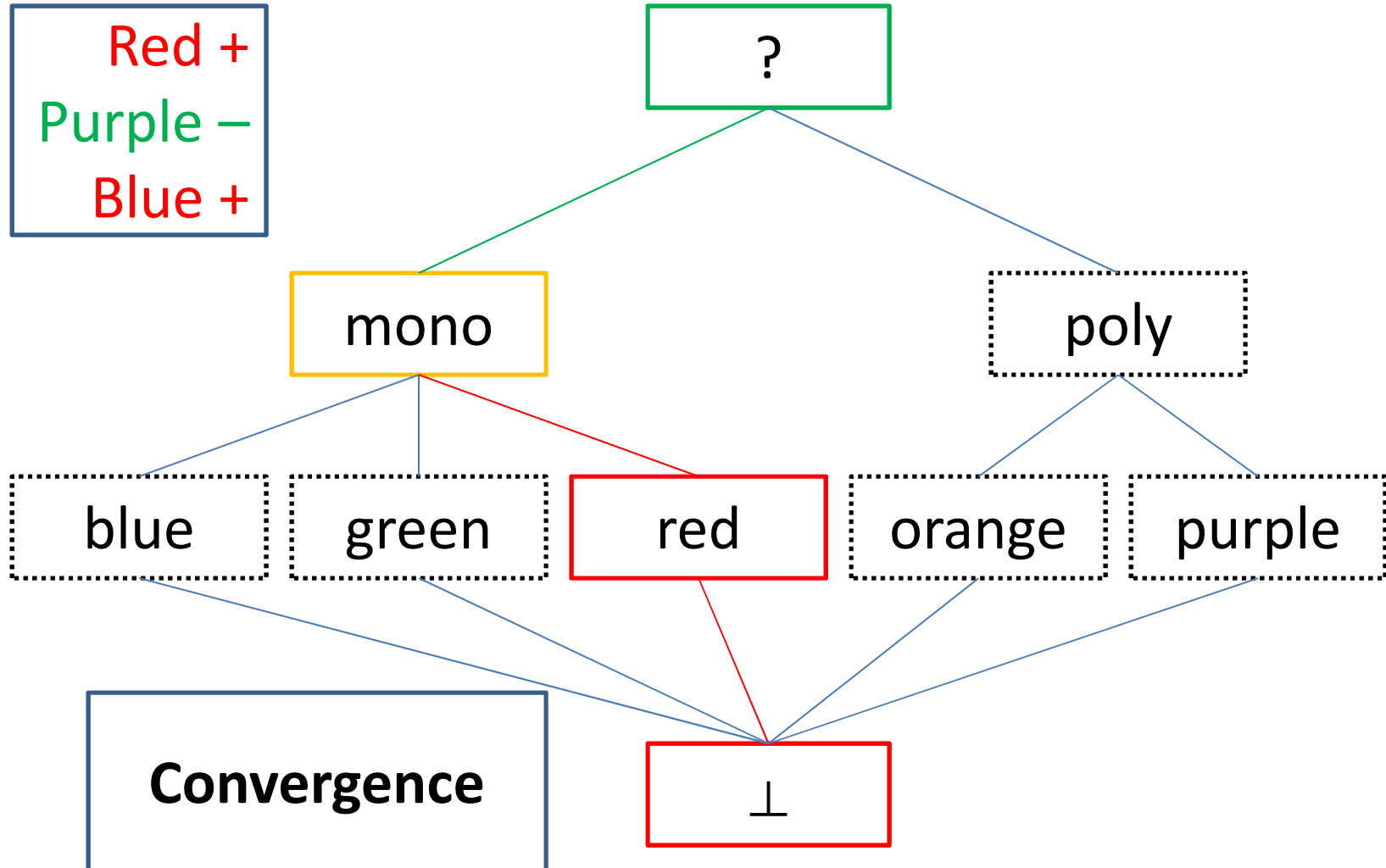
Version-Spaces Algorithm



Version-Spaces Algorithm



Version-Spaces Algorithm



Exercises: Artificial Intelligence

Version Spaces: Playing Cards

Version-Spaces Algorithm

[7,D] +
[A,C] -
[Q,H] -
[9,H] +
[8,C] -

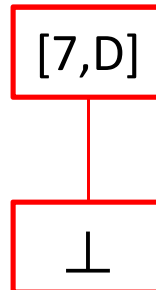
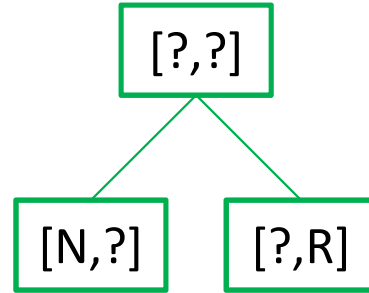
[?,?]

[7,D]

⊥

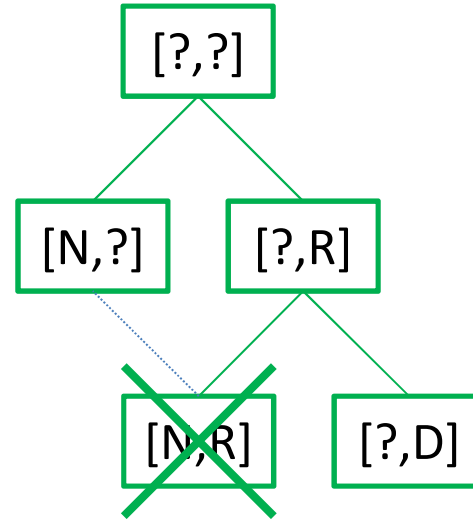
Version-Spaces Algorithm

[7,D] +
[A,C] -
[Q,H] -
[9,H] +
[8,C] -

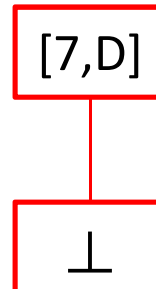


Version-Spaces Algorithm

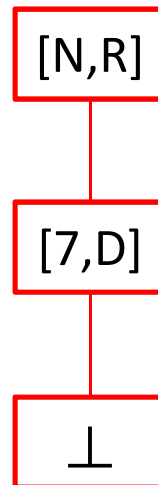
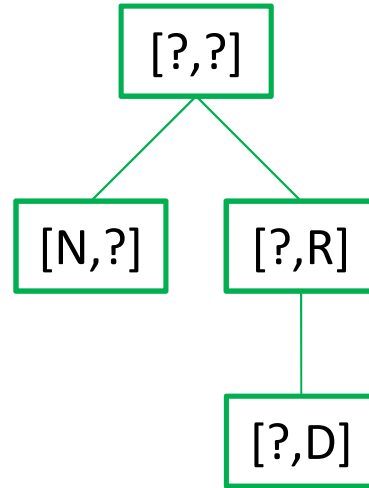
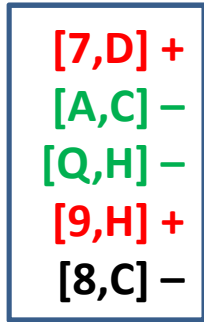
[7,D] +
[A,C] -
[Q,H] -
[9,H] +
[8,C] -



**Redundant
Hypotheses**

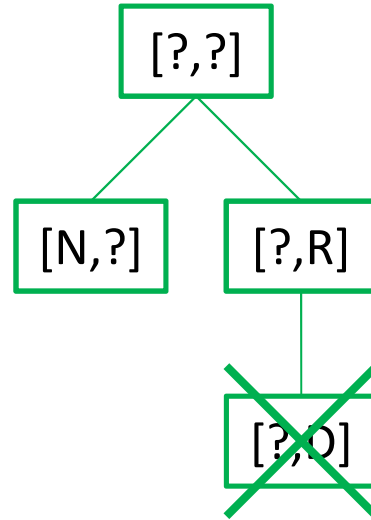


Version-Spaces Algorithm

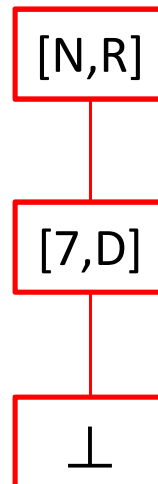


Version-Spaces Algorithm

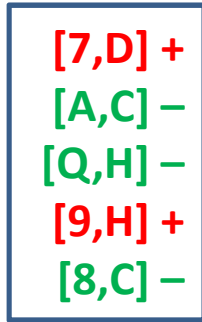
[7,D] +
[A,C] -
[Q,H] -
[9,H] +
[8,C] -



**does not cover
last positive
example**



Version-Spaces Algorithm



[?,?]

[N,?]

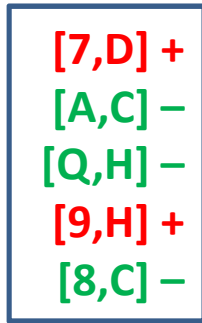
[N,R]

[N,R]

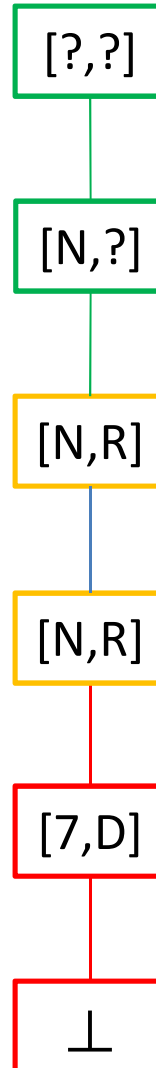
[7,D]

\perp

Version-Spaces Algorithm



Convergence



Exercises: Artificial Intelligence

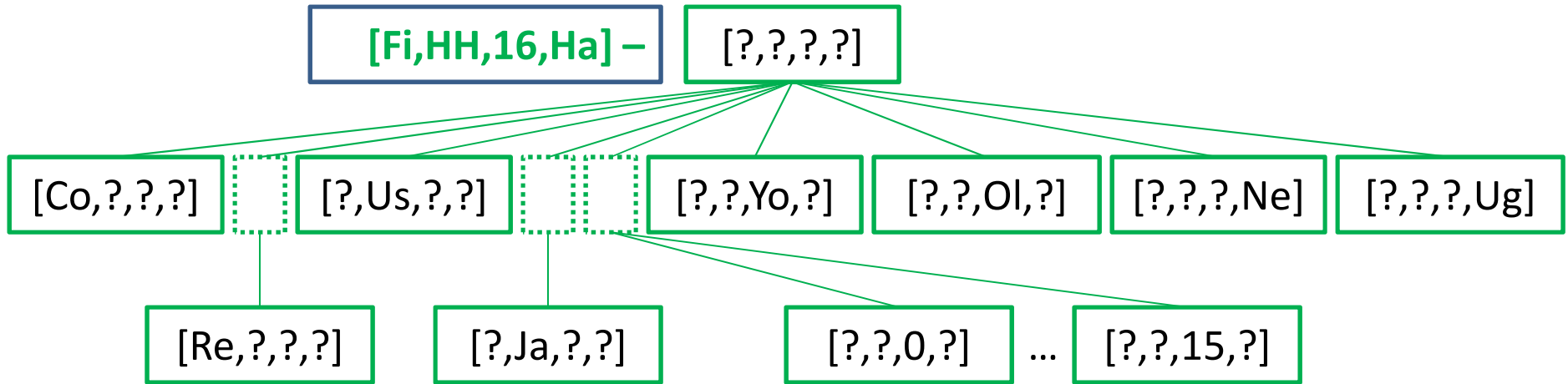
Version Spaces: Ex-exam

Version-Spaces Algorithm

[?,?,?,?]

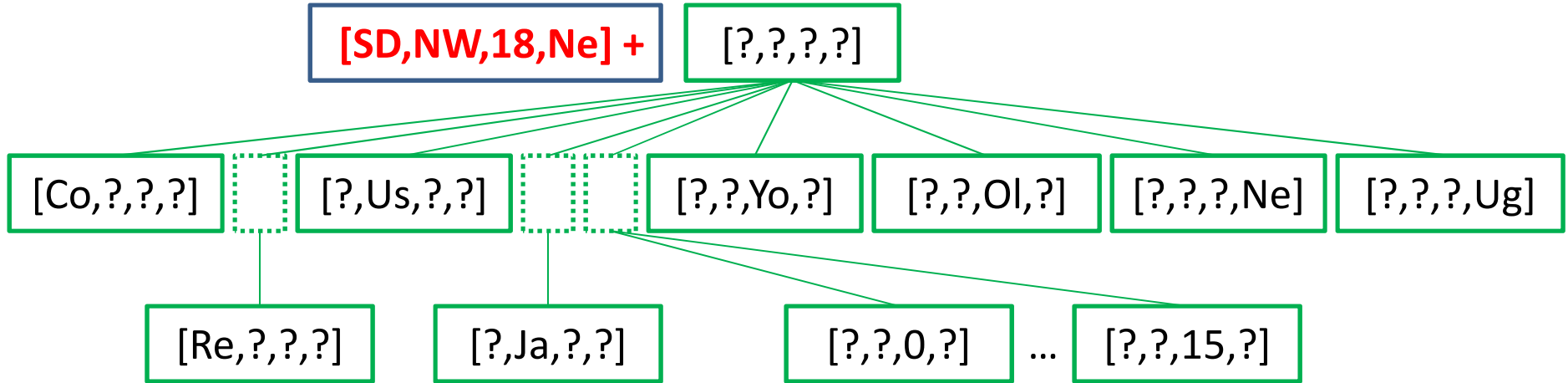
⊥

Version-Spaces Algorithm



⊥

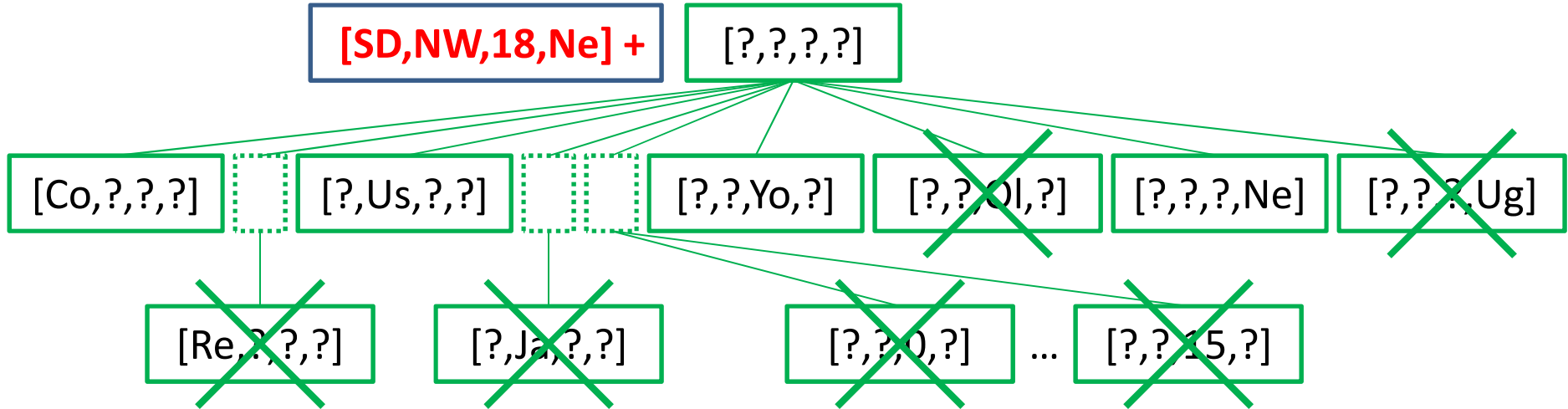
Version-Spaces Algorithm



$[SD, NW, 18, Ne]$

\perp

Version-Spaces Algorithm

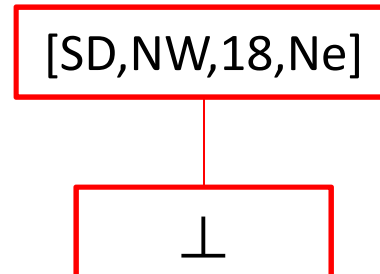
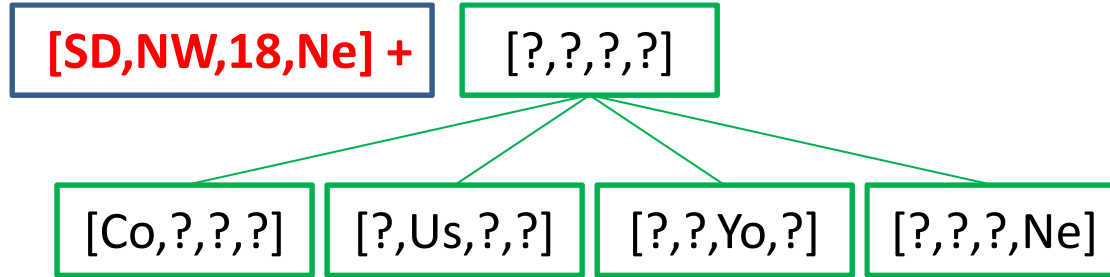


19 out of 23 do not cover last positive example

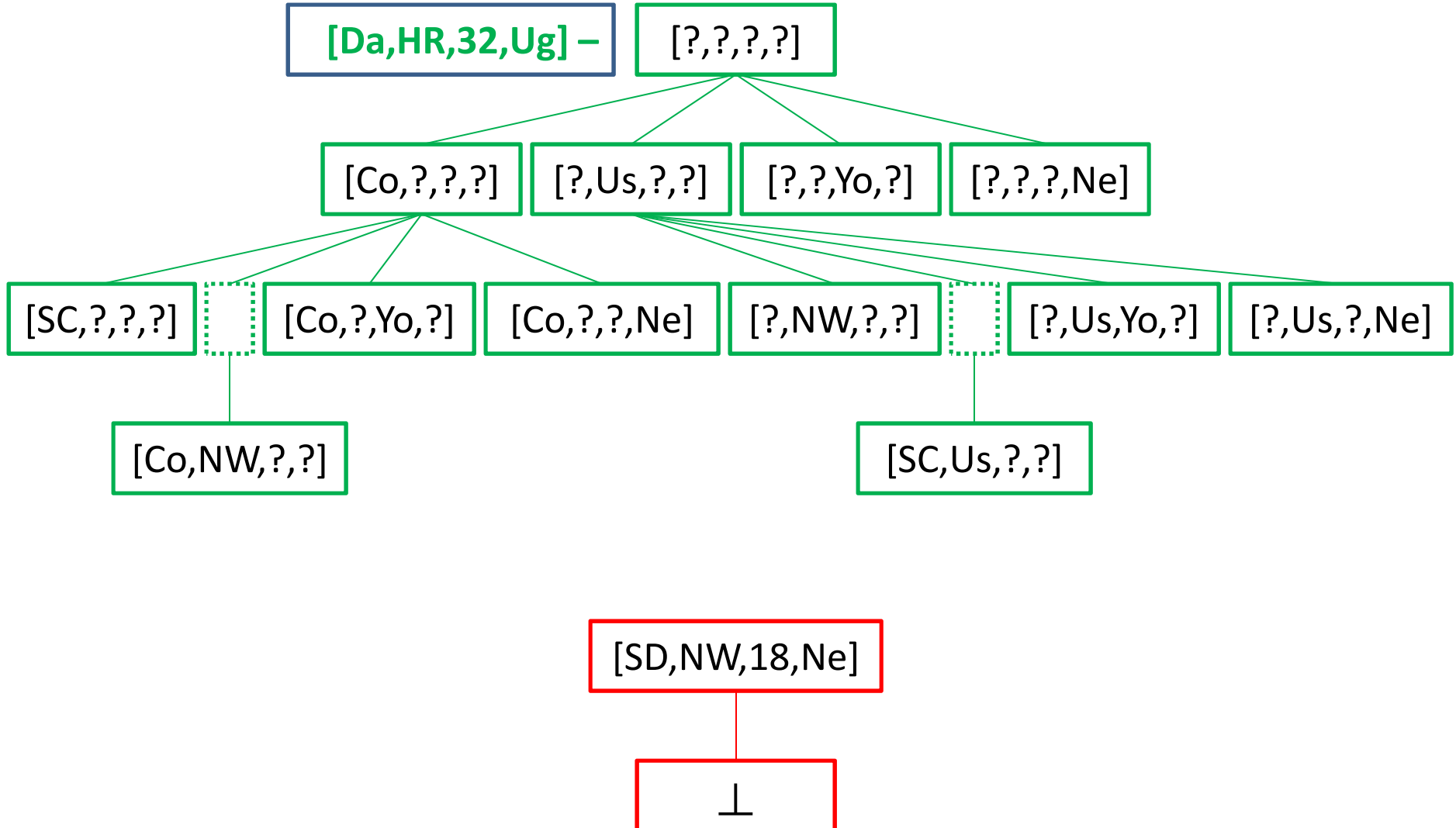
[SD,NW,18,Ne]

⊥

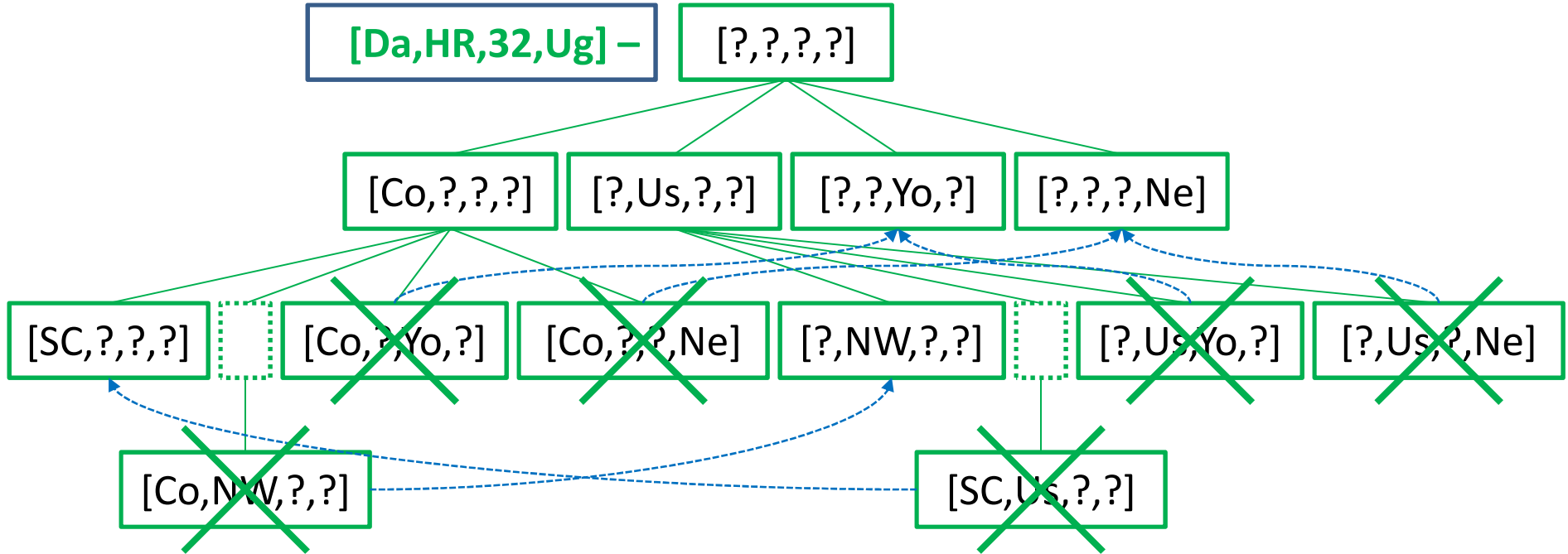
Version-Spaces Algorithm



Version-Spaces Algorithm



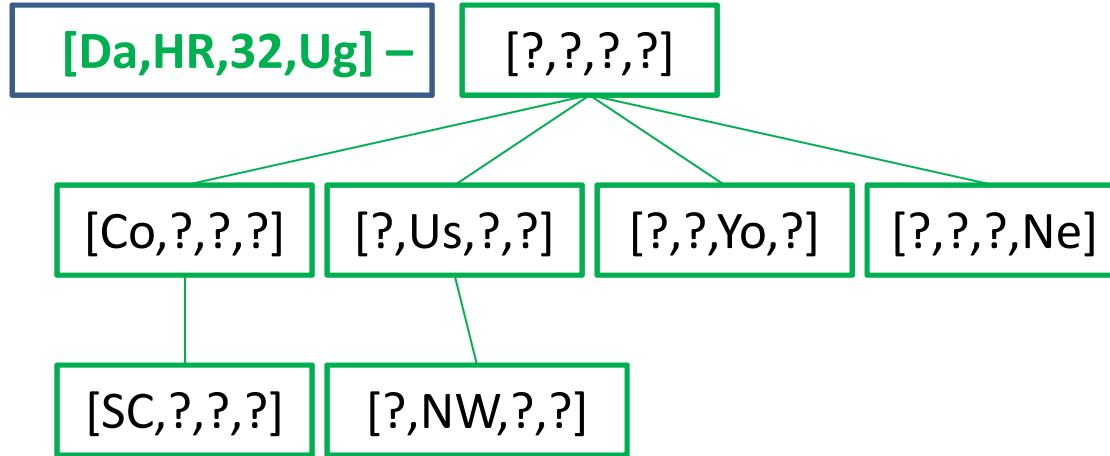
Version-Spaces Algorithm



[SD,NW,18,Ne]

⊥

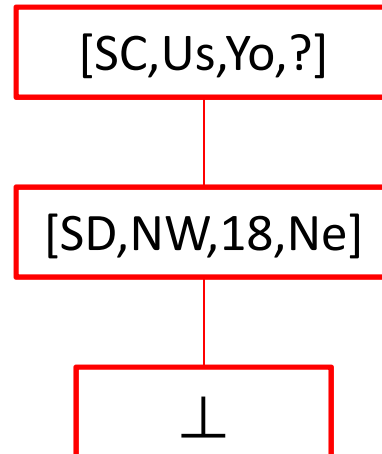
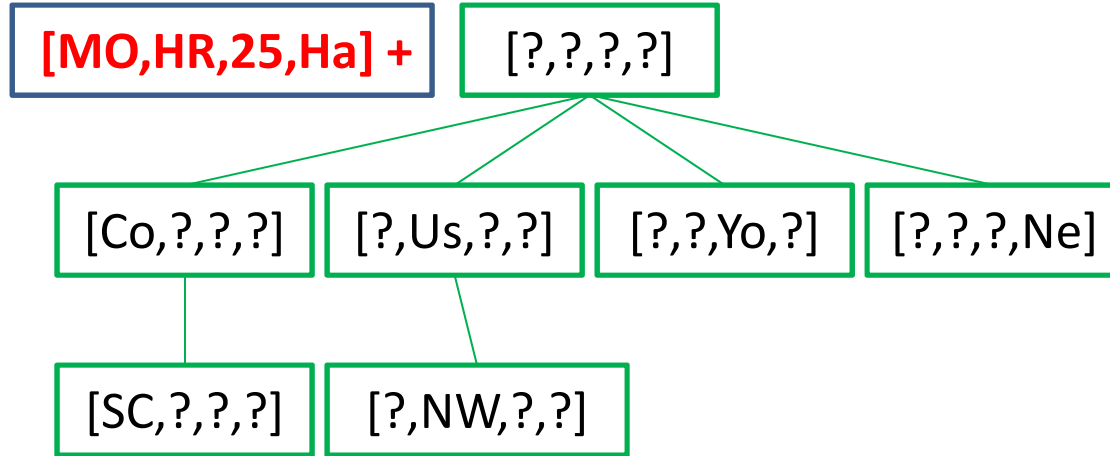
Version-Spaces Algorithm



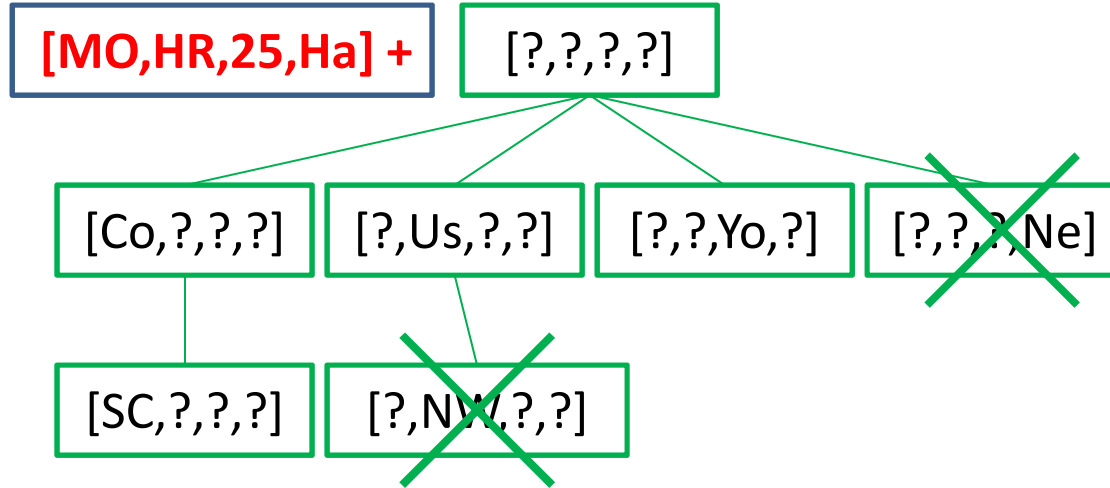
[SD,NW,18,Ne]

⊥

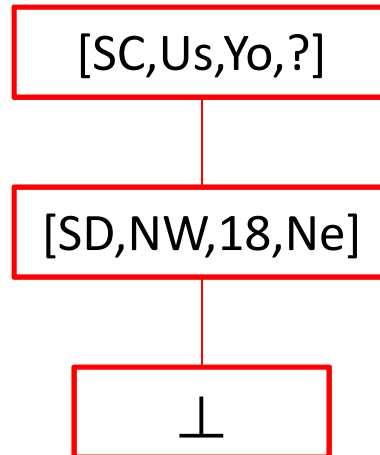
Version-Spaces Algorithm



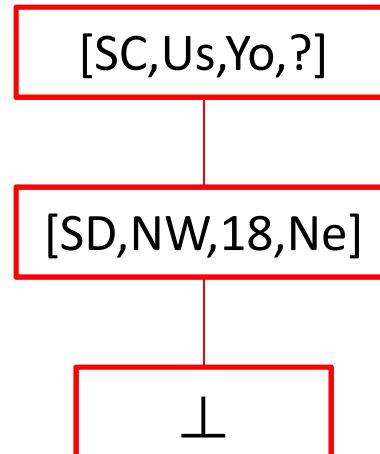
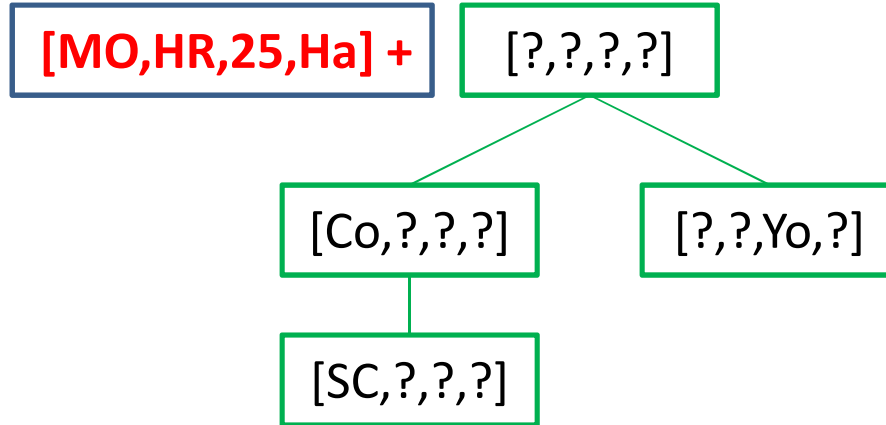
Version-Spaces Algorithm



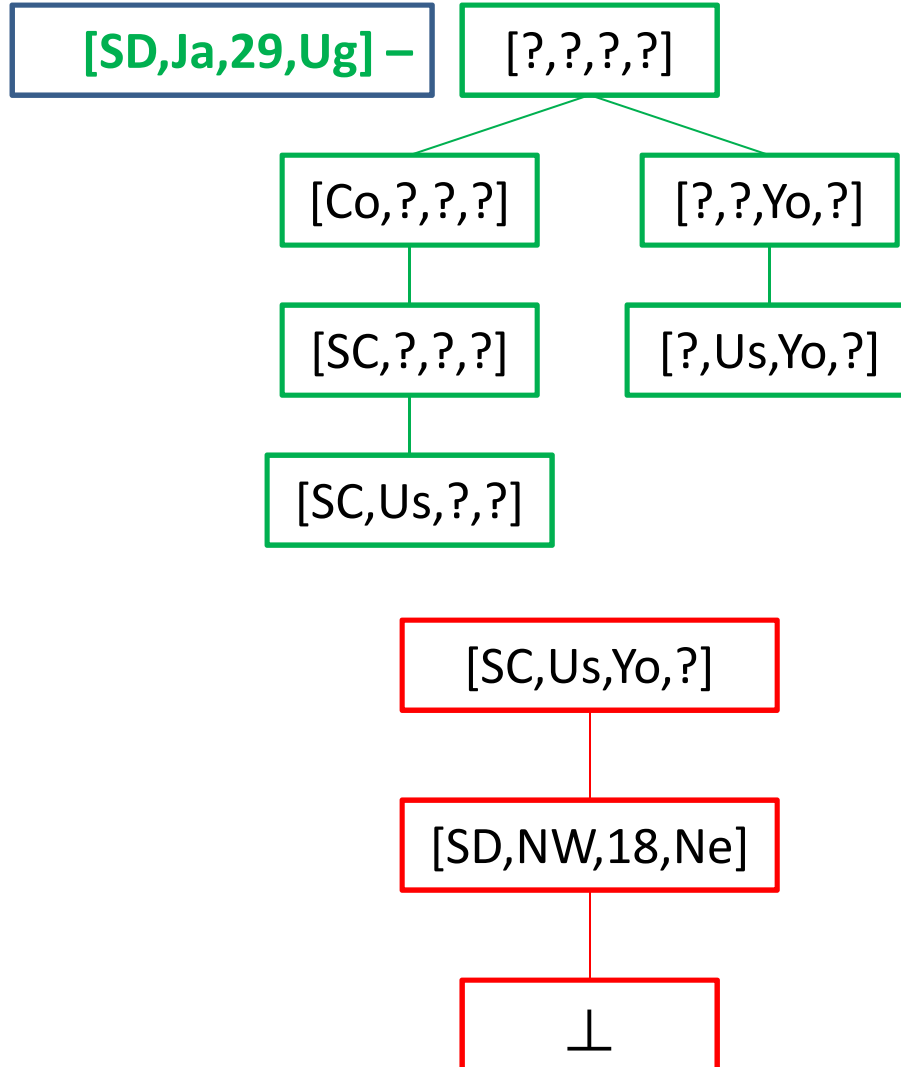
2 out of 4 do not cover last positive example



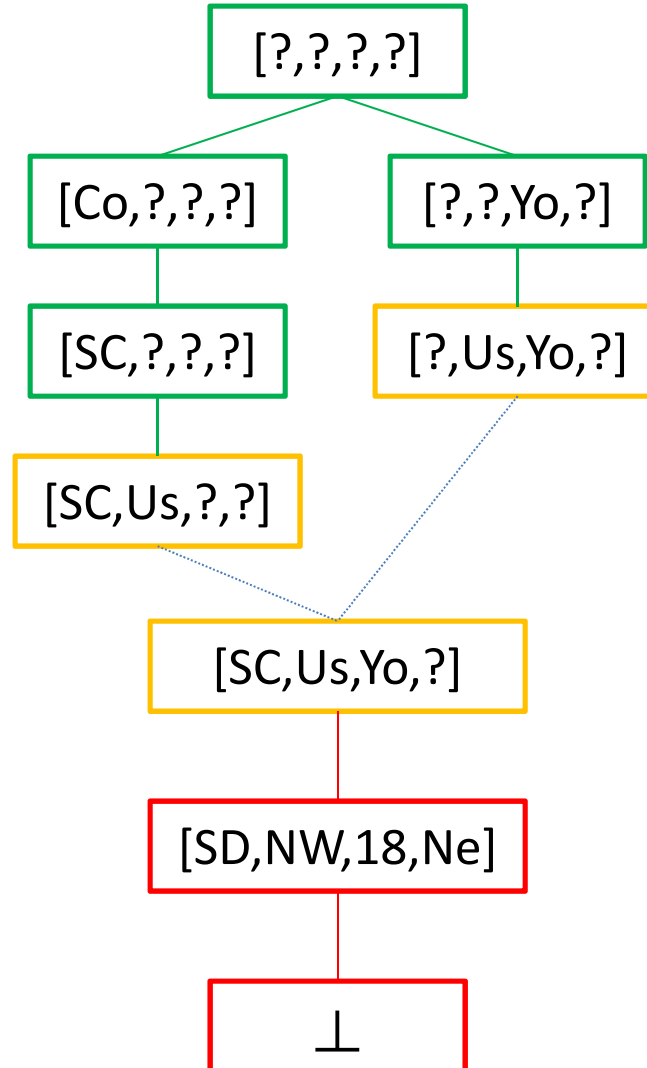
Version-Spaces Algorithm



Version-Spaces Algorithm

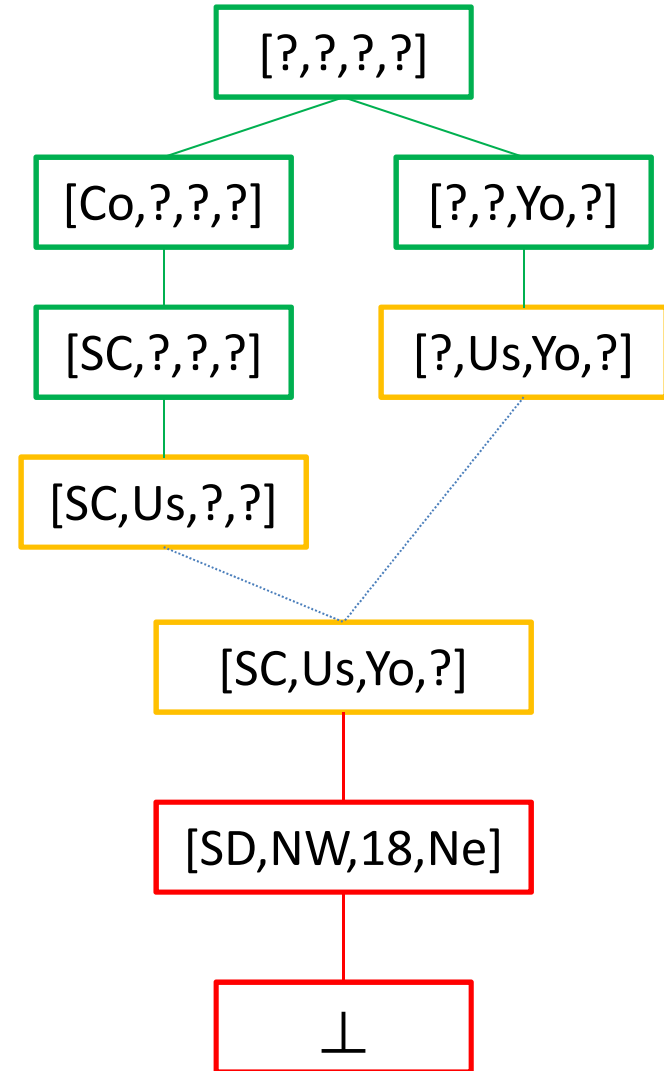


Version-Spaces Algorithm



Using the result

- [MO,HR,32,Ha]: **Maybe**
 - More Specific than [SC,Us,?,?]
 - Not more Specific than [SC,Us,Yo,?]
- [SD,HH,18,Ne]: **NO**
 - Not More Specific than [SC,Us,?,?]
 - Not More Specific than [?,Us,Yo,?]
- [Da,NW,22,Ug]: **Maybe**
 - More Specific than [?,Us,Yo,?]
 - Not more Specific than [SC,Us,Yo,?]



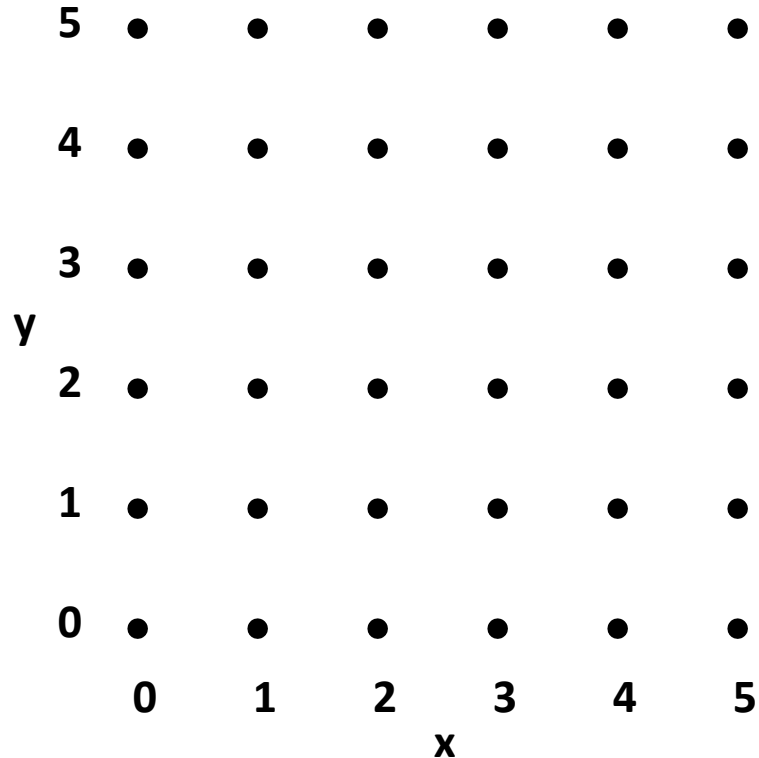
Exercises: Artificial Intelligence

Version Spaces: Computer Screen

Version-Spaces Algorithm

$G = \{[(0,0),5], \text{white}\}$

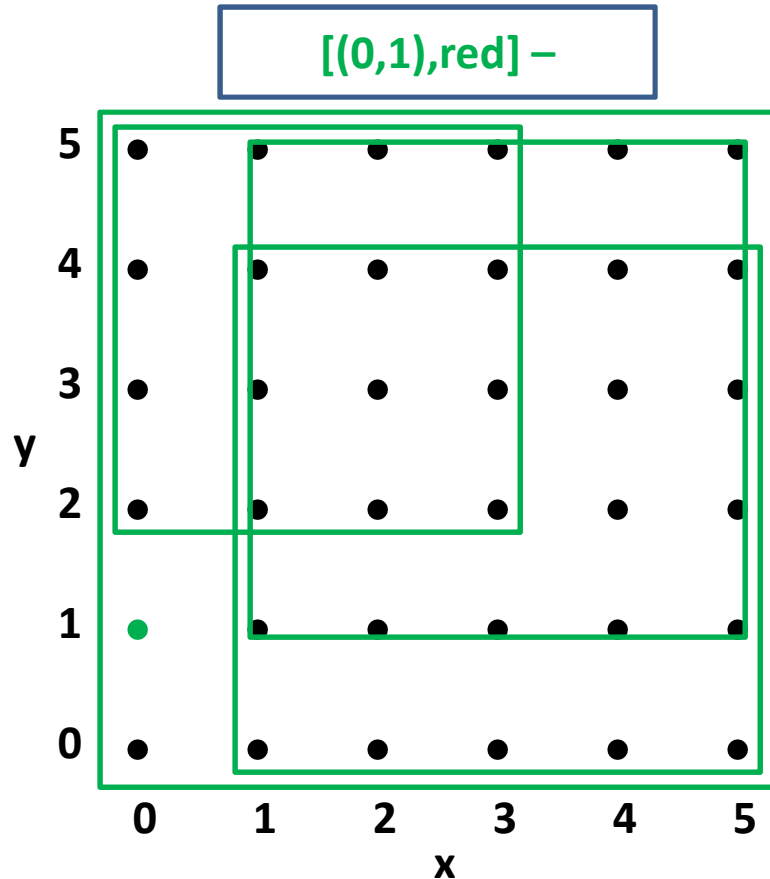
$S = \{\perp\}$



Version-Spaces Algorithm

$G = \{[(0,0),5],\text{white}]\}$

$S = \{\perp\}$



$G = \{$
 $[(0,2),3],\text{white},$
 $[(1,0),4],\text{white},$
 $[(1,1),4],\text{white},$
 $[(0,0),5],\text{cyan}$
 $\}$

Redundant:

$[(0,0),5],\text{green}$

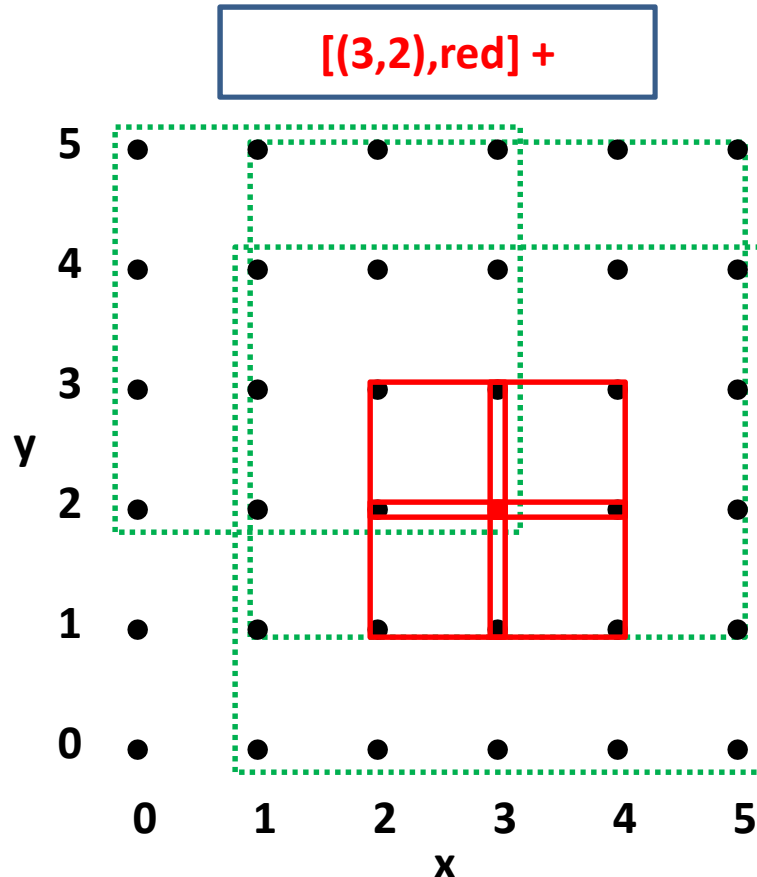
$[(0,0),5],\text{blue}$

$S = \{\perp\}$

Version-Spaces Algorithm

$G = \{ [((0,2),3),white], [((1,0),4),white], [((1,1),4),white], [((0,0),5),cyan] \}$

$S = \{\perp\}$



$G = \{$
 $[((0,2),3),white],$
 $[((1,0),4),white],$
 $[((1,1),4),white]$
 $\}$

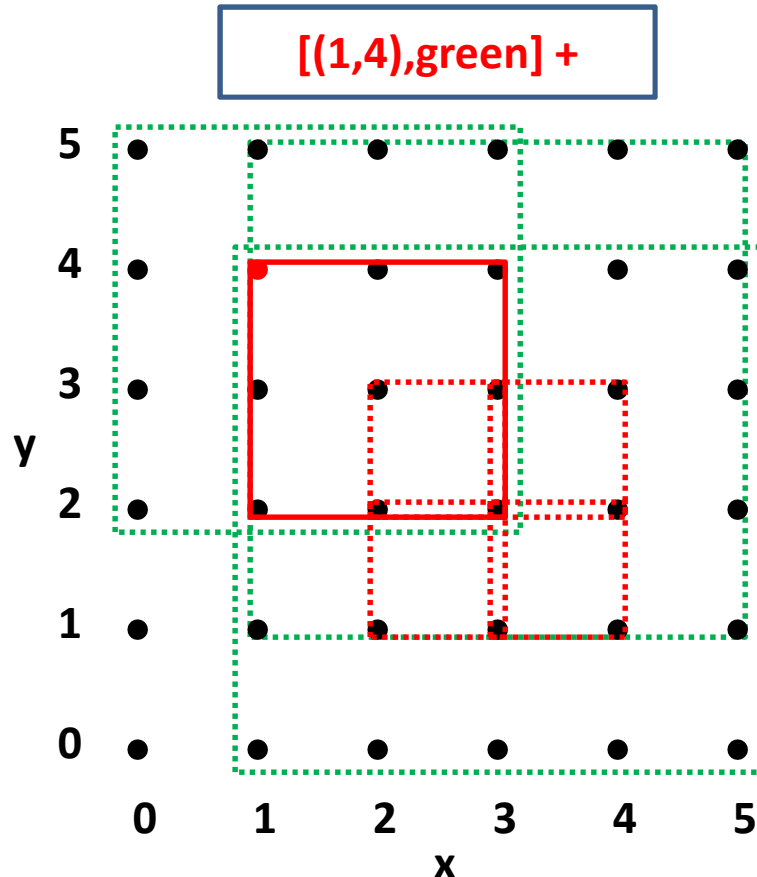
Removed:

$S = \{$
 $[((0,0),5),cyan]$
 $[((2,1),1),red],$
 $[((2,2),1),red],$
 $[((3,1),1),red],$
 $[((3,2),1),red]$
 $\}$

Version-Spaces Algorithm

$G = \{ [((0,2),3),\text{white}], [((1,0),4),\text{white}], [((1,1),4),\text{white}] \}$

$S = \{ [((2,1),1),\text{red}], [((2,2),1),\text{red}], [((3,1),1),\text{red}], [((3,2),1),\text{red}] \}$



$G = \{$

$[((0,2),3),\text{white}],$
 $[((1,0),4),\text{white}],$
 $[((1,1),4),\text{white}]$

$\}$

$S = \{$

$[((1,2),2),\text{yellow}]$

$\}$

Redundant:

$[((0,2),3),\text{yellow}]$

$[((1,2),3),\text{yellow}]$

$[((1,1),3),\text{yellow}]$

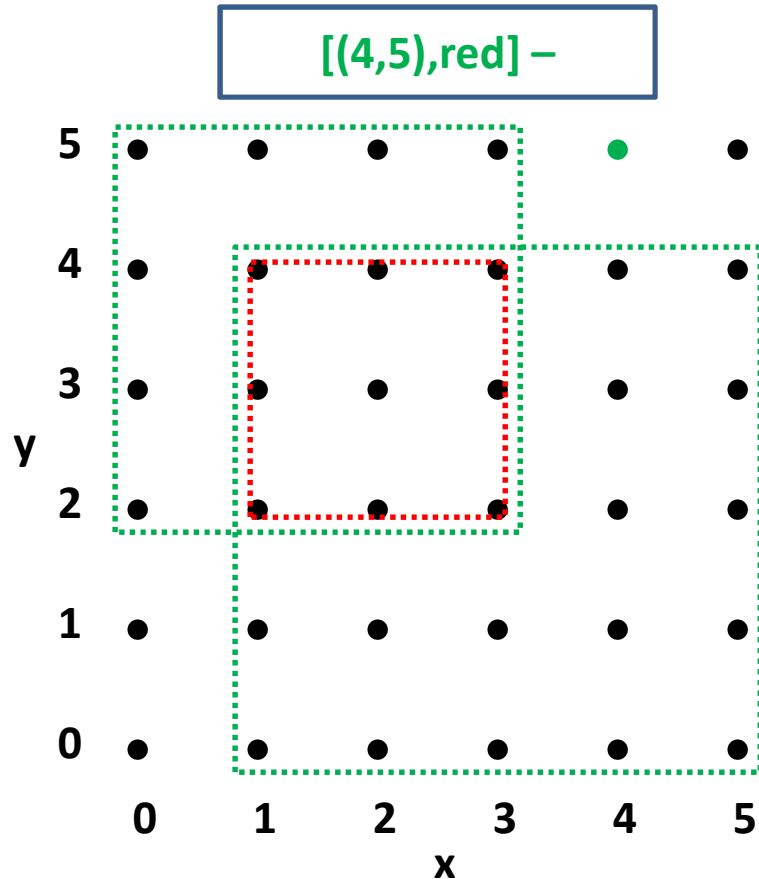
$[((1,1),4),\text{yellow}]$

$[((1,0),4),\text{yellow}]$

Version-Spaces Algorithm

$G = \{ [((0,2),3),white], [((1,0),4),white], [((1,1),4),white] \}$

$S = \{ [((1,2),2),yellow] \}$



$G = \{$
 $[((0,2),3),white],$
 $[((1,0),4),white]$
 $\}$

Redundant:

$[((1,1),3),white]$

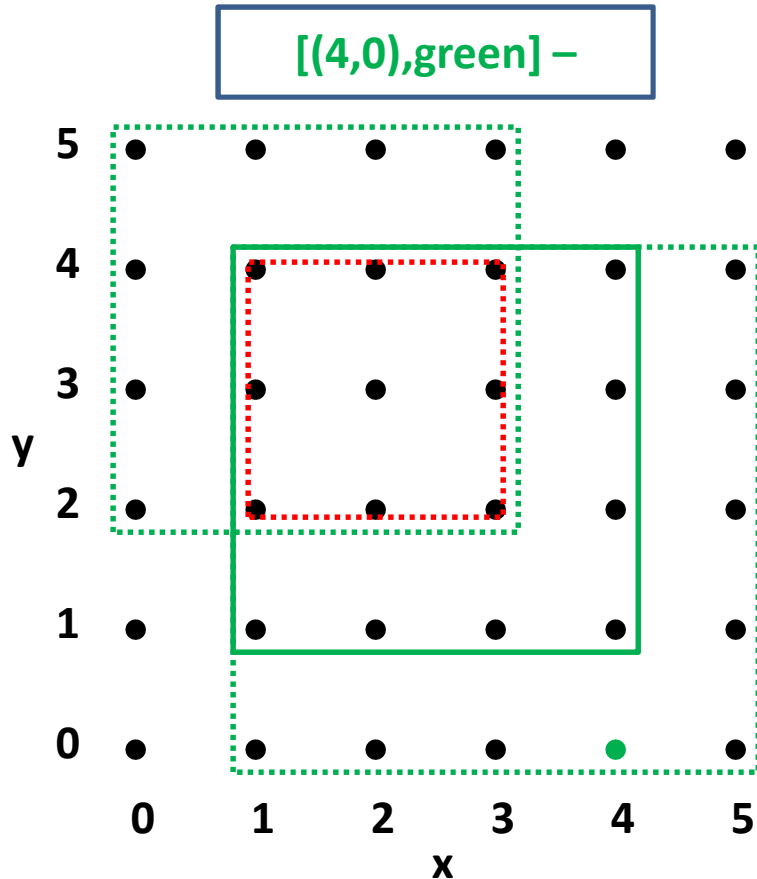
Others don't generalize S

$S = \{$
 $[((1,2),2),yellow]$
 $\}$

Version-Spaces Algorithm

$G = \{ [((0,2),3),\text{white}], [((1,0),4),\text{white}] \}$

$S = \{ [((1,2),2),\text{yellow}] \}$

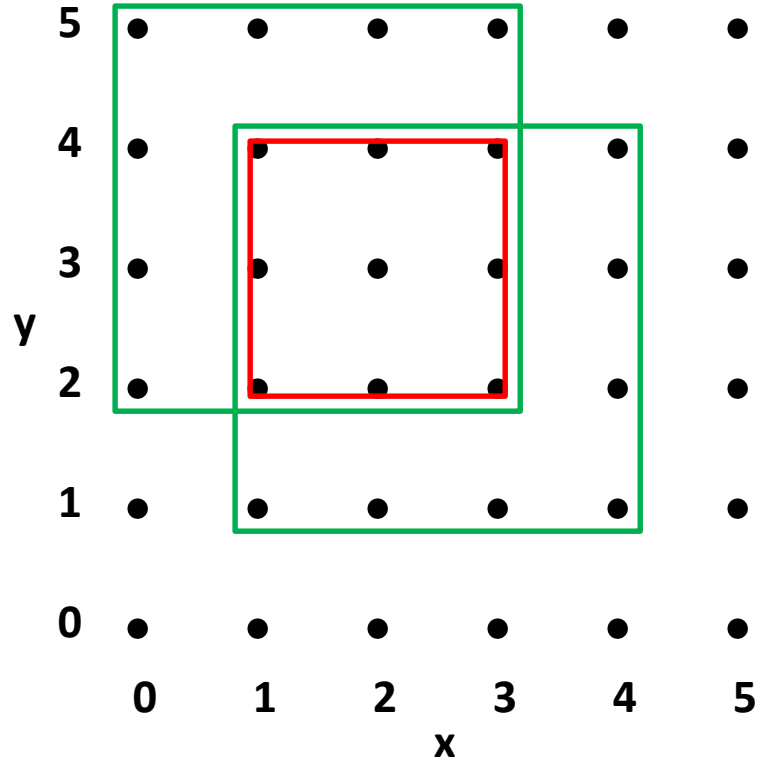


$G = \{$
 $[((0,2),3),\text{white}],$
 $[((1,1),3),\text{white}]$
 $\}$
Others don't generalize S
 $S = \{$
 $[((1,2),2),\text{yellow}]$
 $\}$

Version-Spaces Algorithm

$G = \{[(0,2),3,white],[(1,1),3,white]\}$

$S = \{[(1,2),2,yellow]\}$



Using the Result

$G = \{[(0,2),3,white],[(1,1),3,white]\}$

$S = \{[(1,2),2,yellow]\}$

