

Branch & Bound

- Another technique for optimization, this time as an and-tree
- Guaranteed to provide the globally optimum solution to a problem, but may need to go through many states taking up time and space
- Use a function f_{Bound} to determine which branches can be worked on and which do not need work

0-1 Knapsack Problem (as GA)

$$c = (2, 4, 1, 1)$$

$$p = (10, 12, 2, 1)$$

$$p_i/c_i = (5, 3, 2, 1)$$

Search Control 1

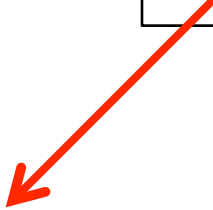
- Change any nodes that can change to yes (if there is more than one chose left-most)
- Otherwise choose the node with the highest f_{Bound}
- Choose the x_i to work on where i is smallest

Branch & Bound

S_0

Env:
Maxsol = 0

(!, !, !, !)	?
Bound = 16	

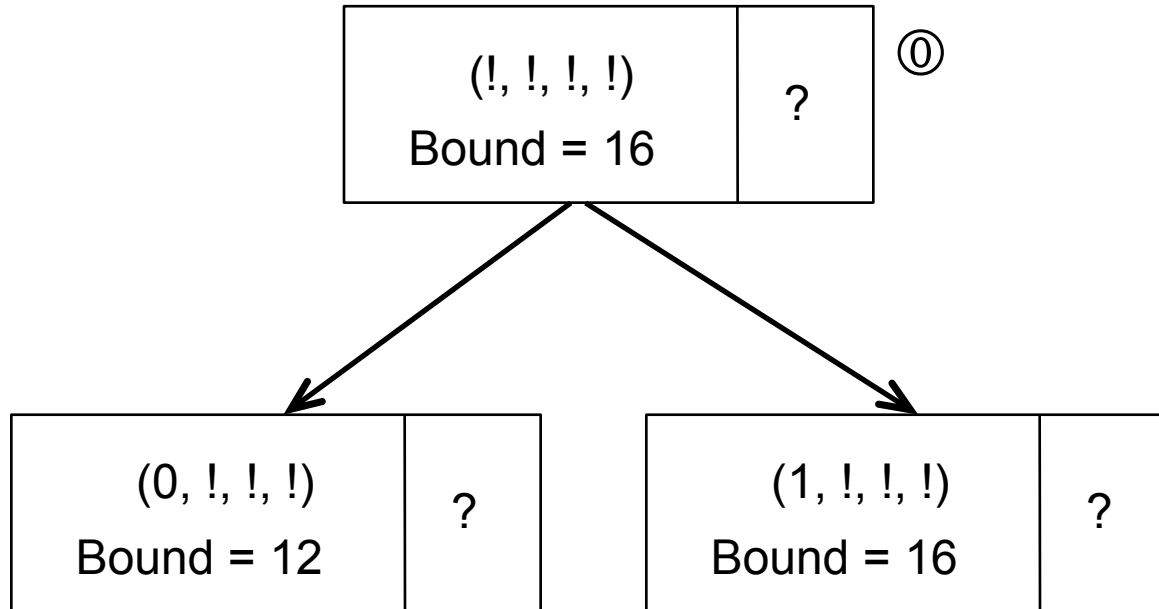


1 x Item 1 $\rightarrow$ 10 profit, 2 cost
.5 x Item 2 $\rightarrow$ 6 profit, 2 cost

Branch & Bound

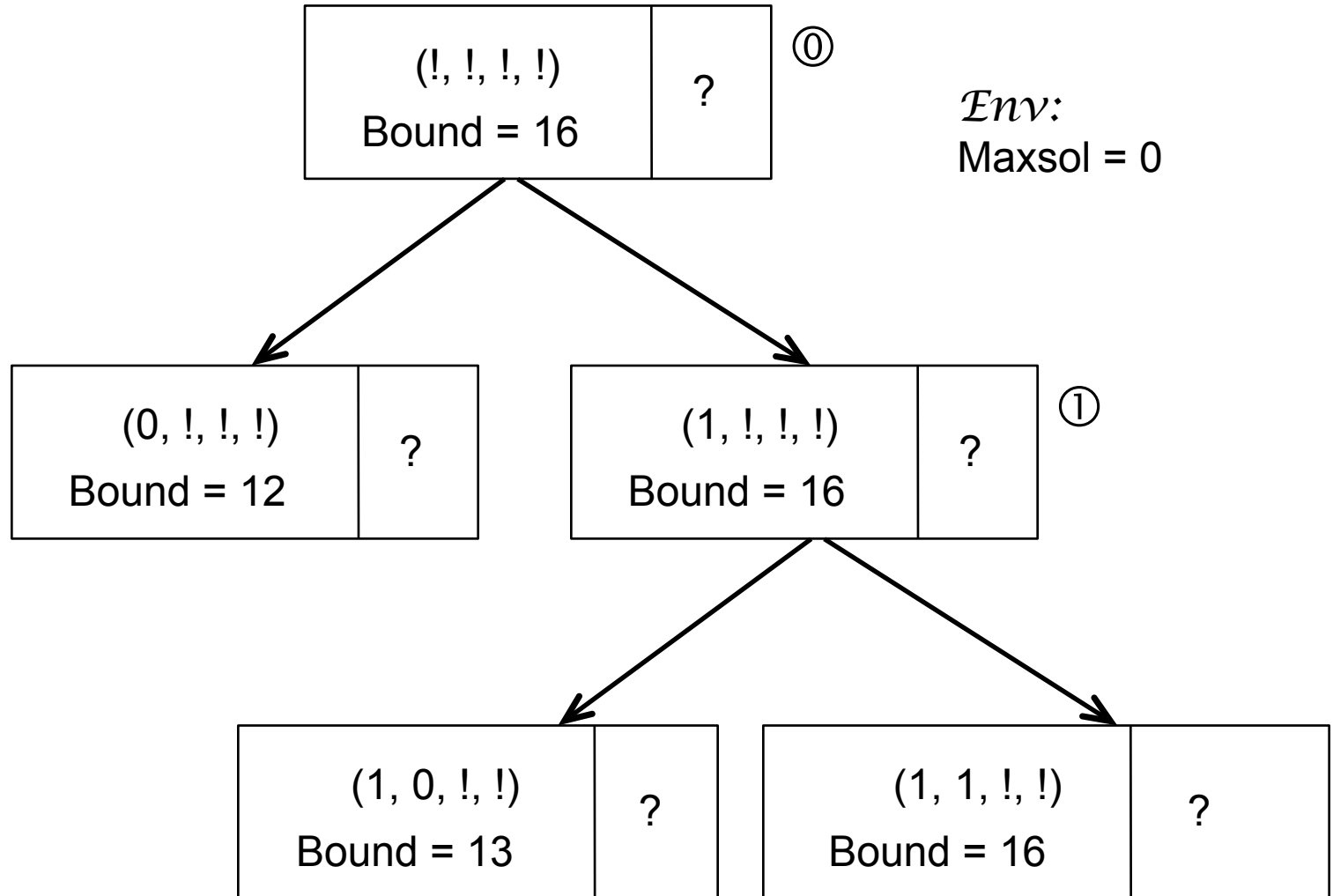
S_0

Env:
Maxsol = 0



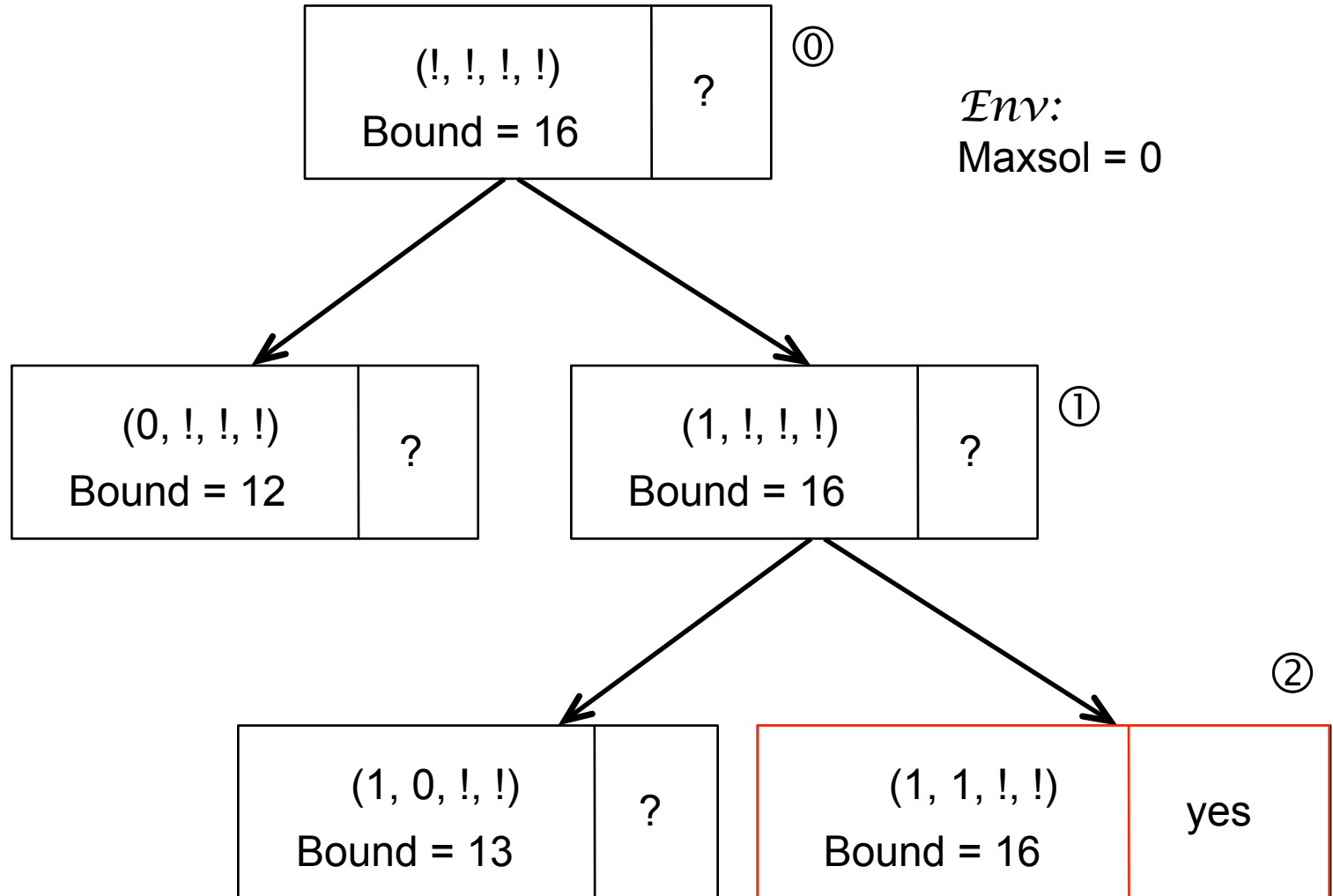
Branch & Bound

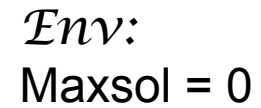
S_1



Branch & Bound

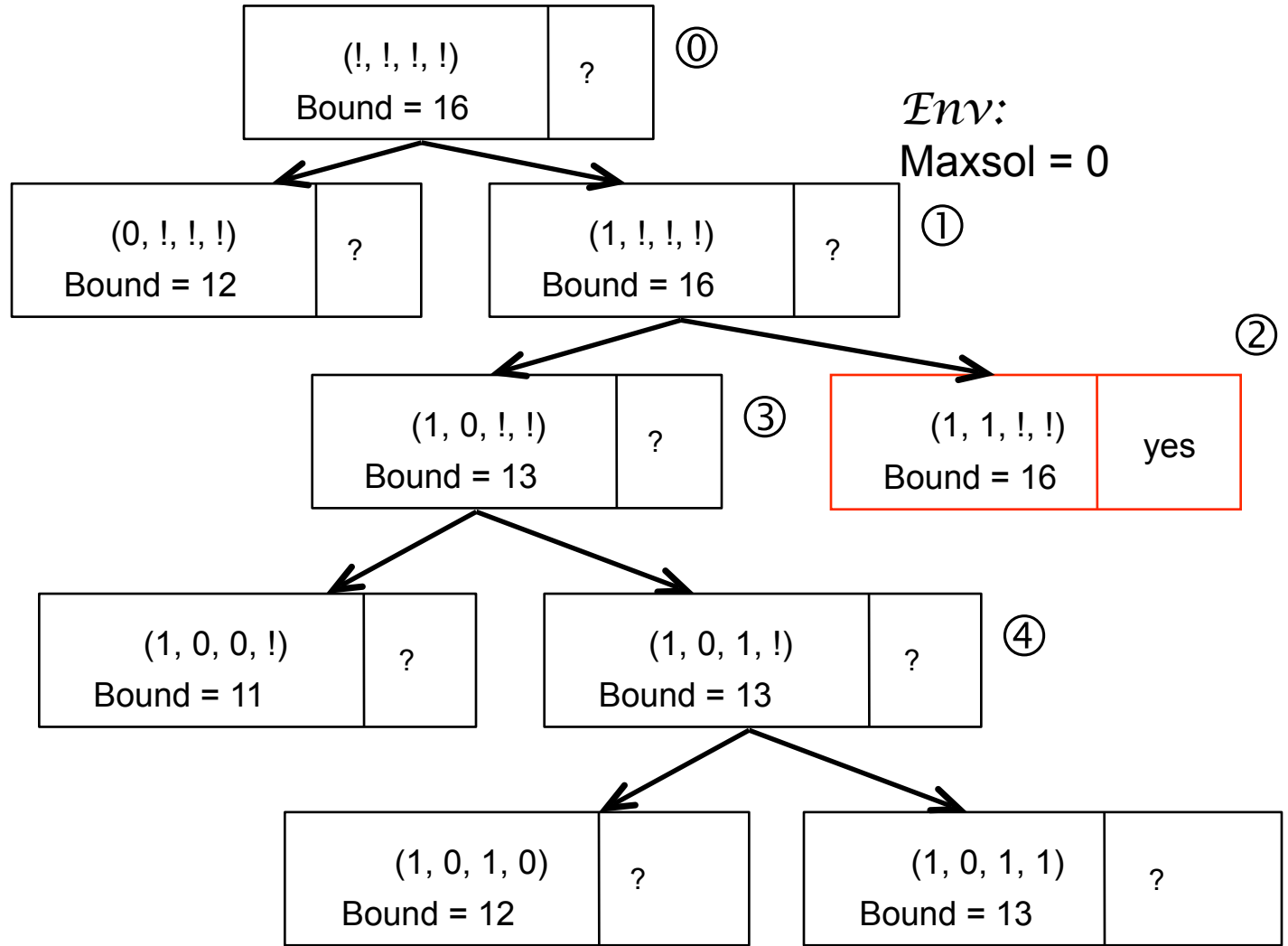
S_2



$$S_3$$


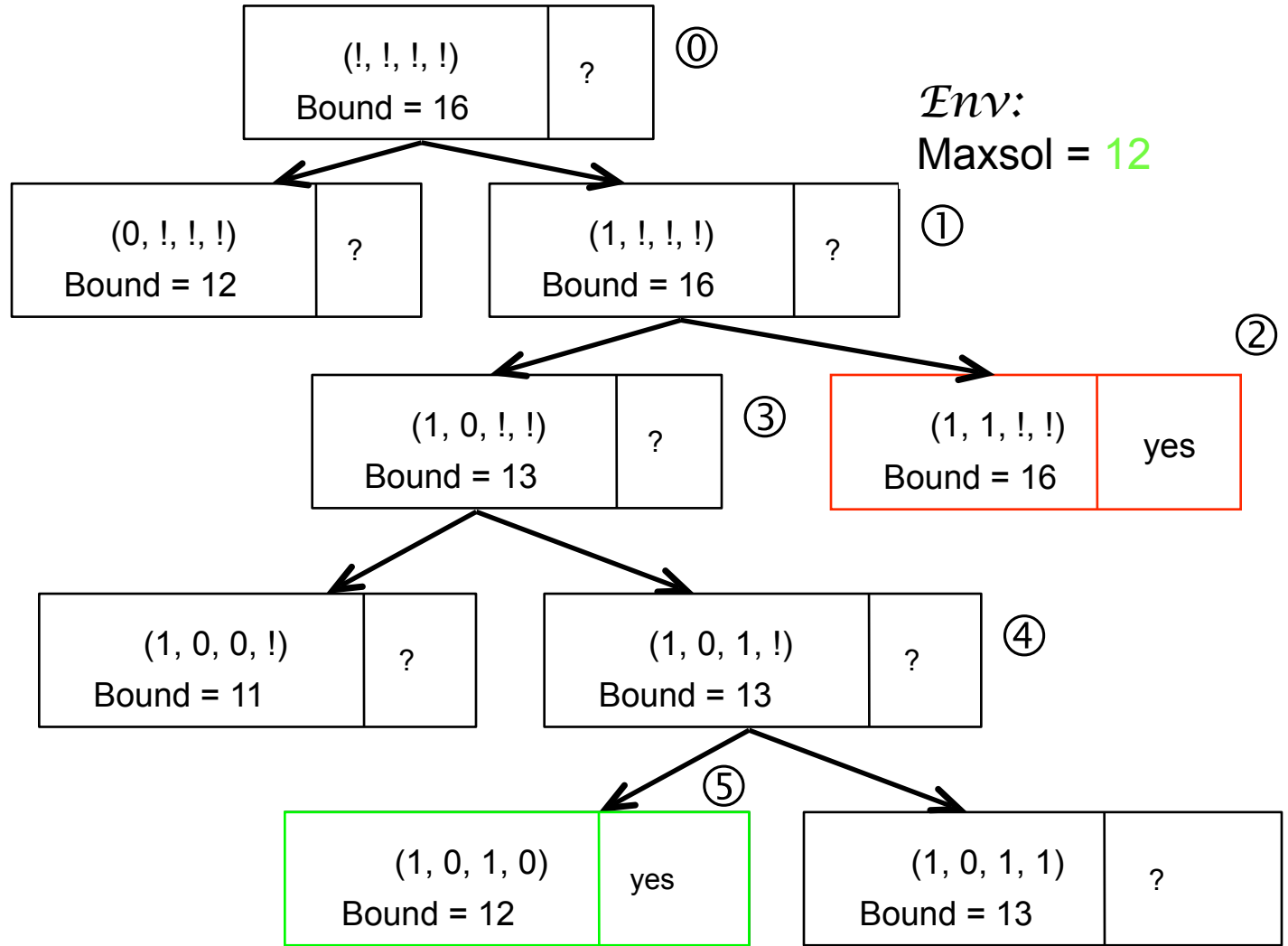
Branch & Bound

S_4



Branch & Bound

S_5

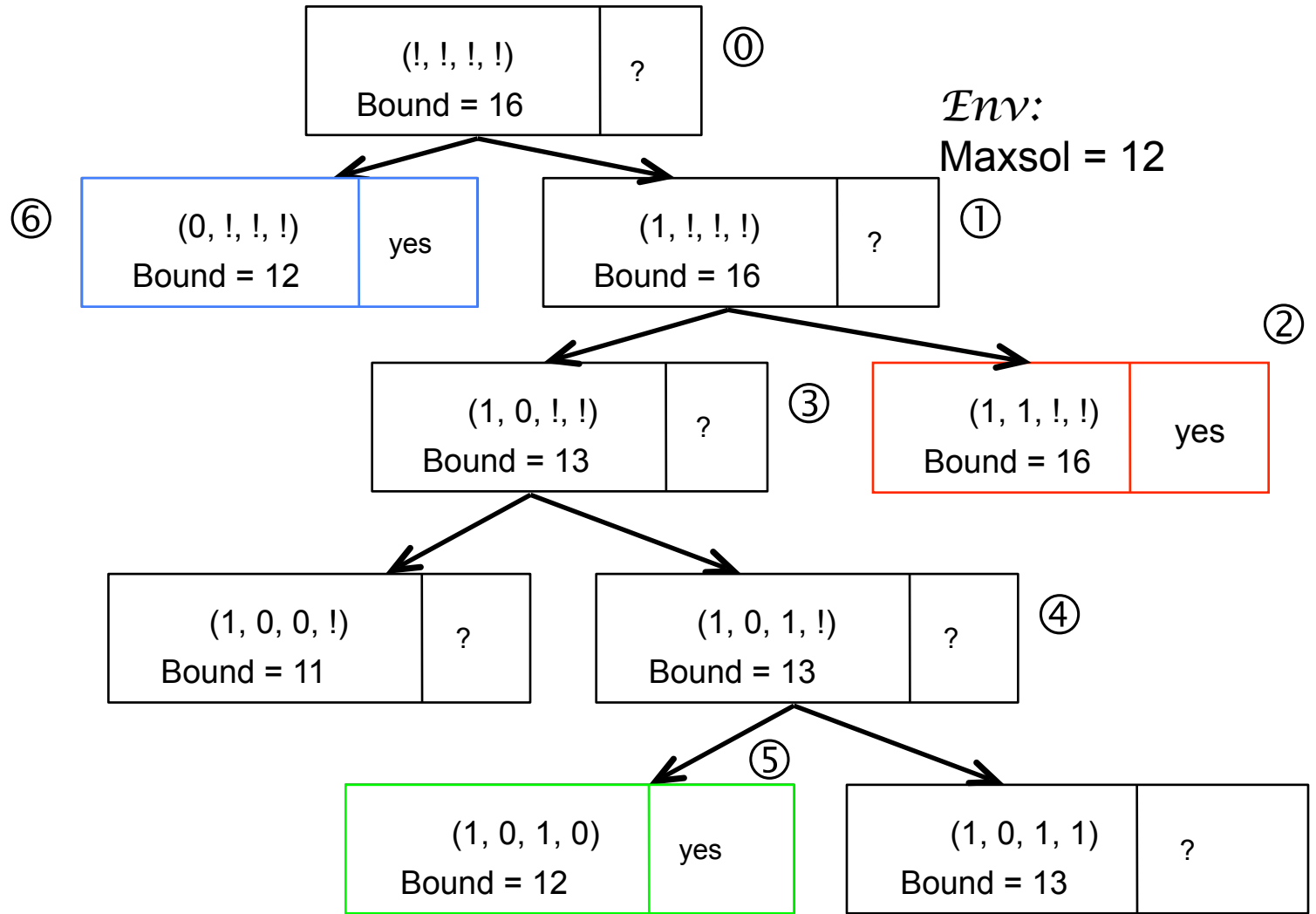


Tyson Kendon © 2007

10

Branch & Bound

S_6

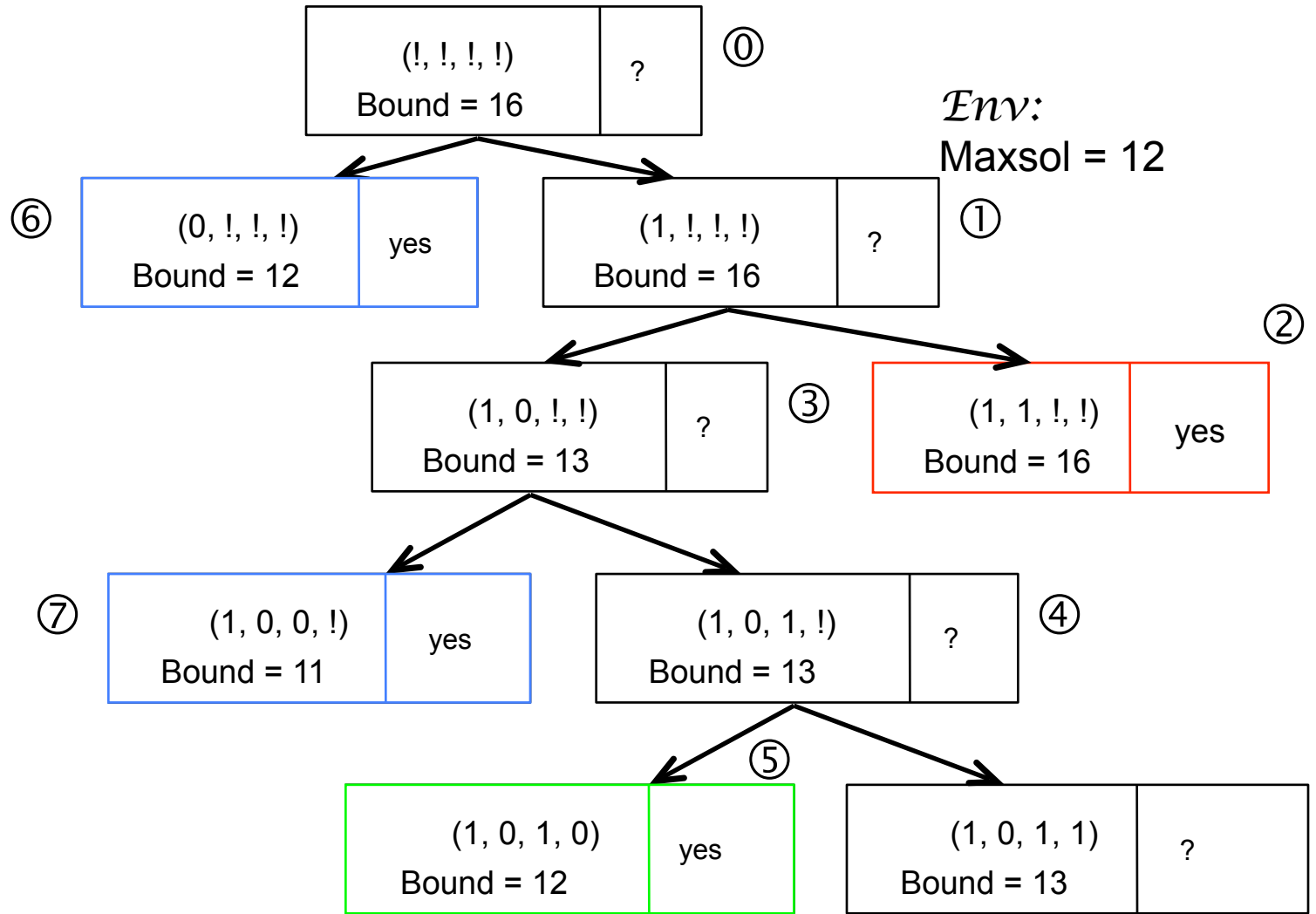


Tyson Kendon © 2007

11

Branch & Bound

S_7

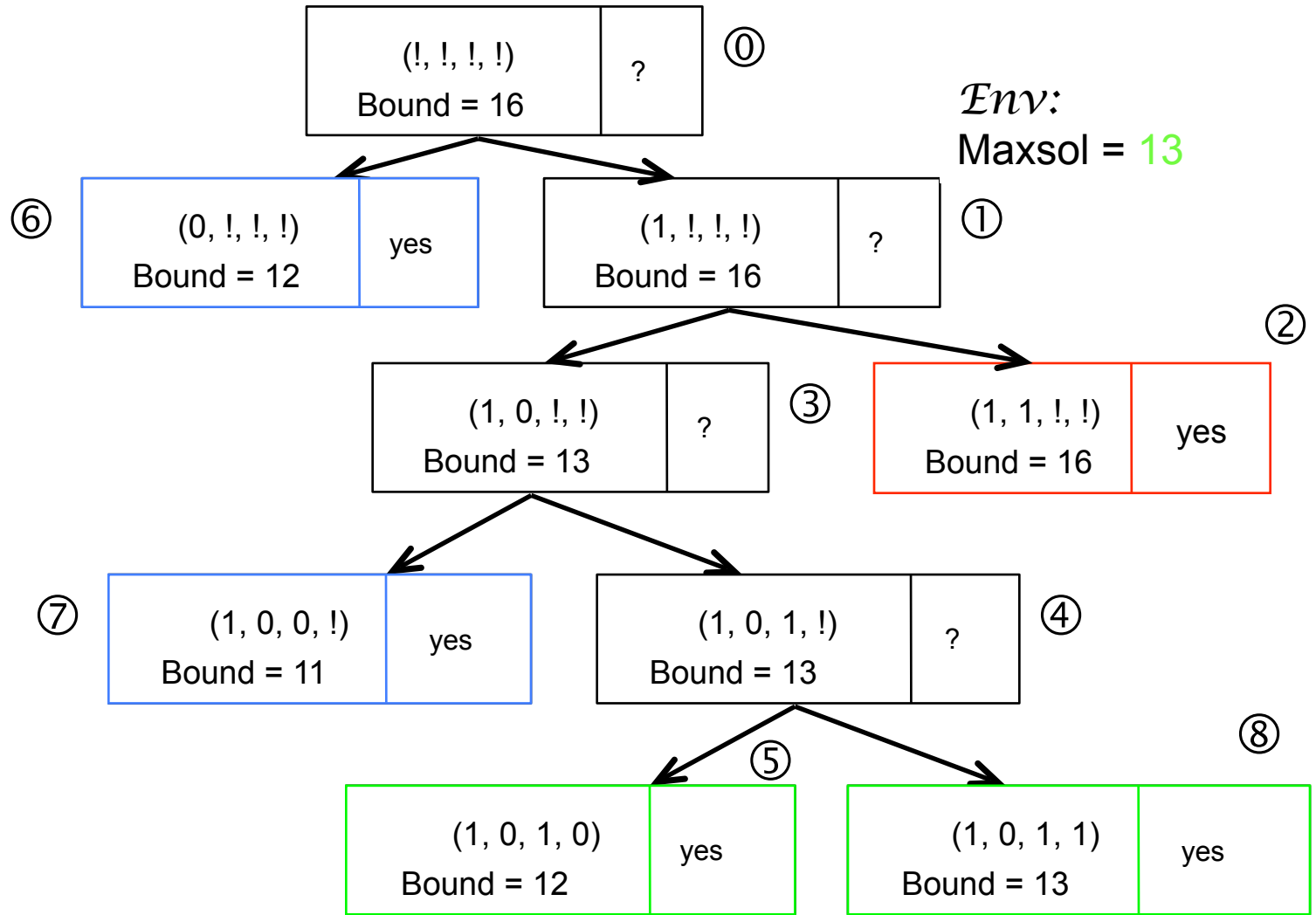


Tyson Kendon © 2007

12

Branch & Bound

S_8



Tyson Kendon © 2007

13

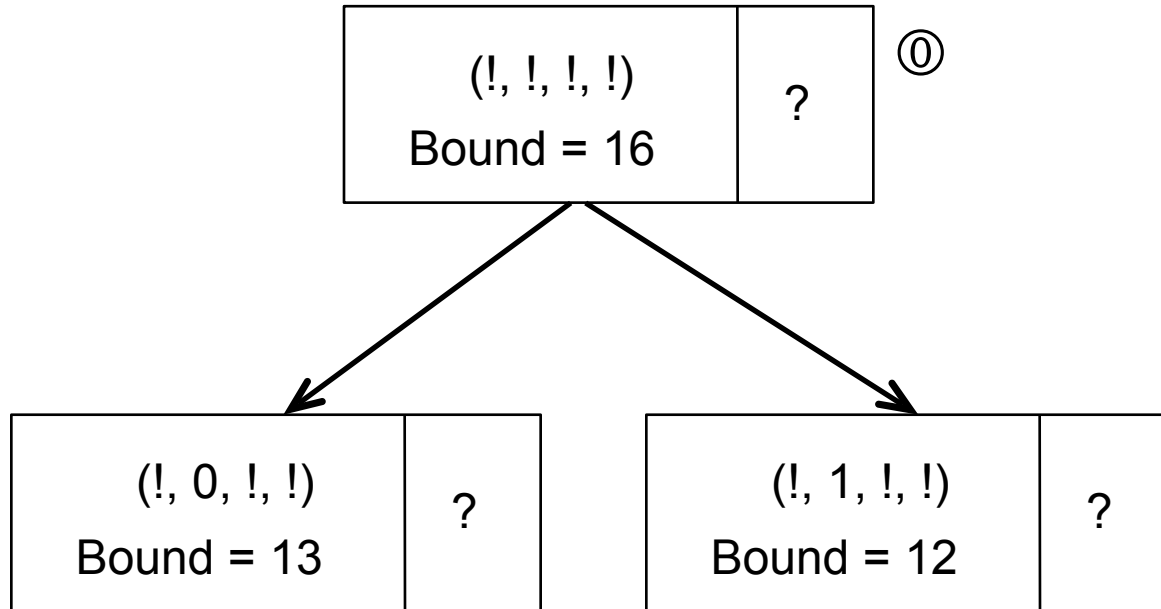
Search Control 2

- Change any nodes that can change to yes (if there is more than one chose left-most)
- Otherwise choose the node with the highest f_{Bound}
- Choose the x_i to work on where p_i/c_i is highest

Branch & Bound

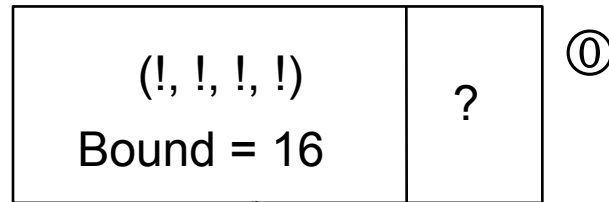
S_0

Env:
Maxsol = 0

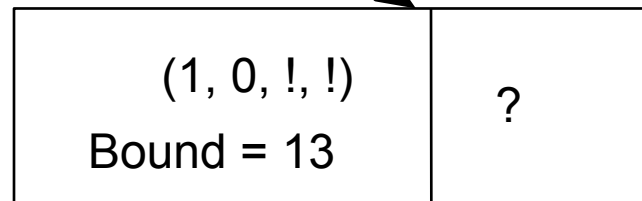
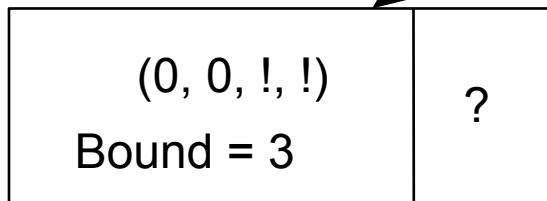
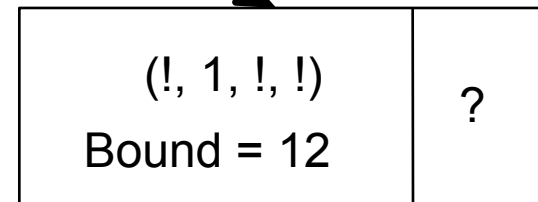
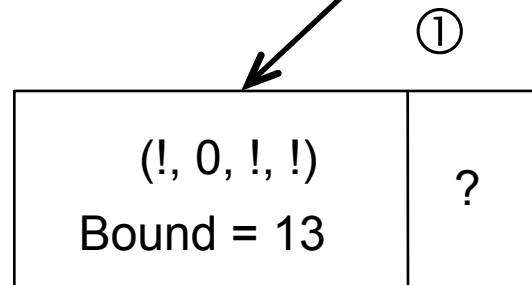


Branch & Bound

S_1

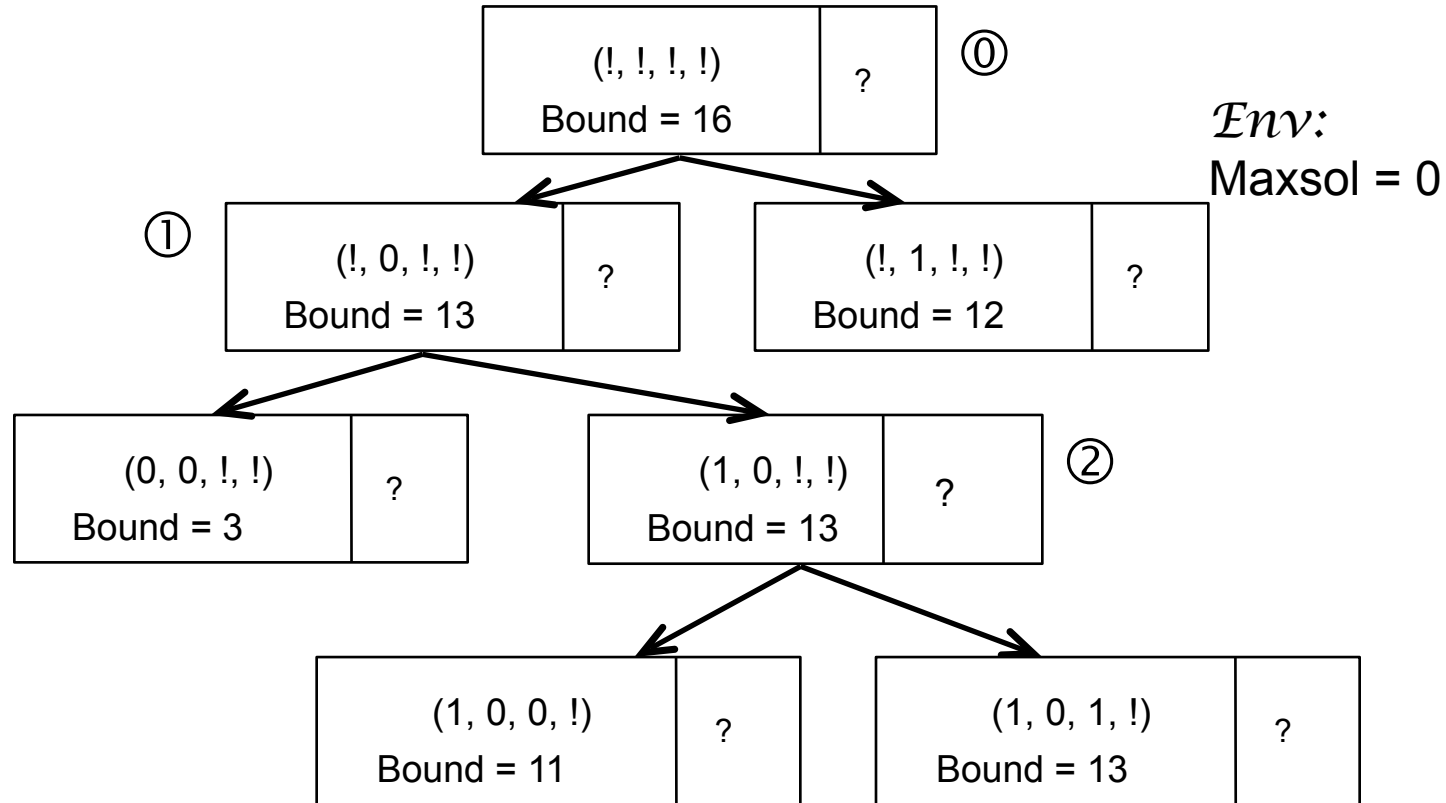


Env:
Maxsol = 0



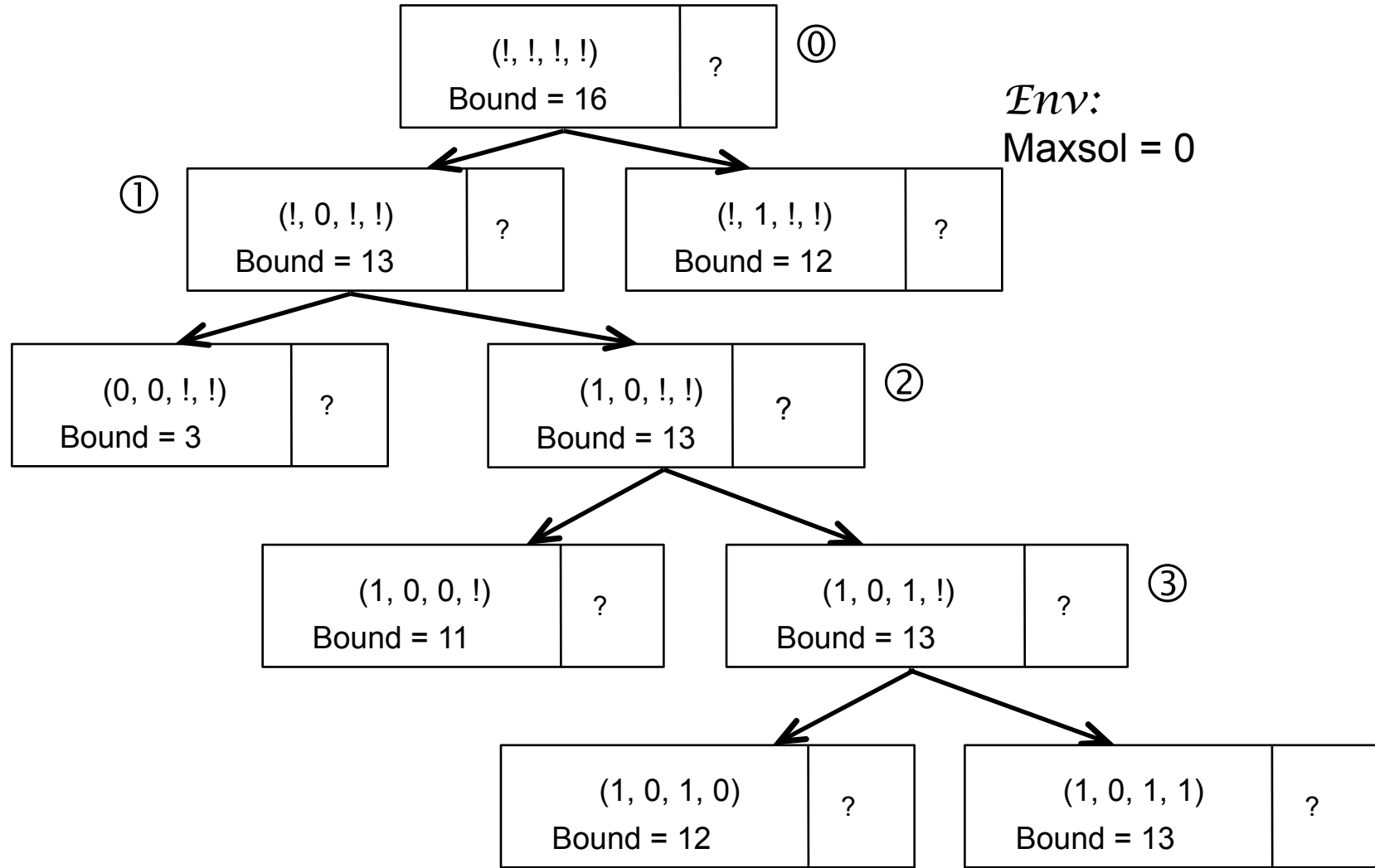
Branch & Bound

S_2



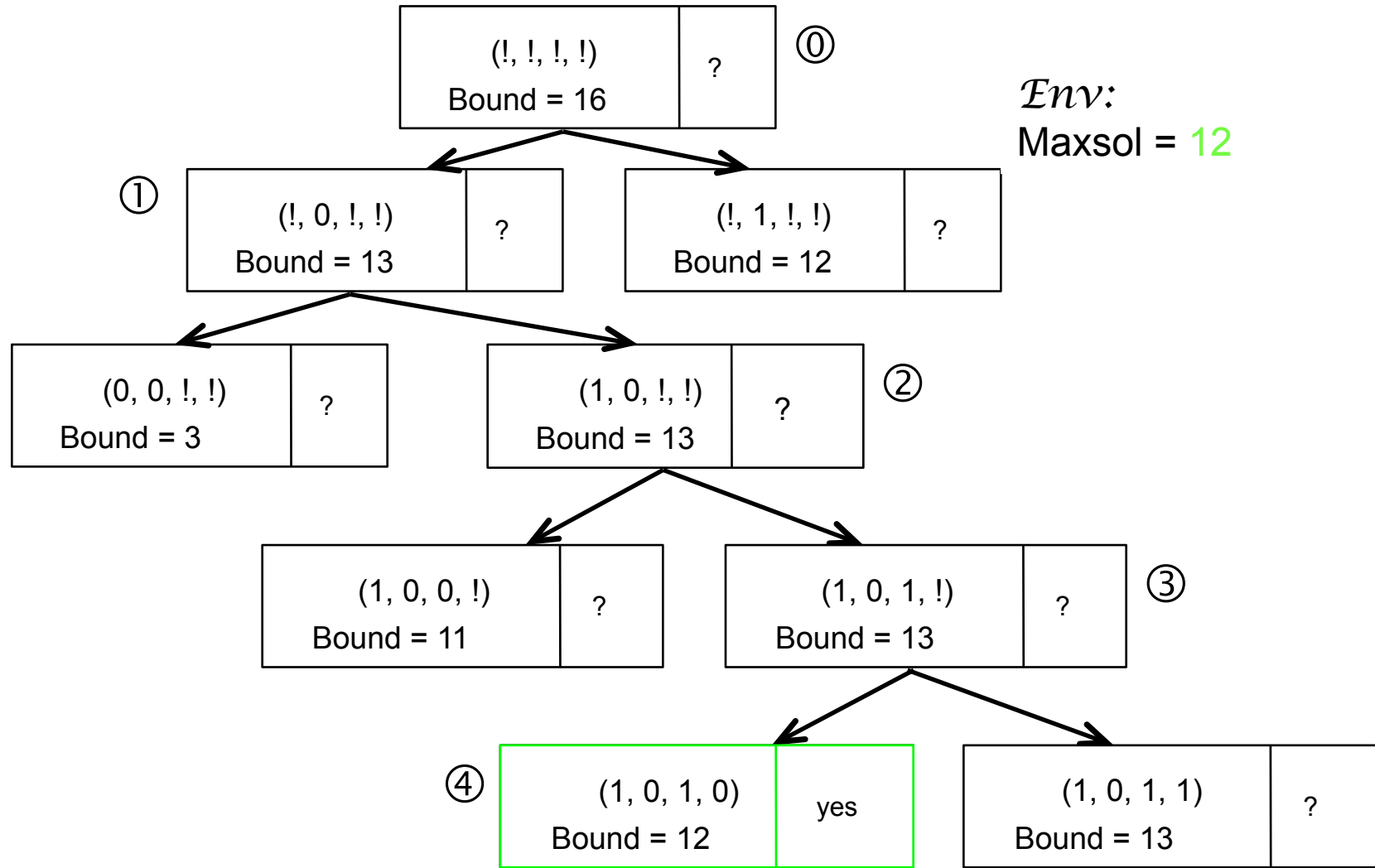
Branch & Bound

S_3



Branch & Bound

S_4

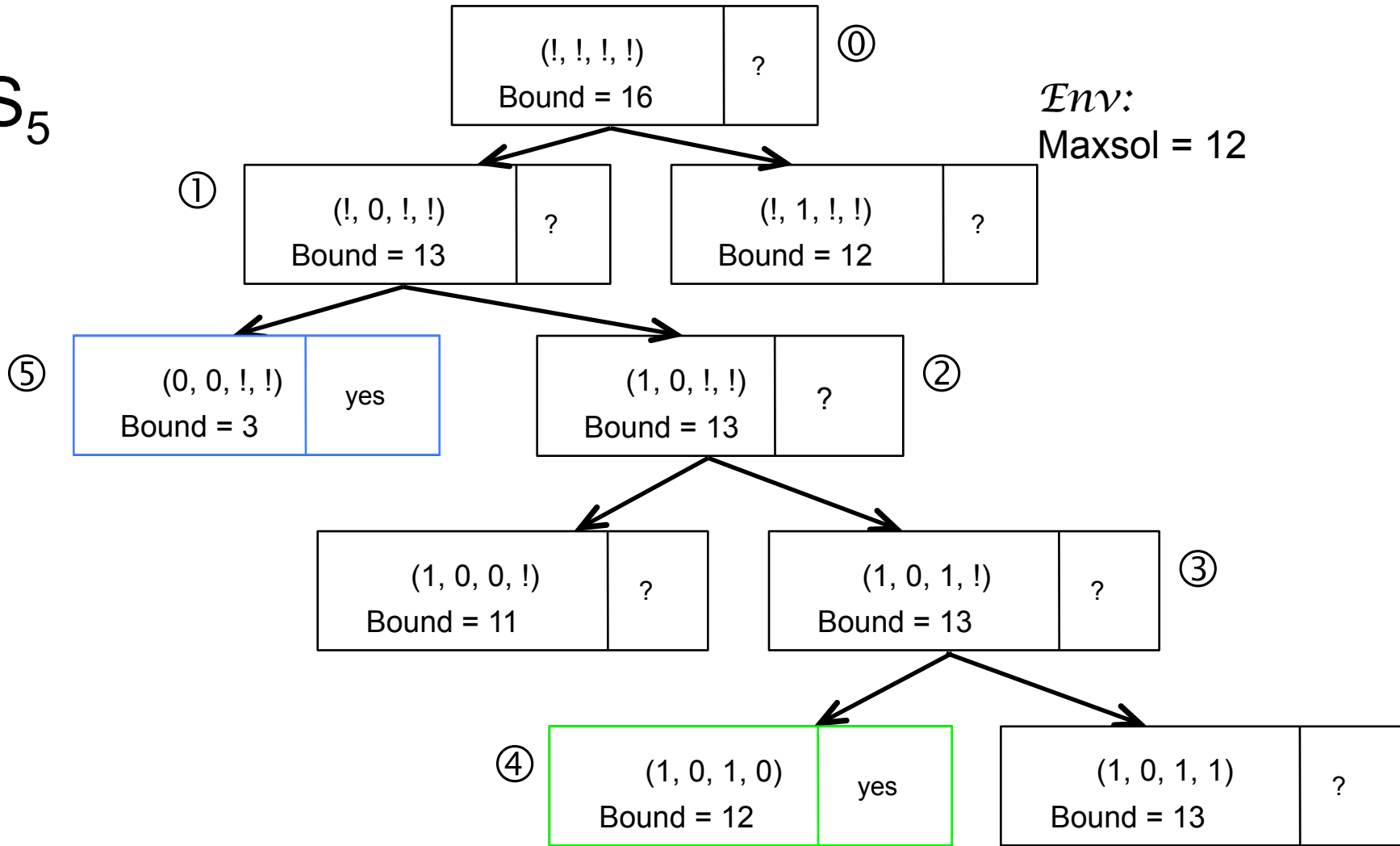


Env:
Maxsol = 12

Branch & Bound

S_5

$Env:$
Maxsol = 12



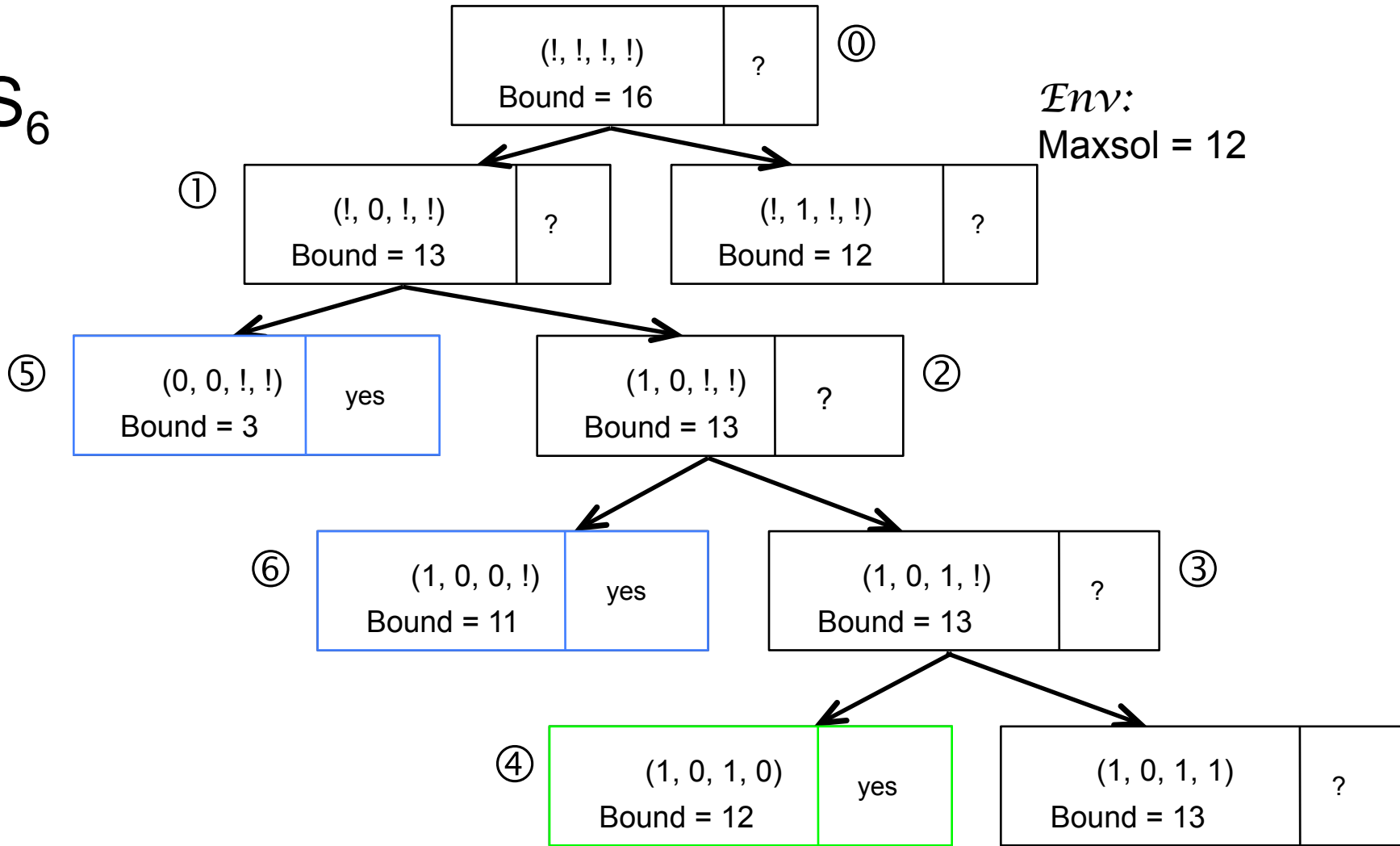
Tyson Kendon © 2007

20

Branch & Bound

S_6

$Env:$
Maxsol = 12



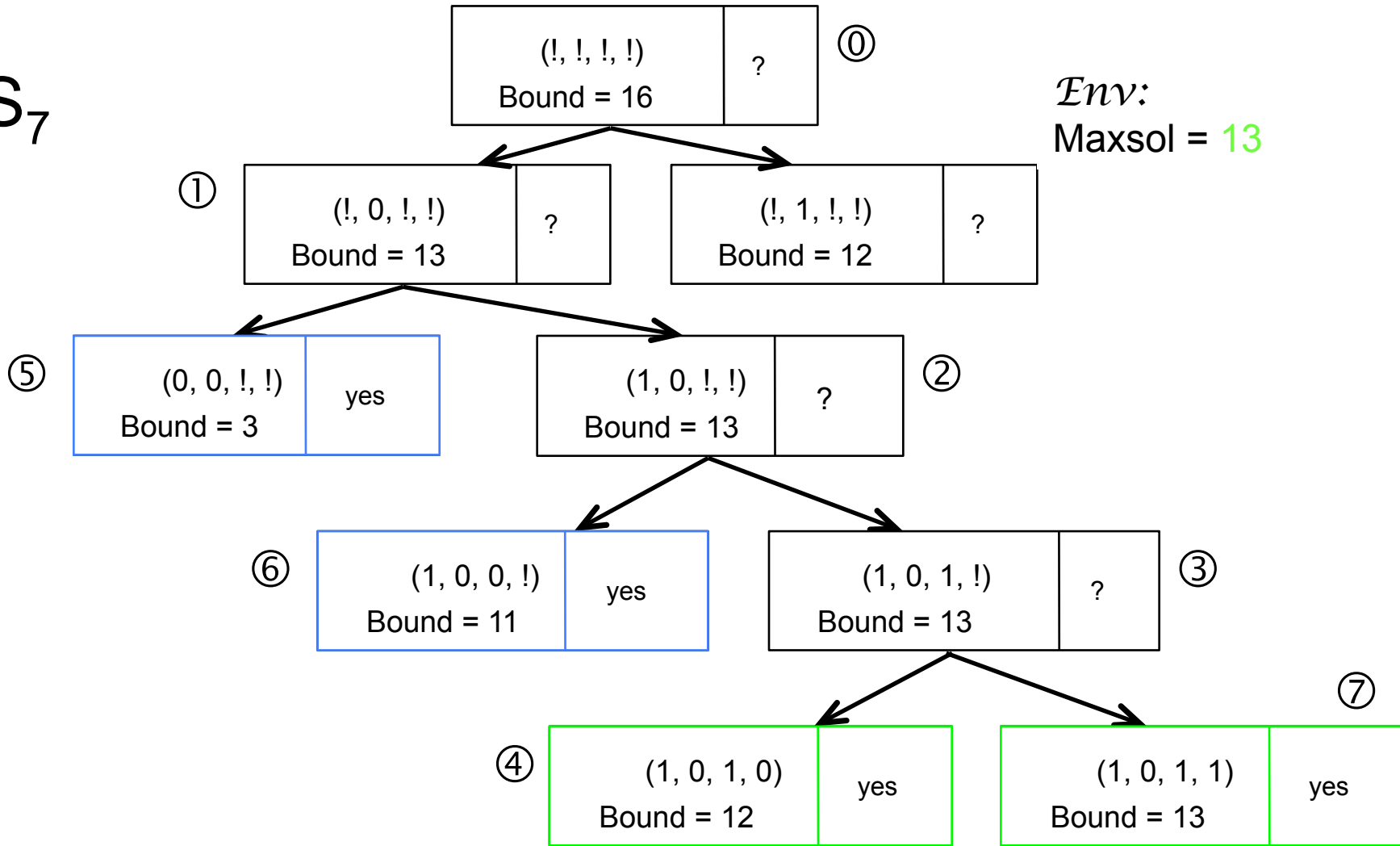
Tyson Kendon © 2007

21

Branch & Bound

S_7

Env:
Maxsol = 13



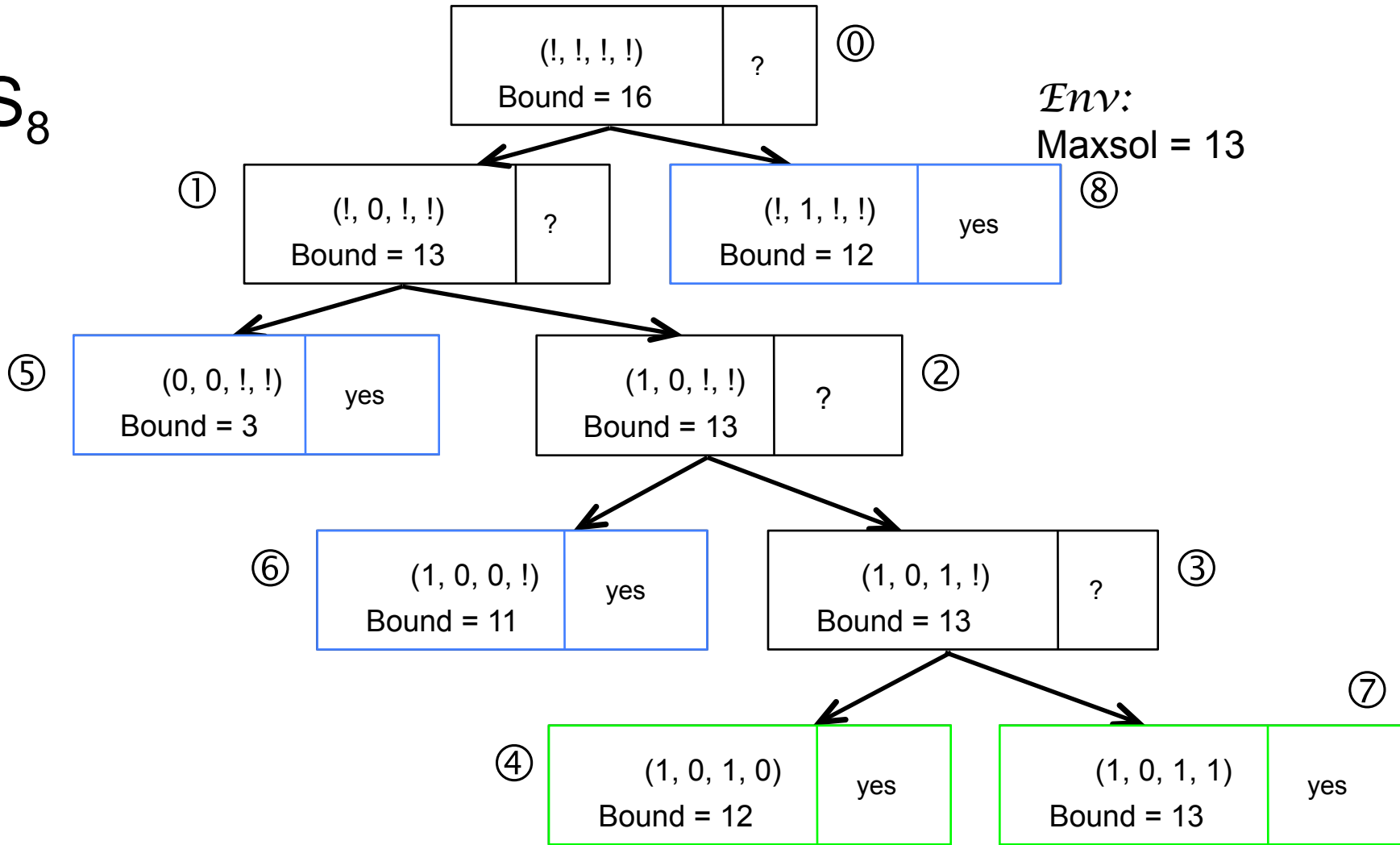
Tyson Kendon © 2007

22

Branch & Bound

S_8

Env:
Maxsol = 13



Tyson Kendon © 2007

23