

# Science informatique

# CM6

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# Exercice 2 du TD5

# Expressions arithmétiques

Une expression arithmétique (totalement parenthésée) est :

- soit un nombre entier  $n$
- soit une somme parenthésée  $(e_1 + e_2)$ , où  $e_1$  et  $e_2$  sont deux sub-expressions (totalement parenthésée)
- soit une soustraction parenthésée  $(e_1 - e_2)$
- soit un produit parenthésé  $(e_1 \times e_2)$
- soit une division parenthésée  $(e_1 \div e_2)$

# Exemples d'expressions

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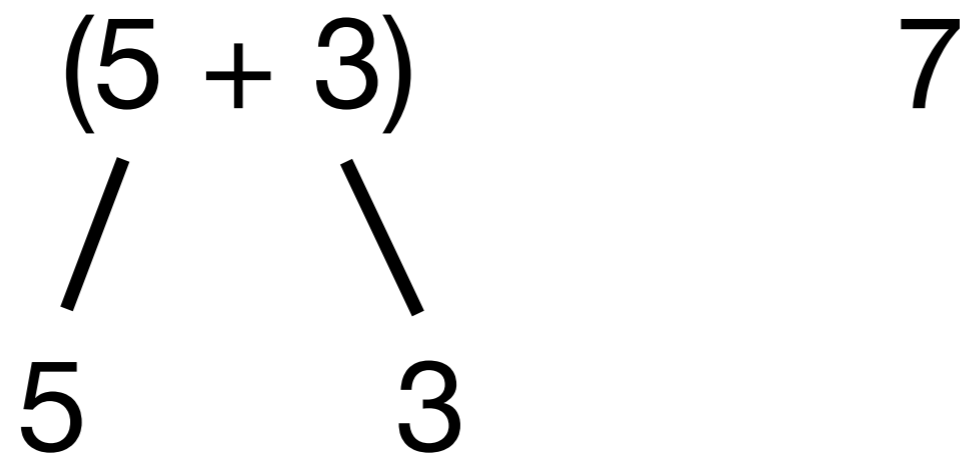
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3

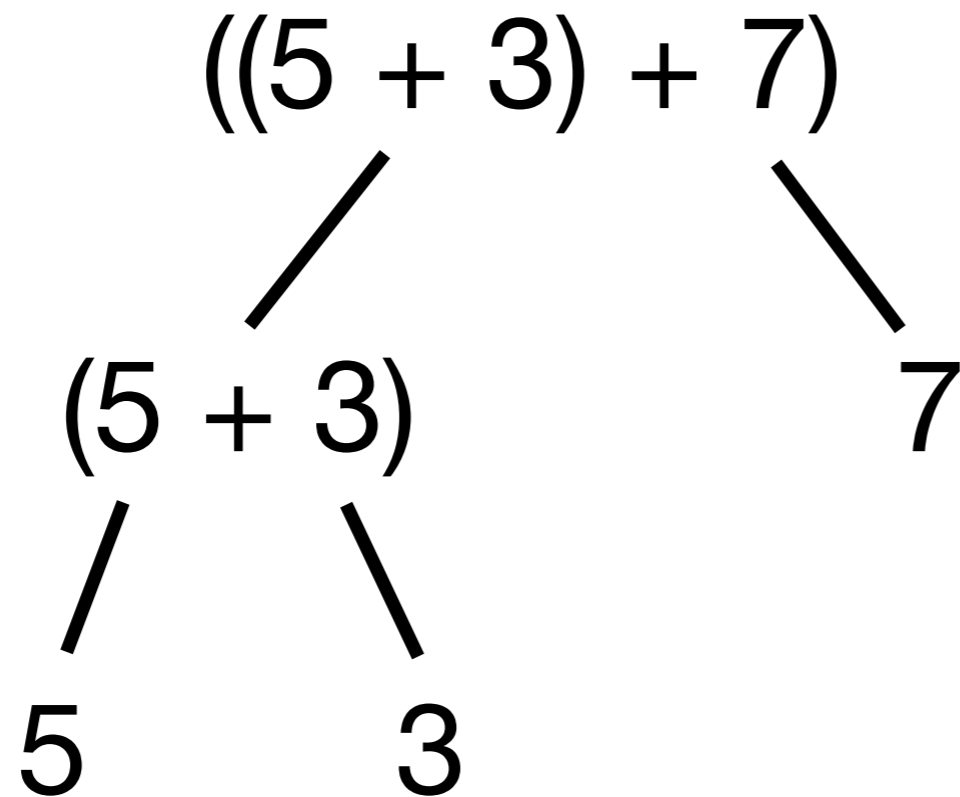
# Exemples d'expressions

$$\begin{array}{c} (5 + 3) \\ / \quad \backslash \\ 5 \quad 3 \end{array}$$

# Exemples d'expressions

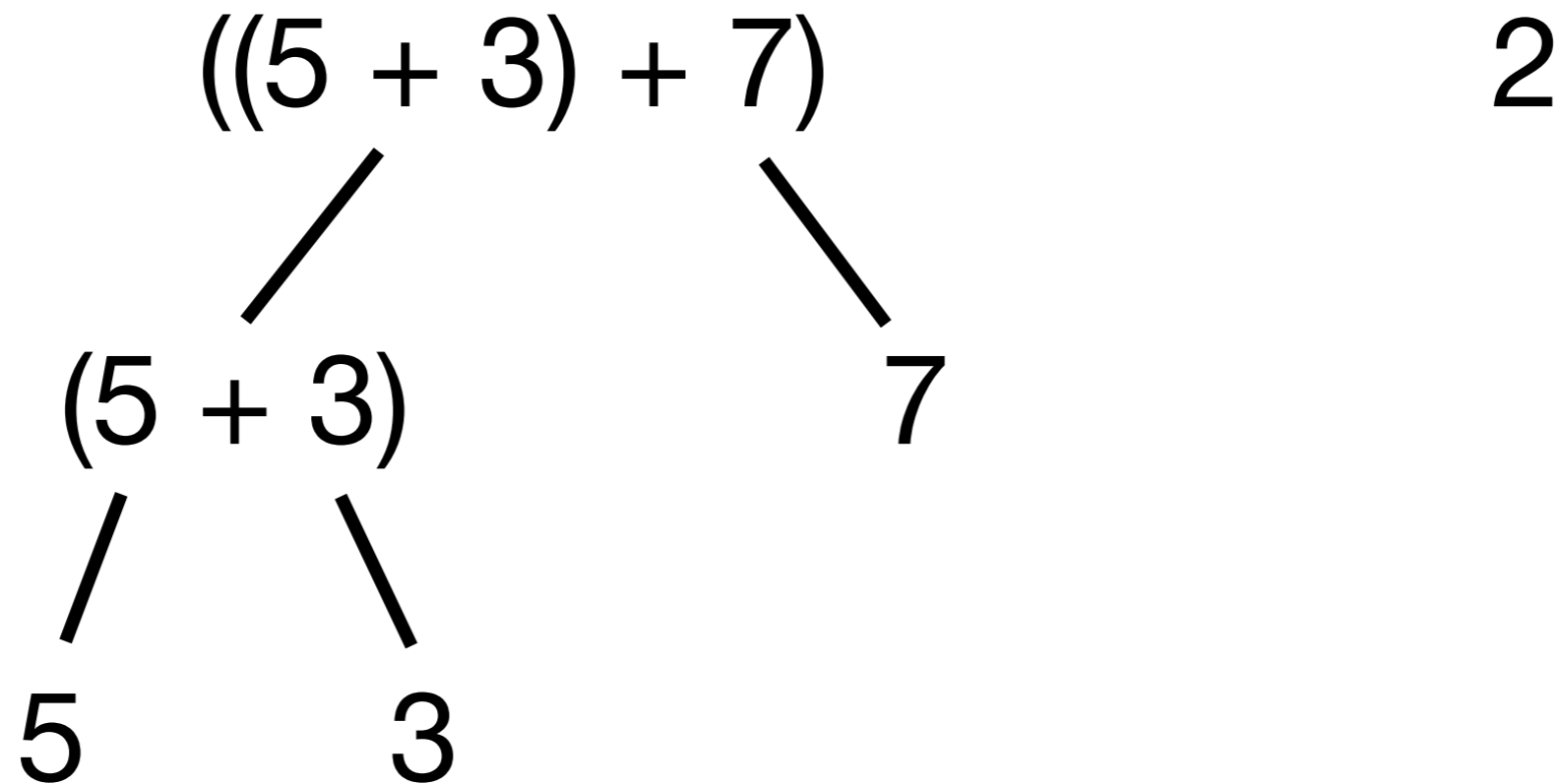


# Exemples d'expressions

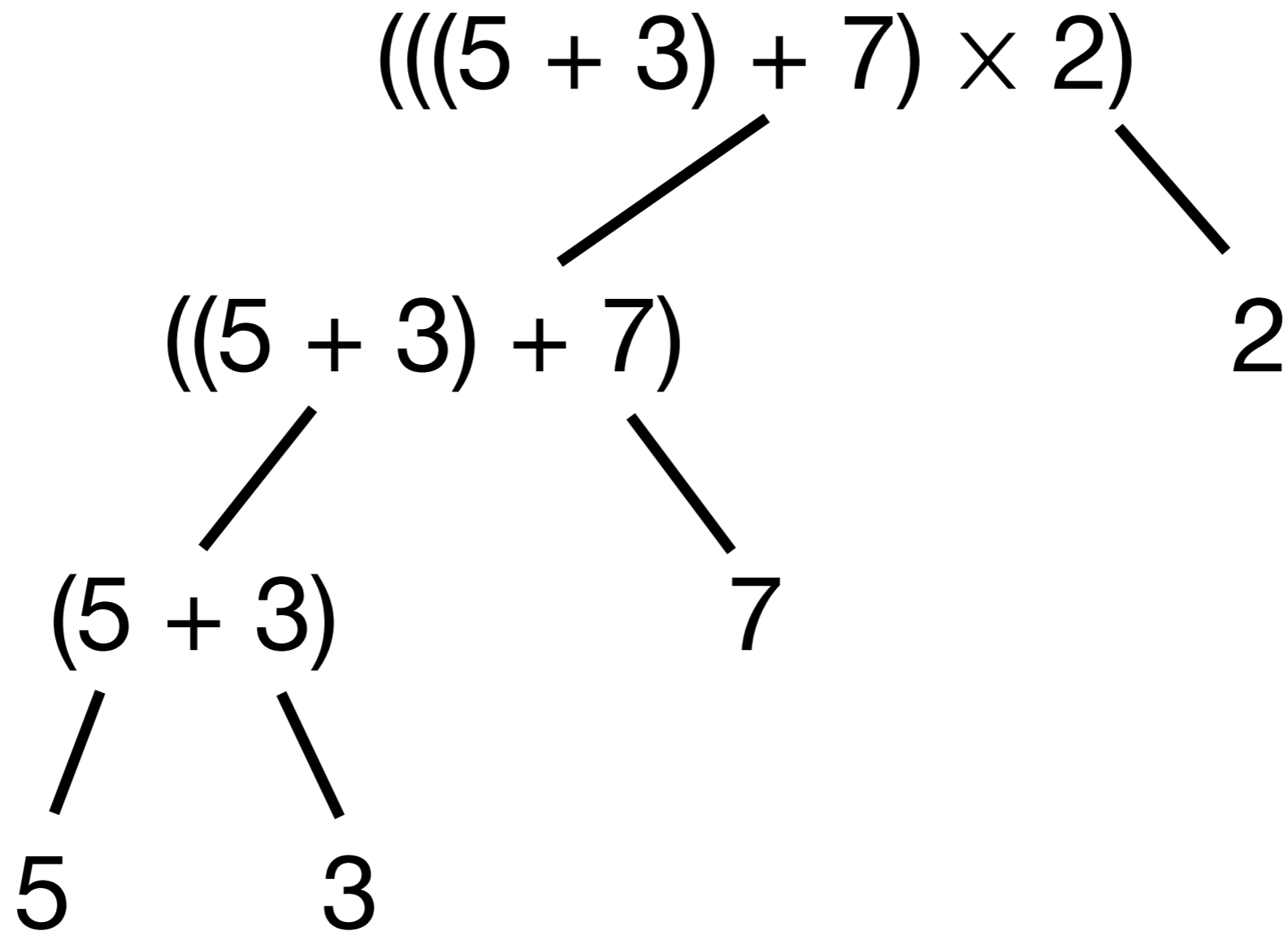




# Exemples d'expressions



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# Exemples d'expressions

5

3

7

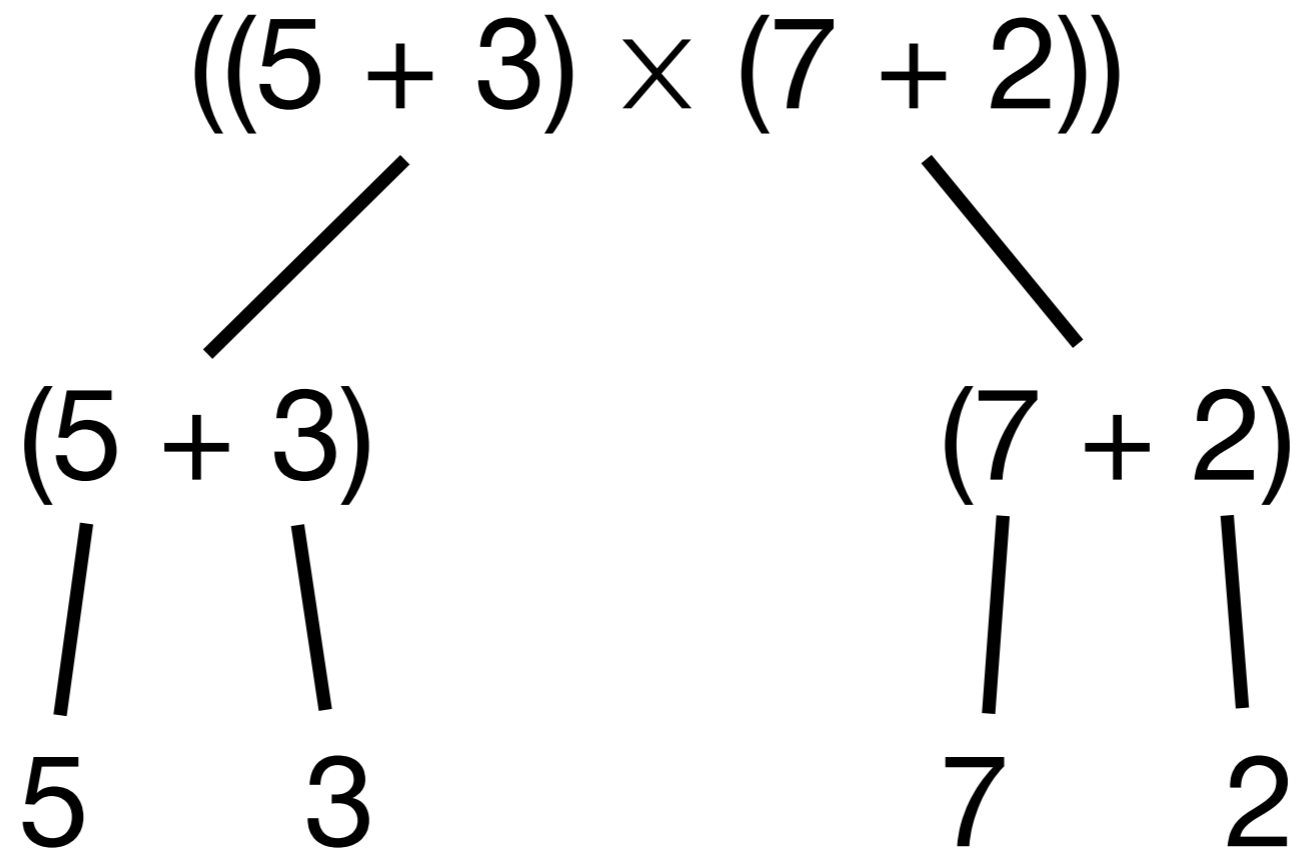
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# Exemples d'expressions

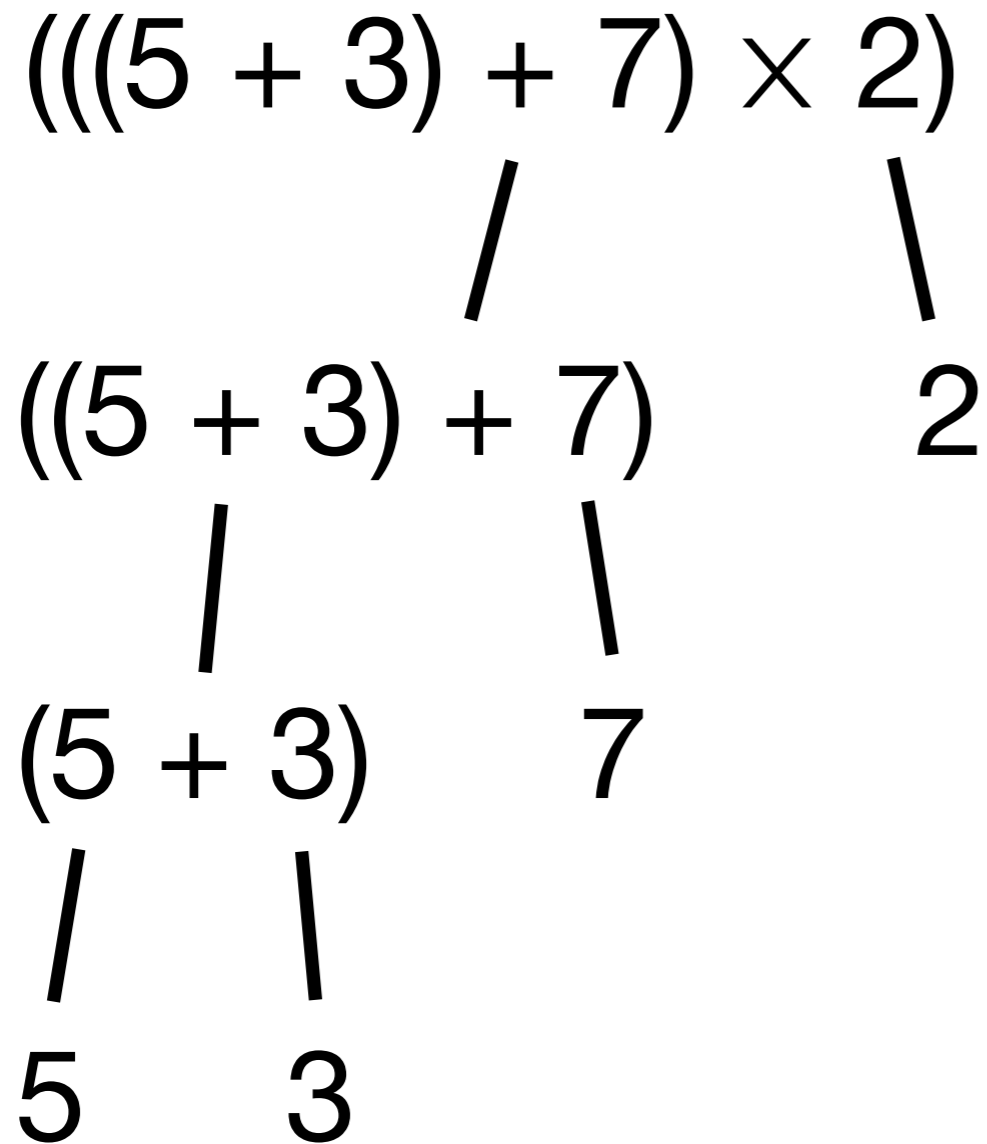
$$\begin{array}{c} (5 + 3) \\ | \quad \backslash \\ 5 \quad 3 \end{array}$$

$$\begin{array}{c} (7 + 2) \\ | \quad \backslash \\ 7 \quad 2 \end{array}$$

# Exemples d'expressions



# Représentation d'expressions



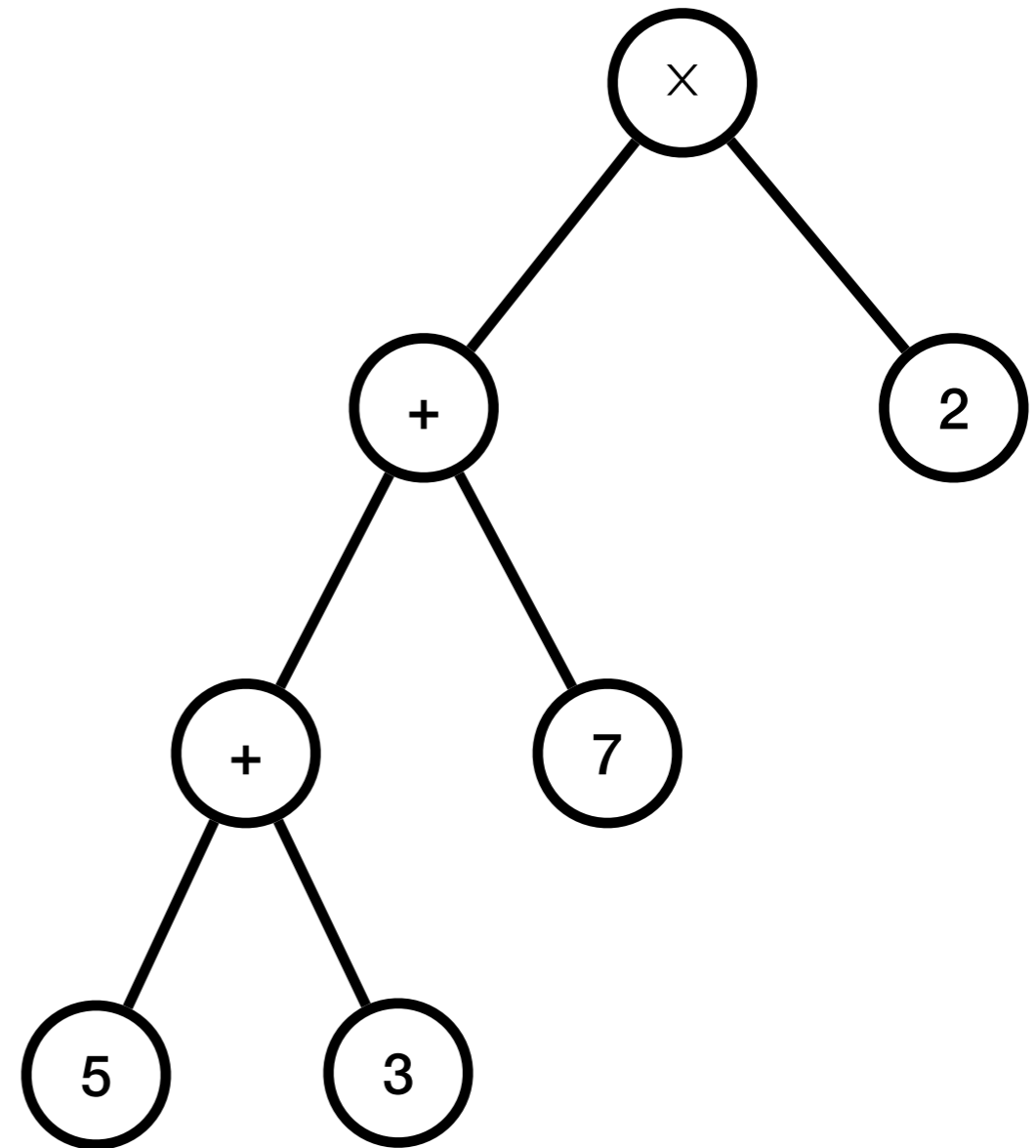
# Représentation d'expressions

$((5 + 3) + 7) \times 2$

$((5 + 3) + 7)$        $2$

$(5 + 3)$        $7$

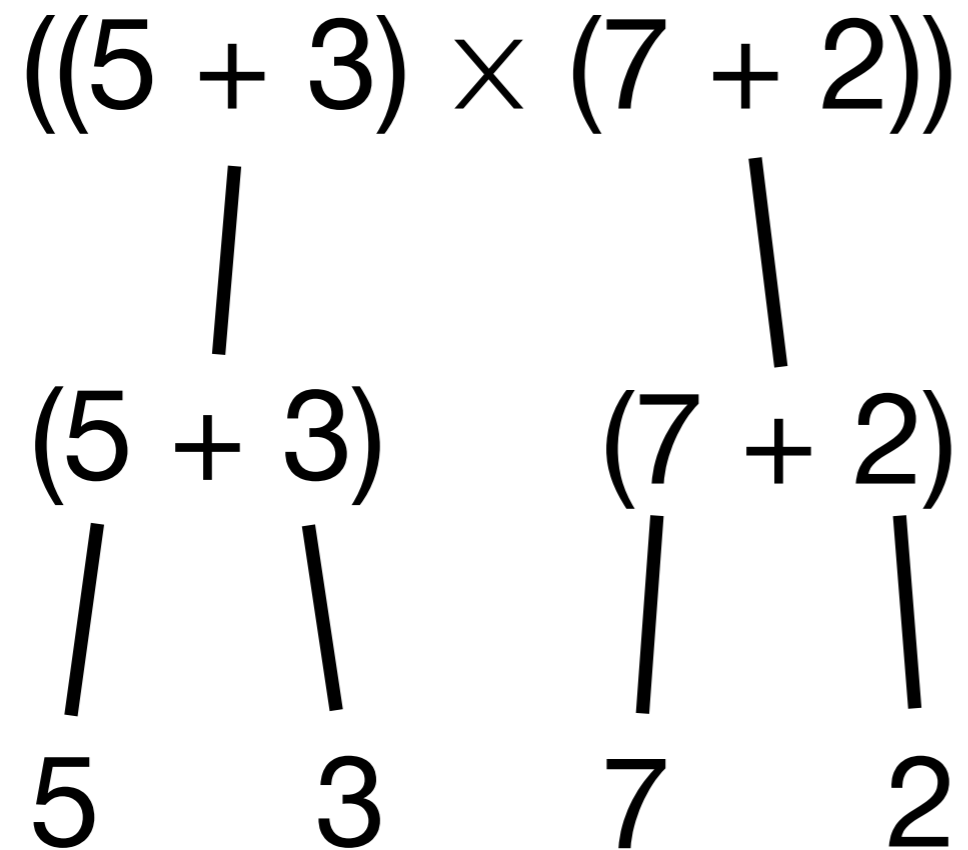
$5$        $3$



# Exercice 3.1 du TD5

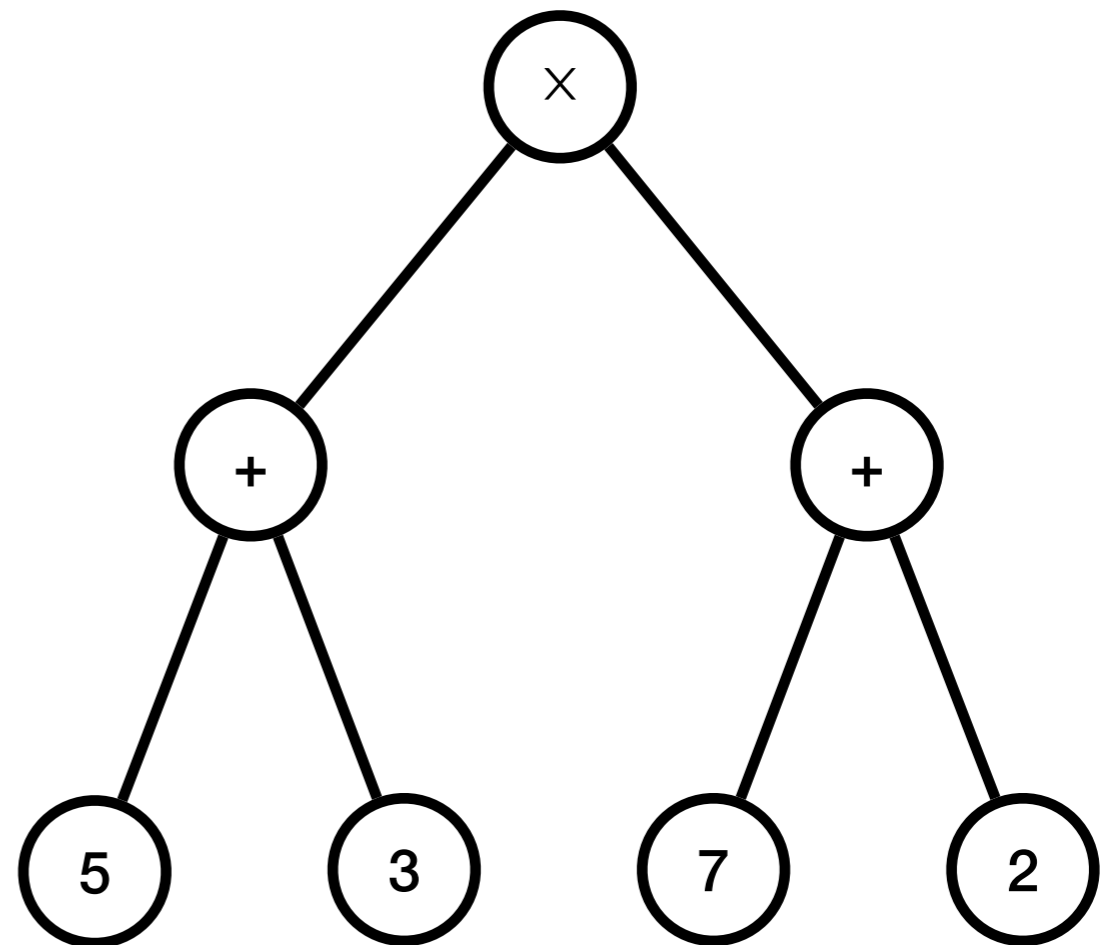
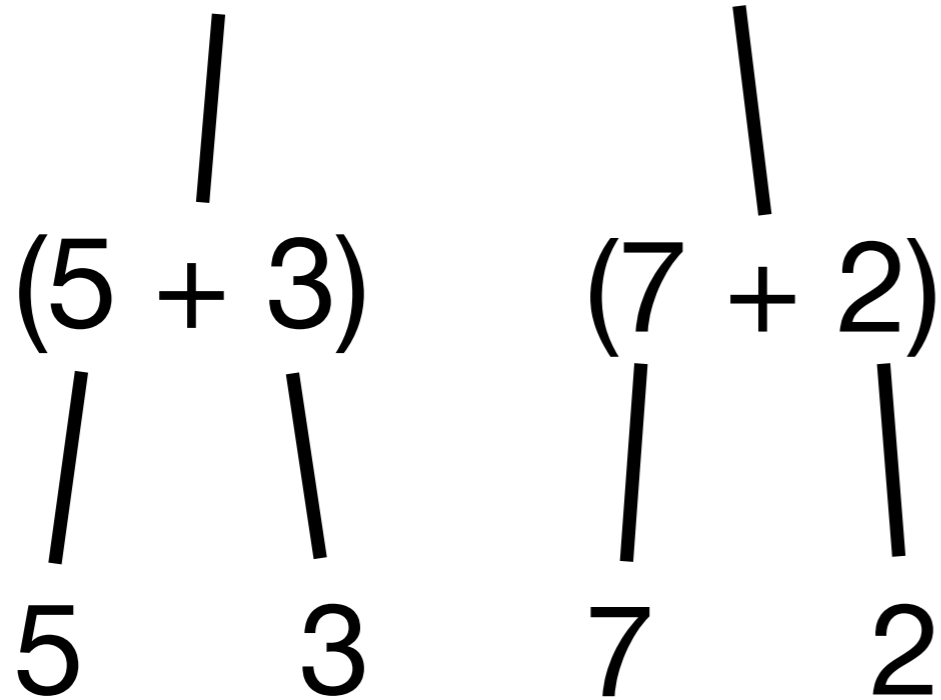


# Représentation d'expressions

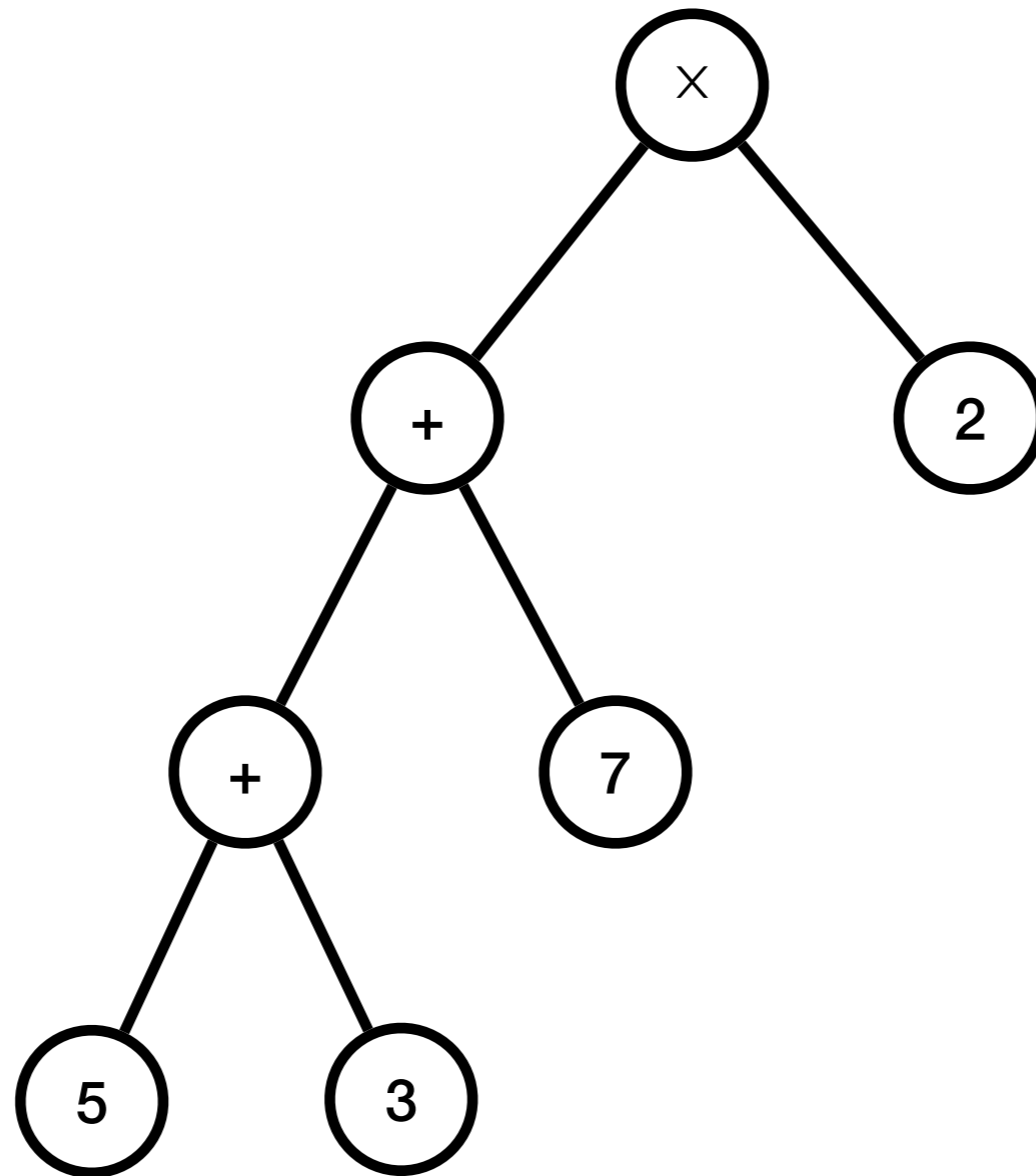


# Représentation d'expressions

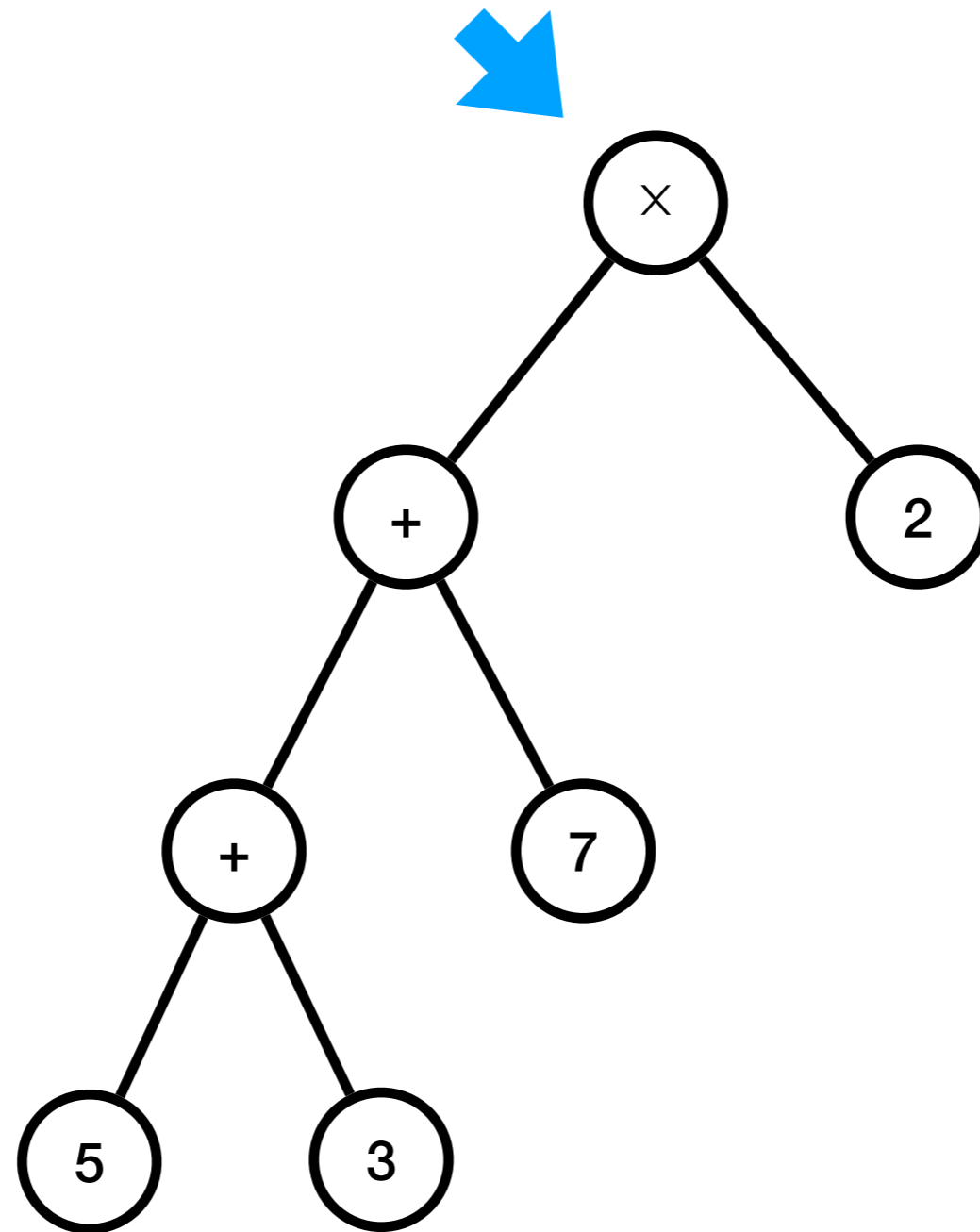
$((5 + 3) \times (7 + 2))$



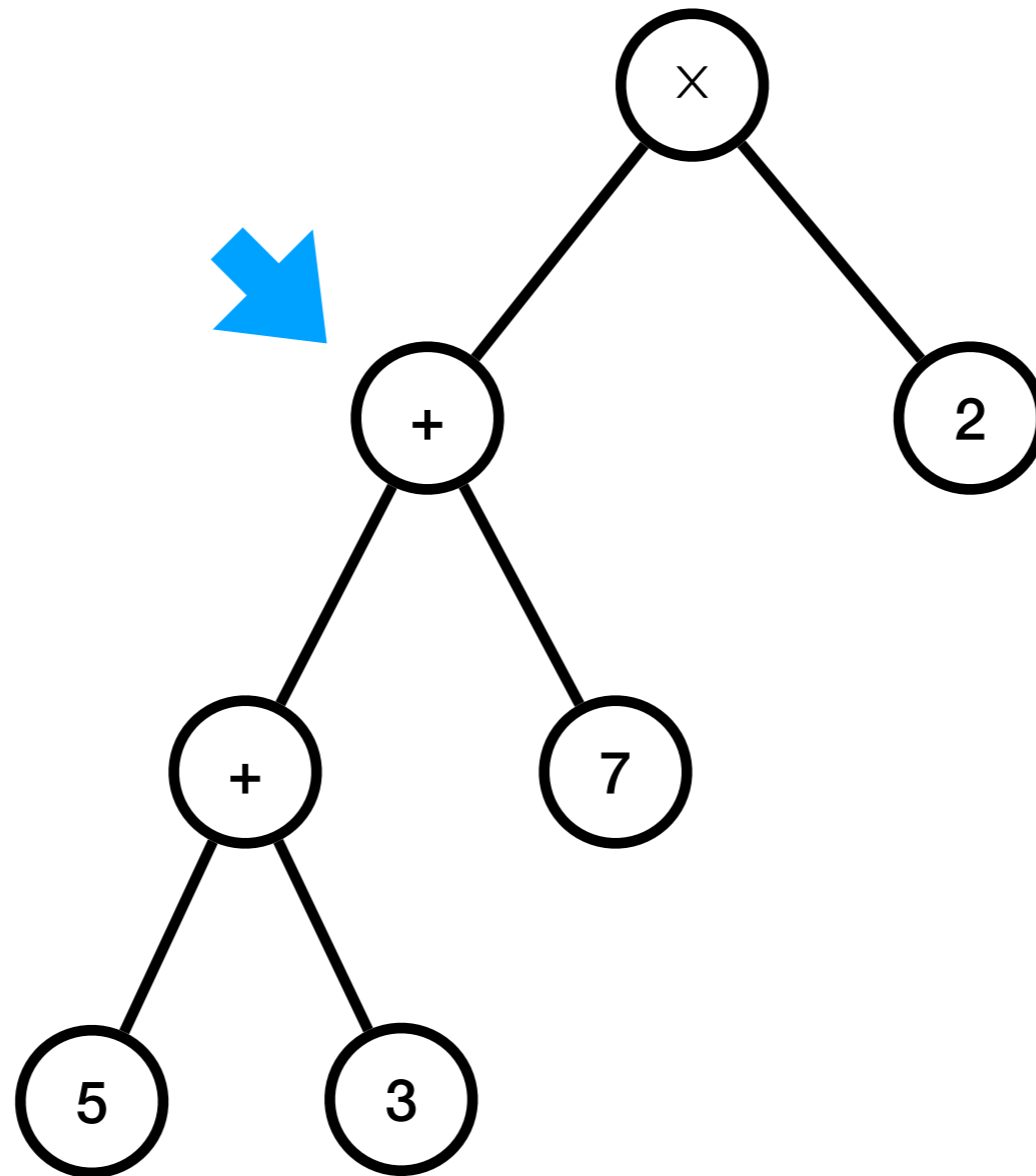
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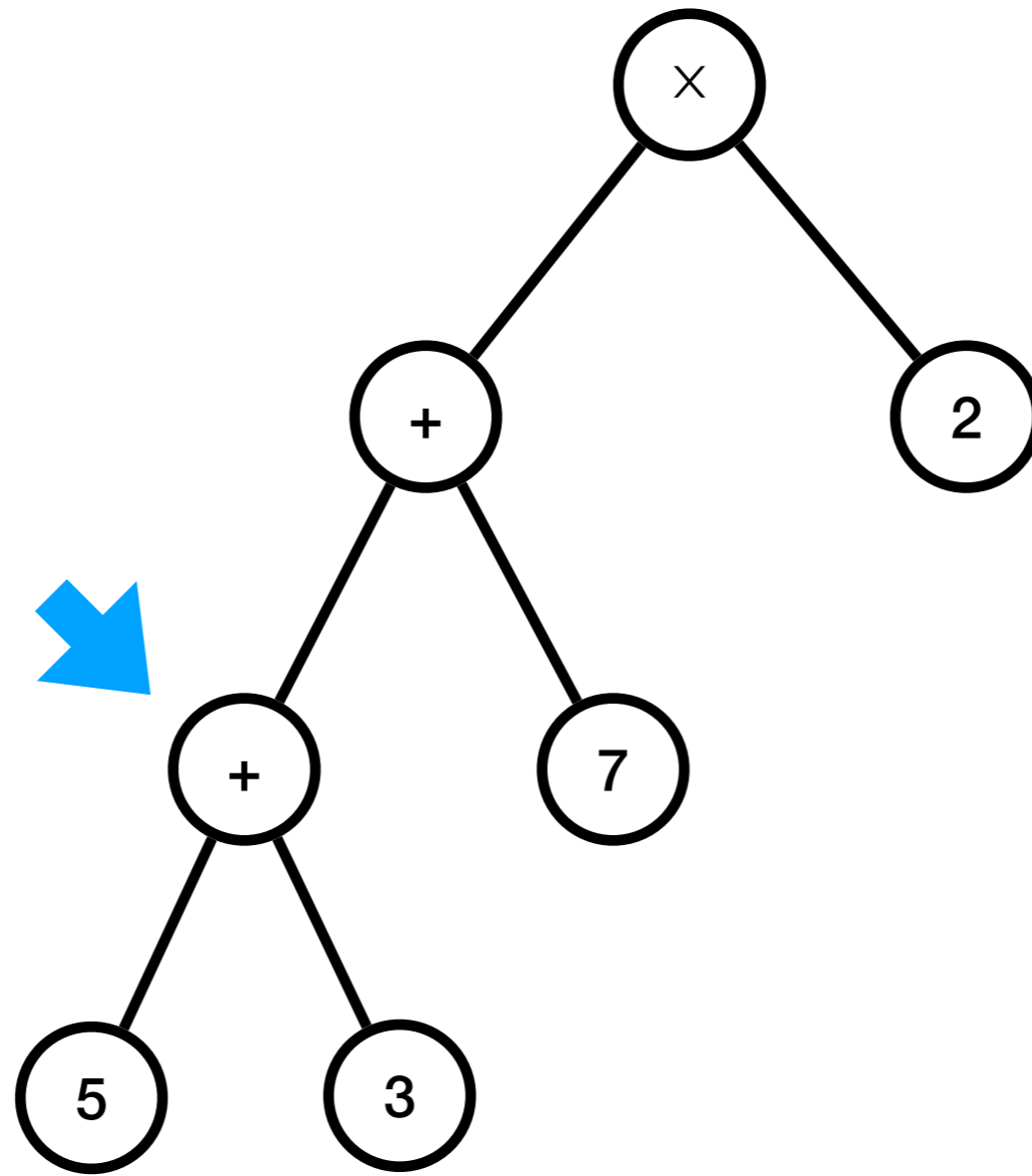
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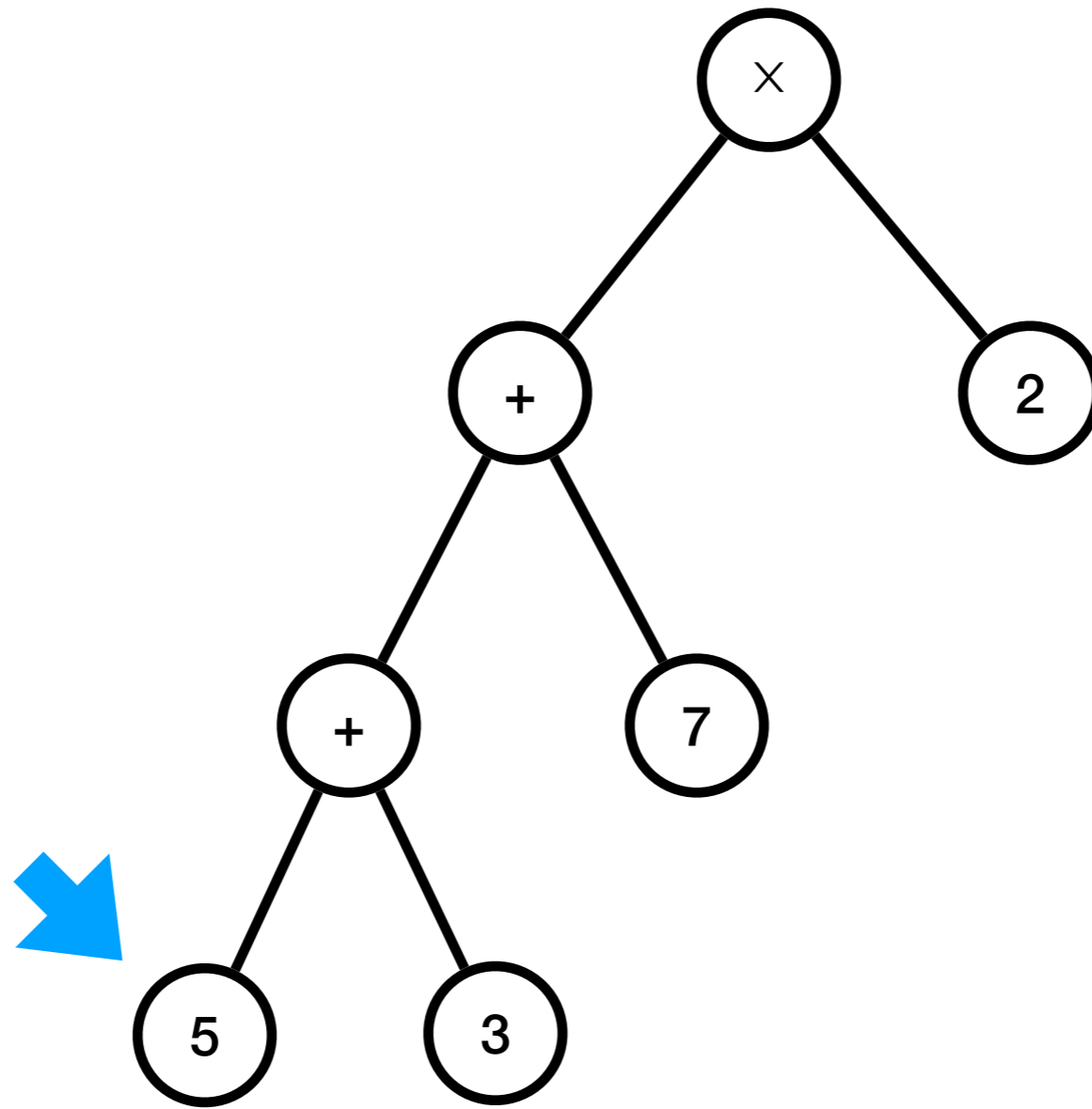
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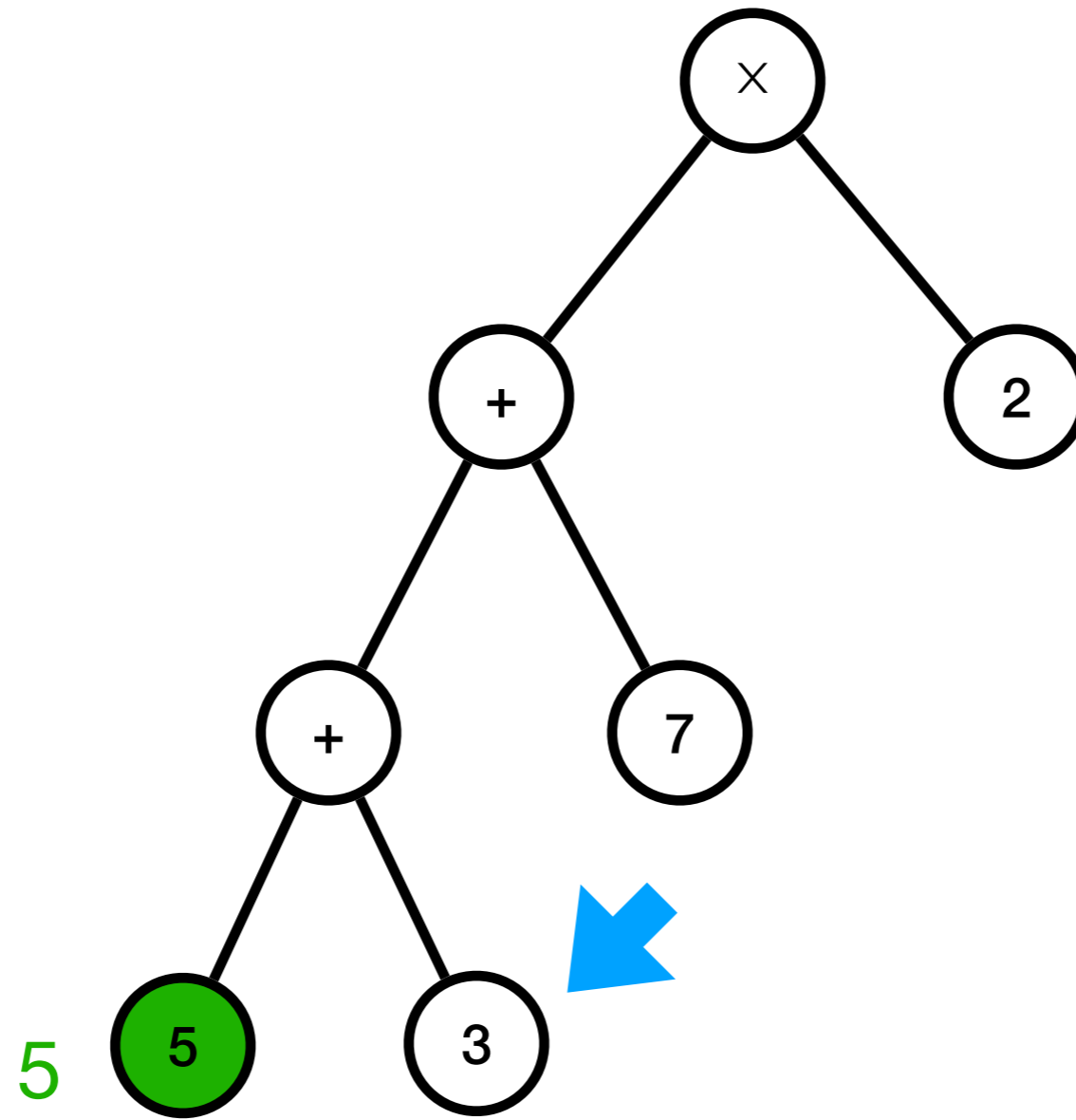




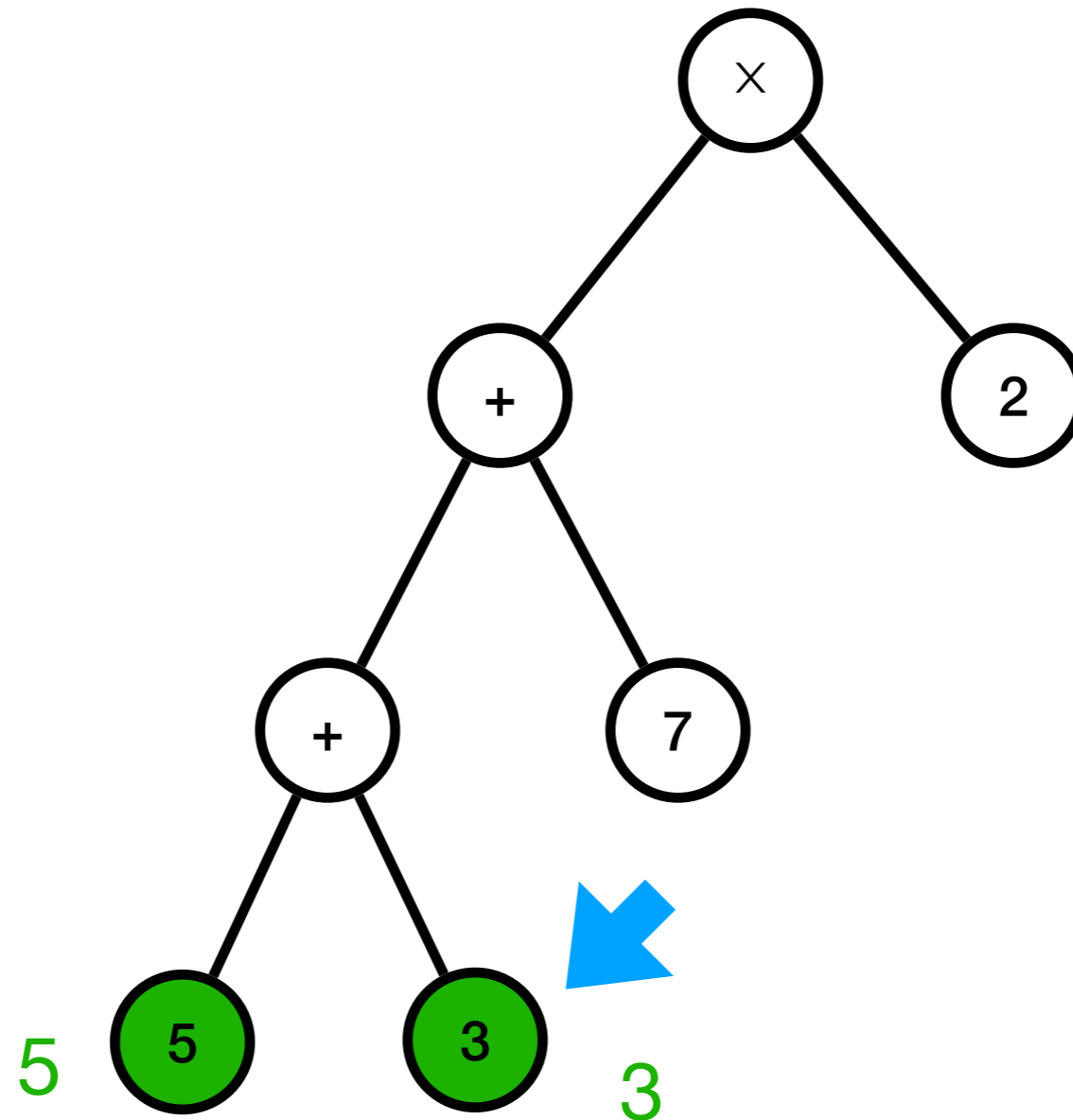




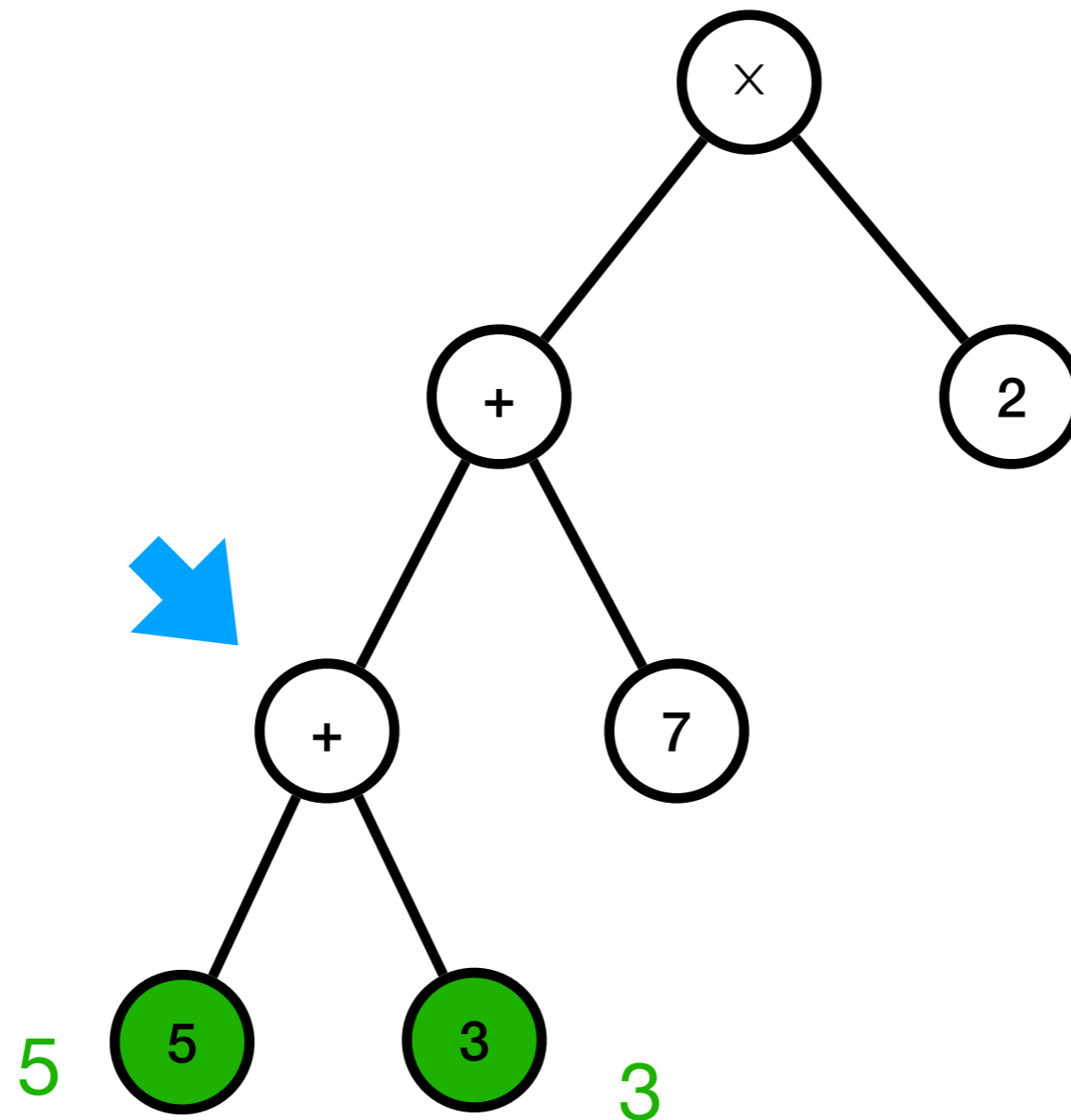
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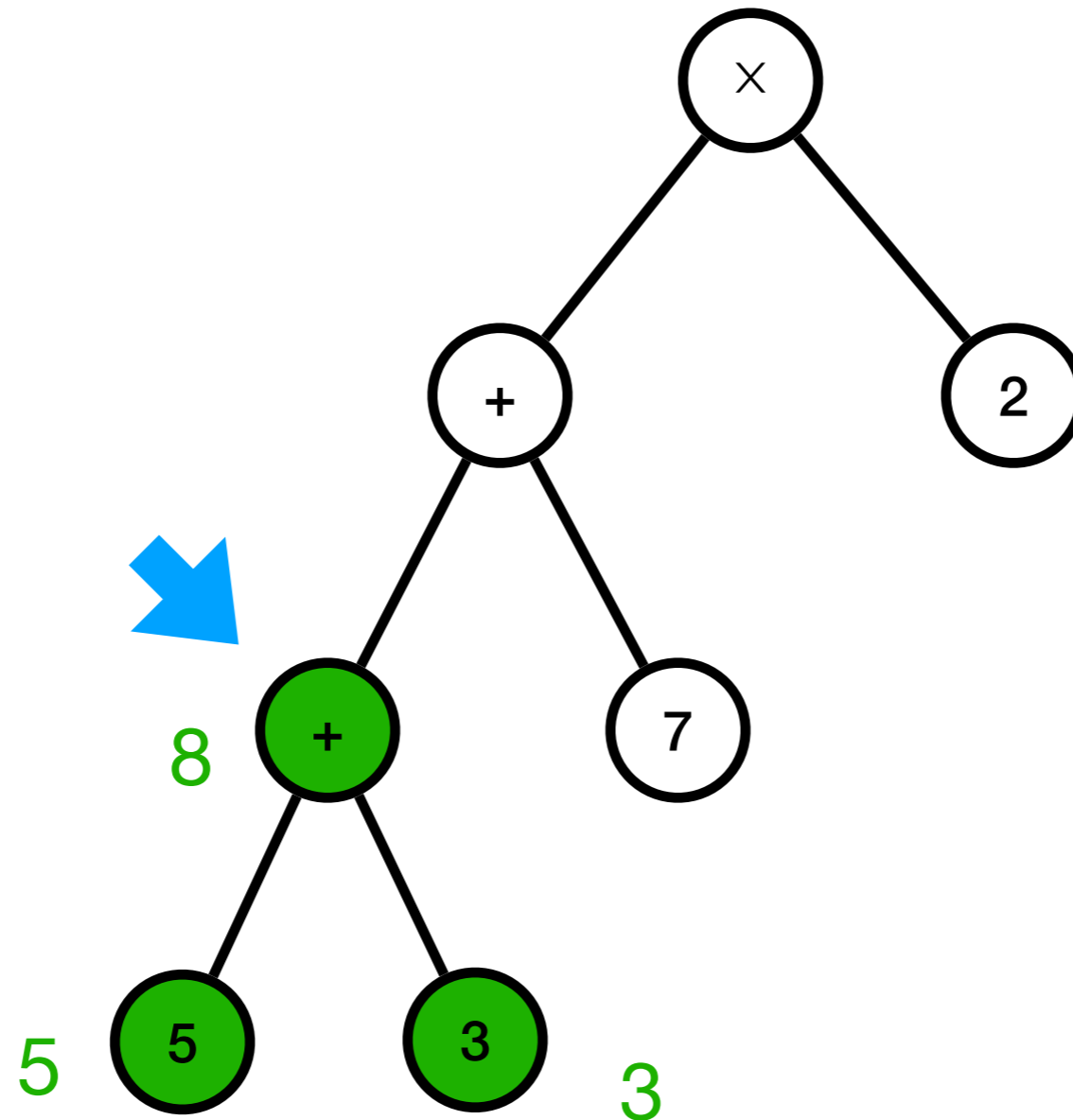
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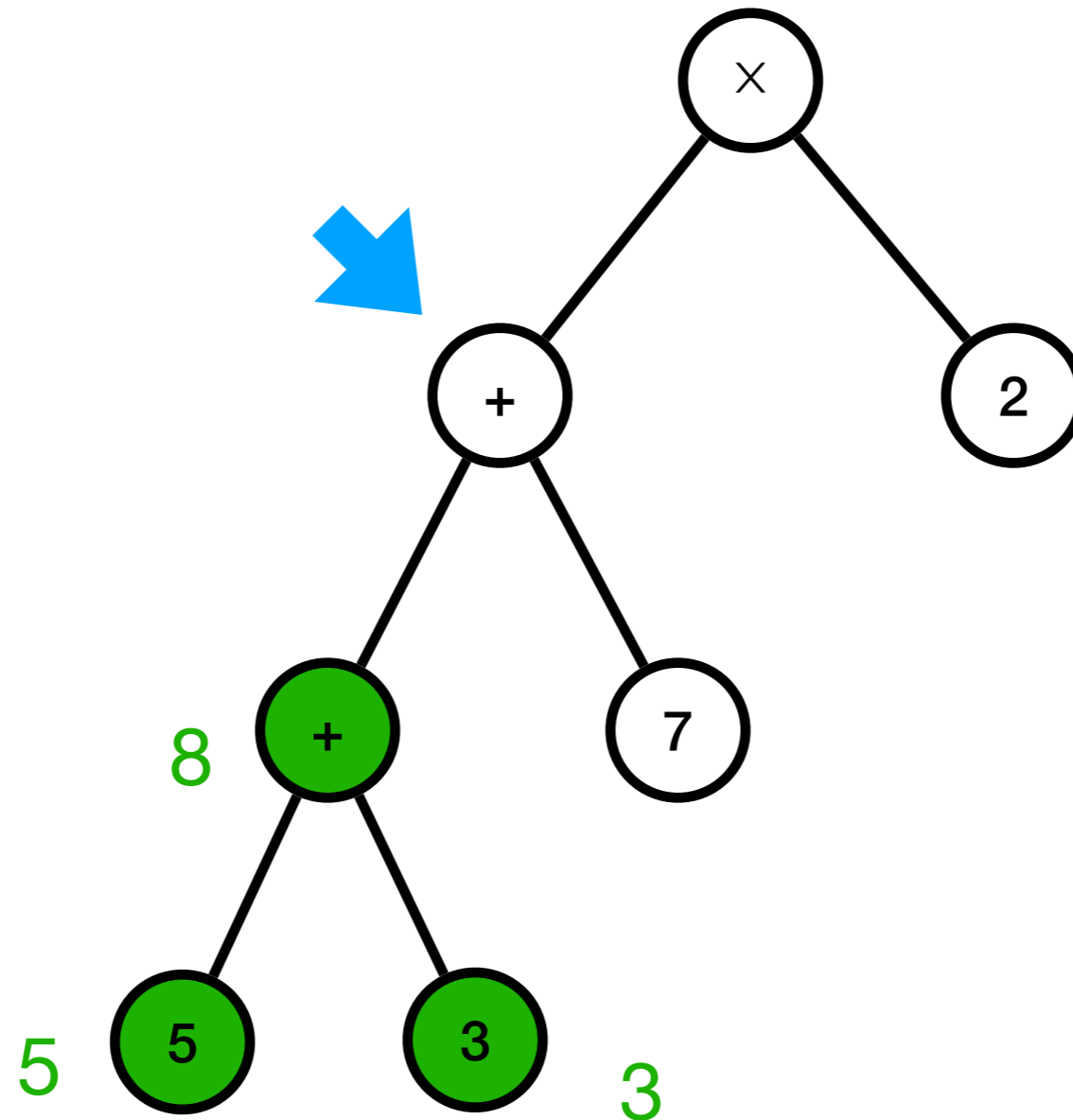
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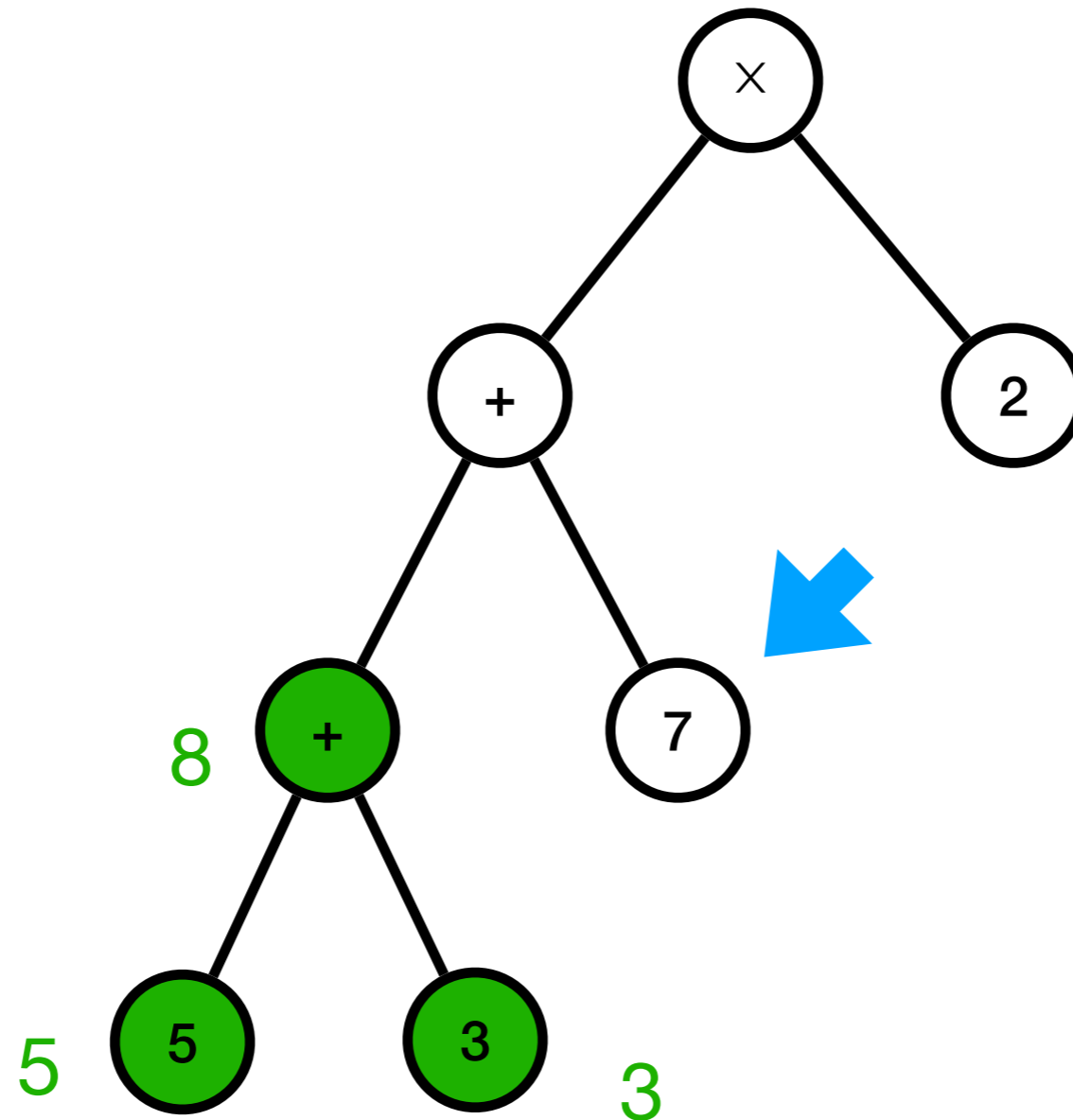
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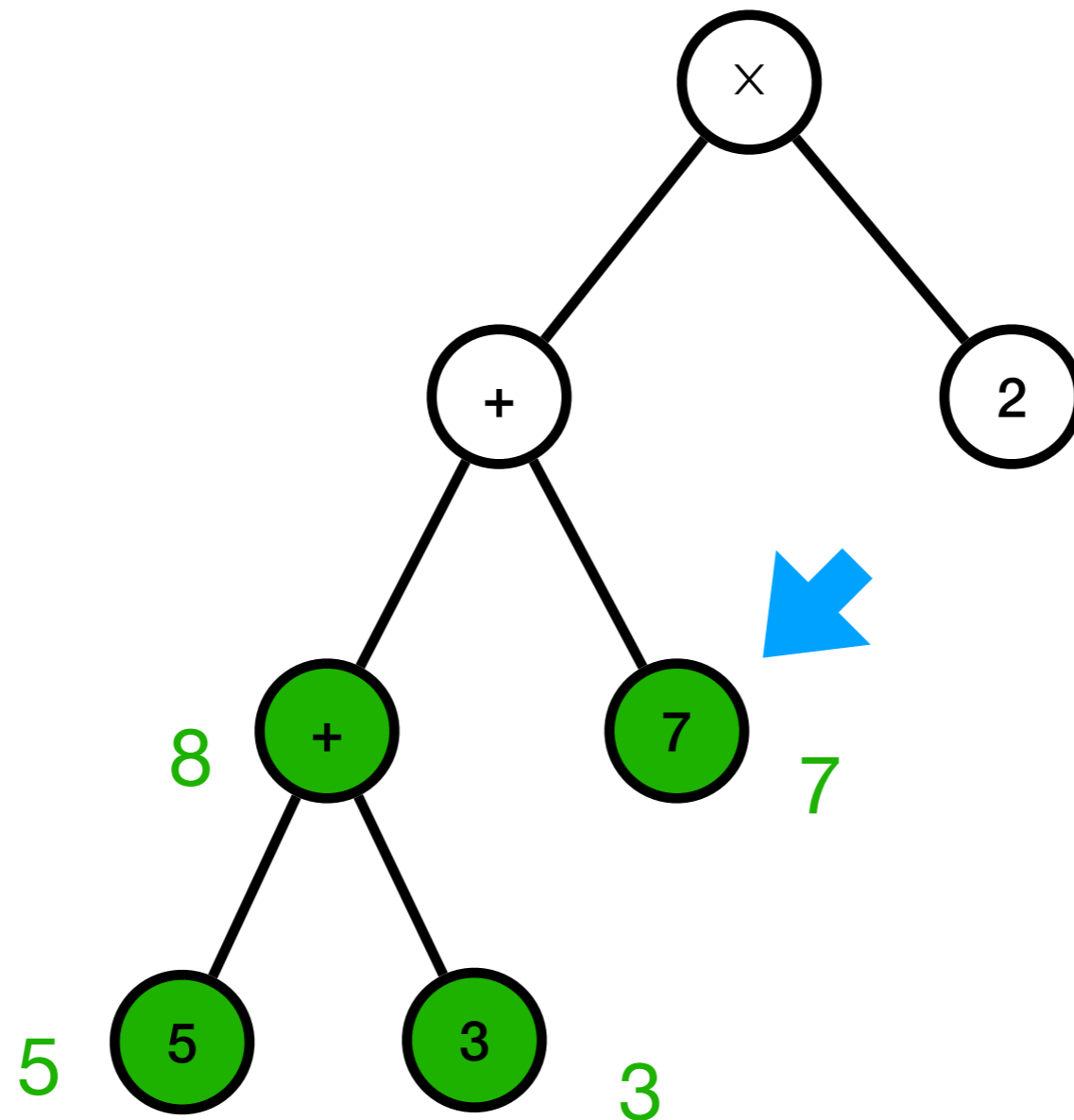
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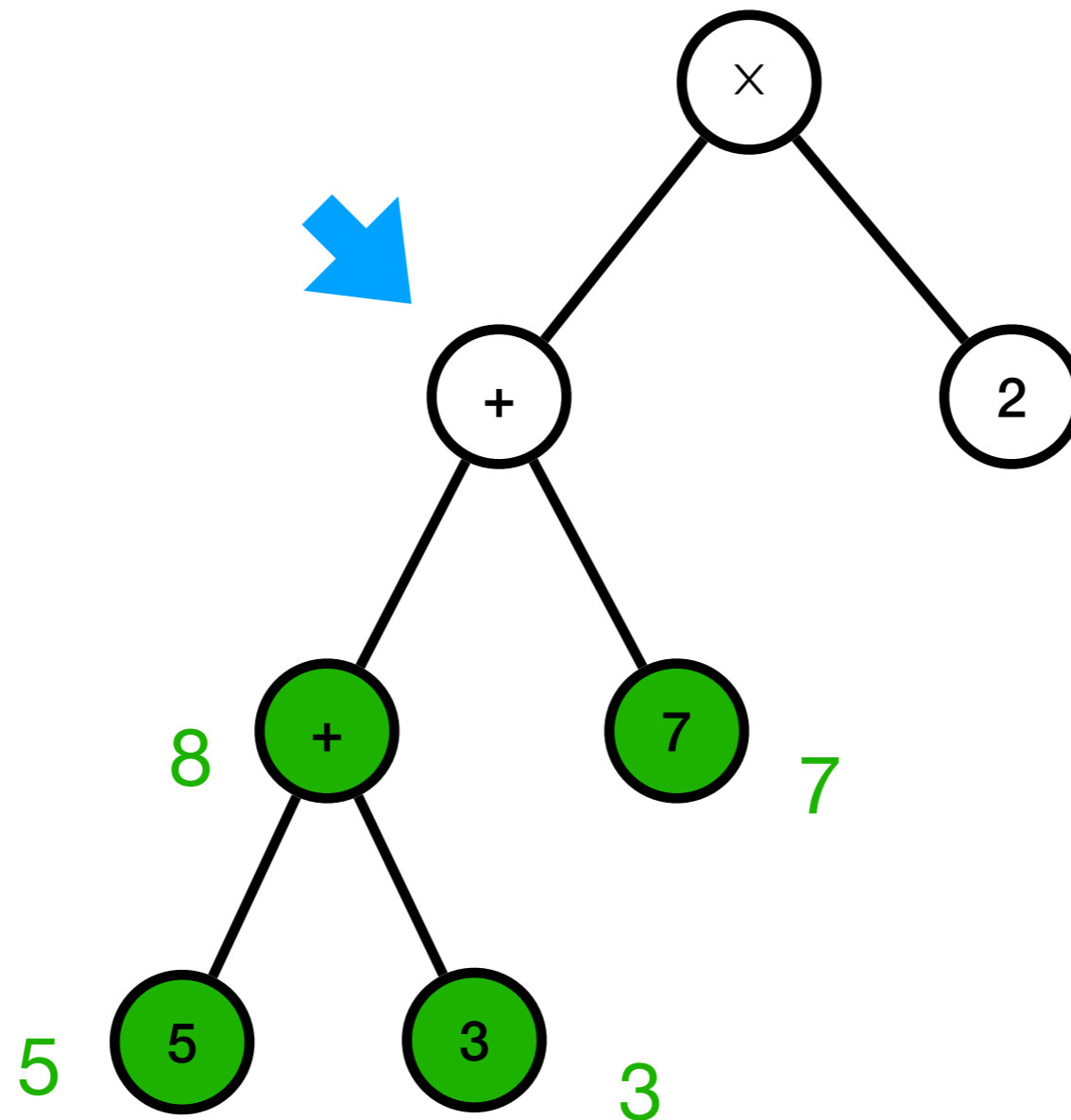


# Évaluer $((5 + 3) + 7) \times 2$

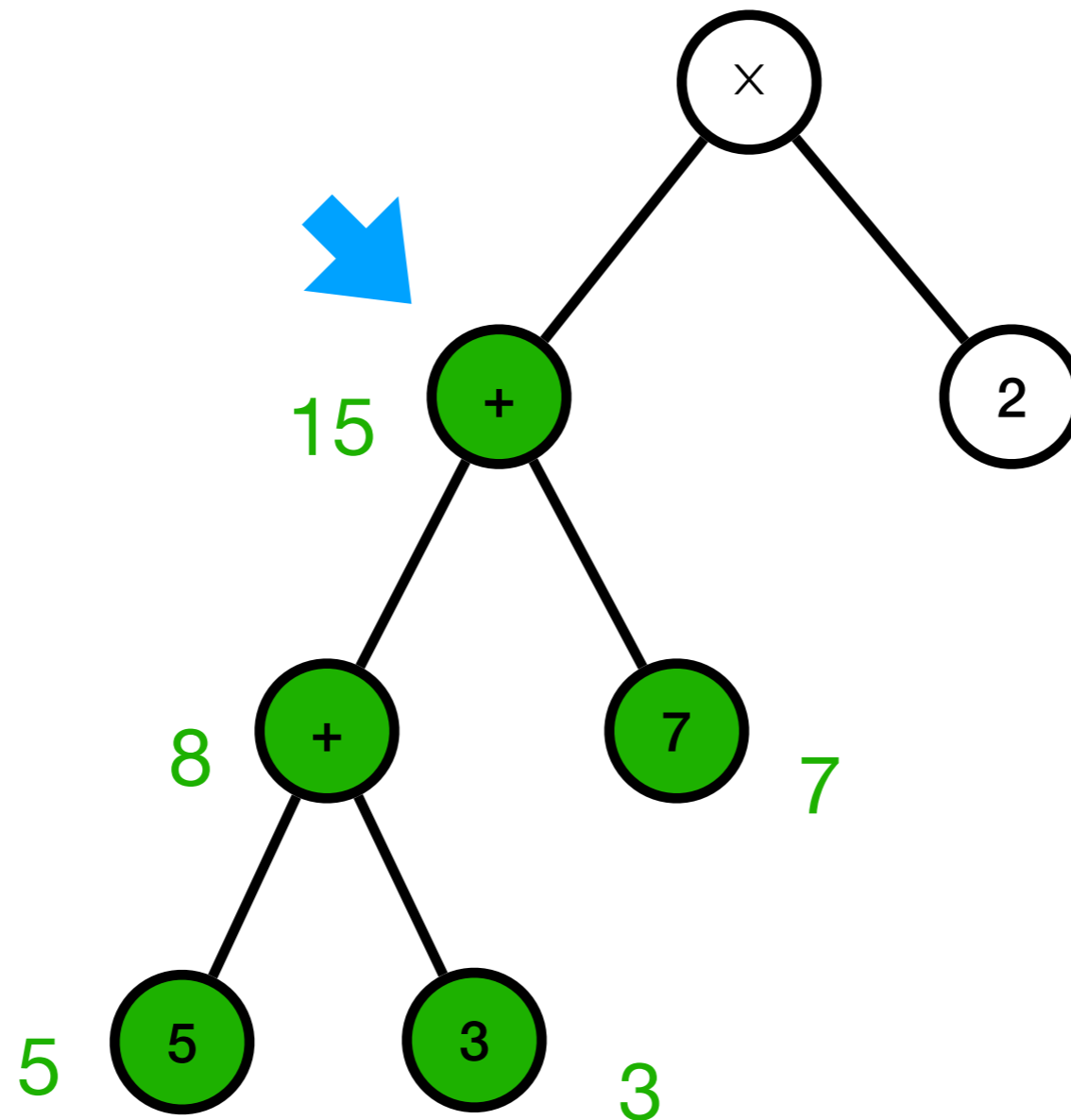




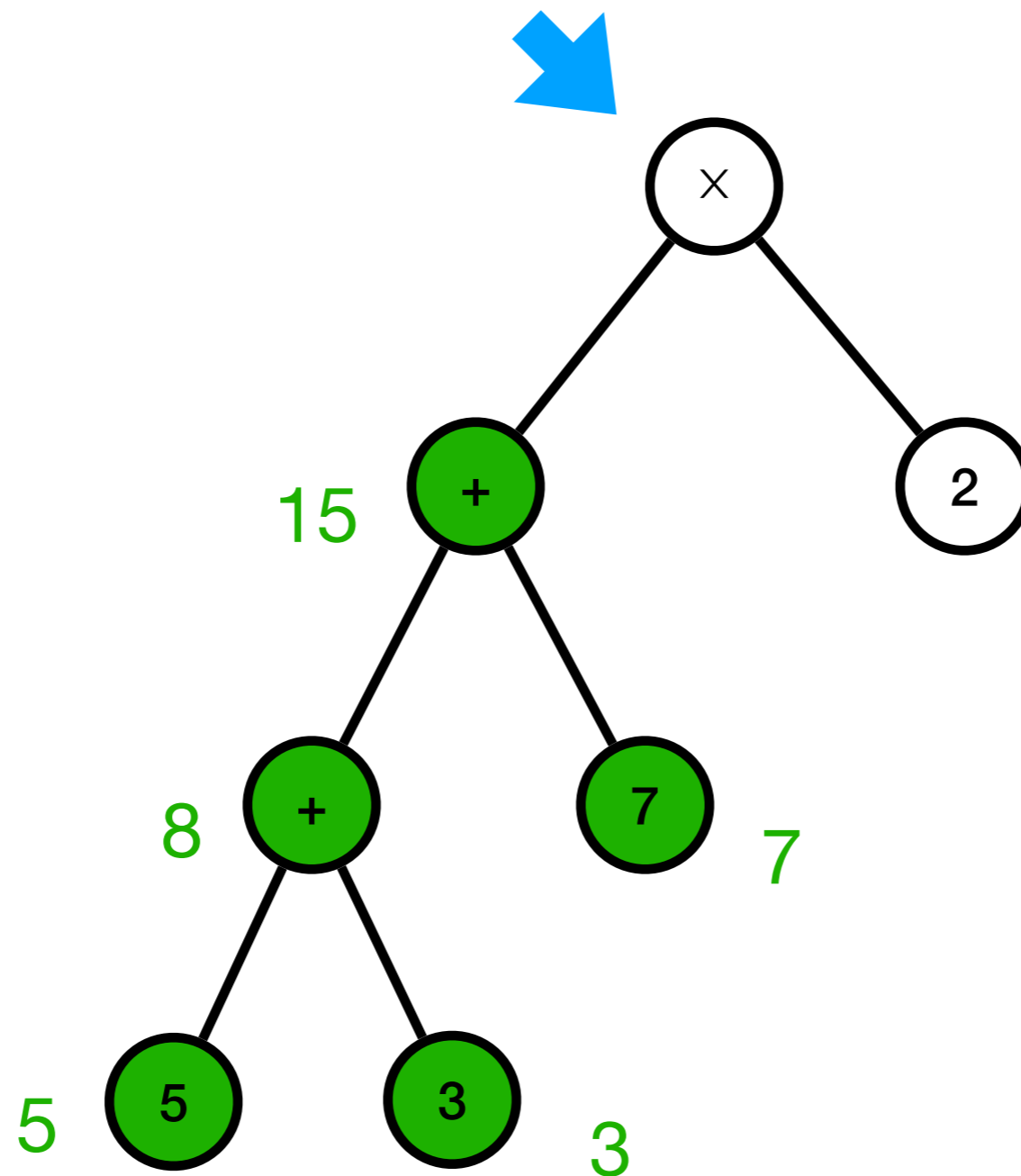
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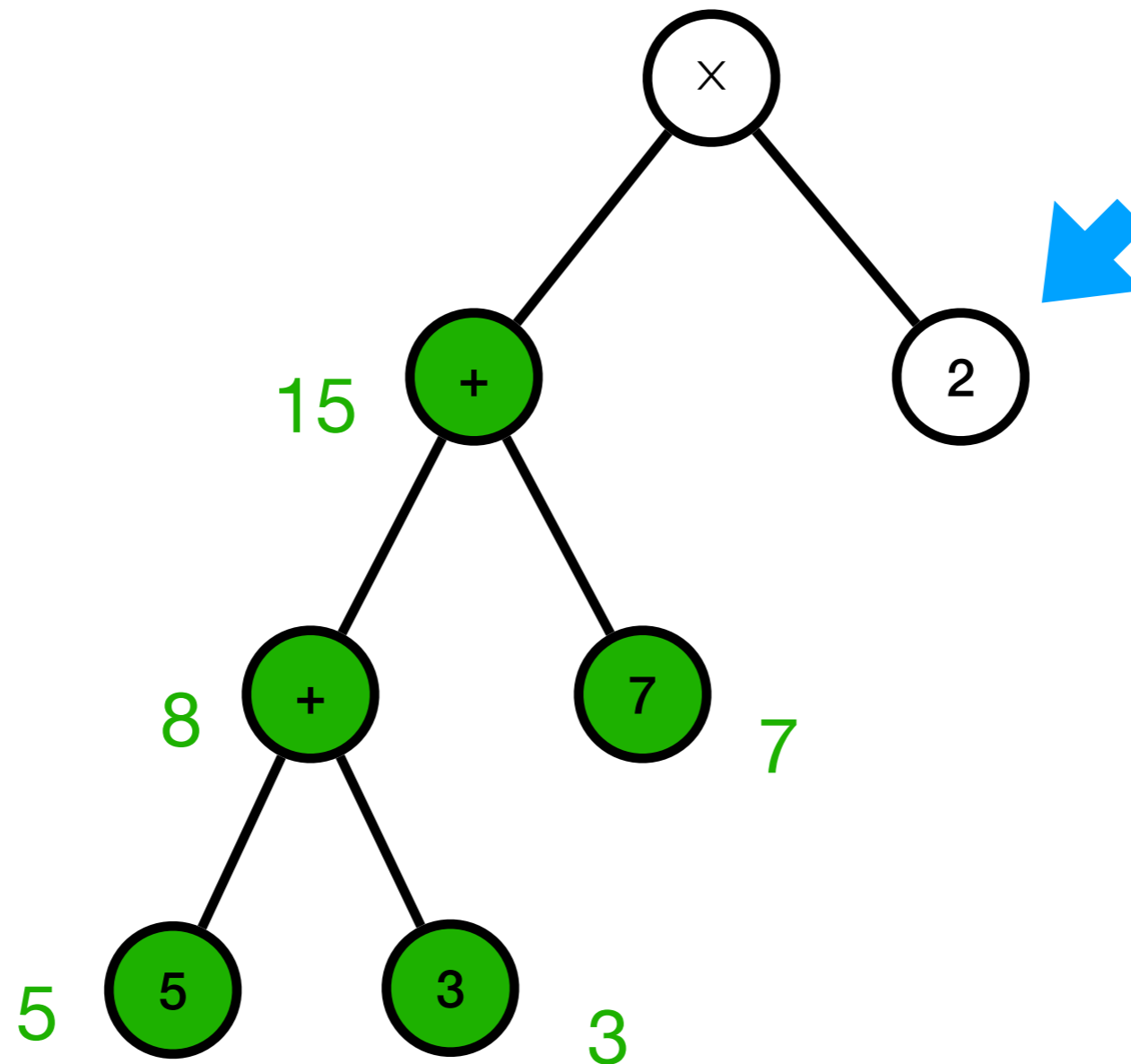
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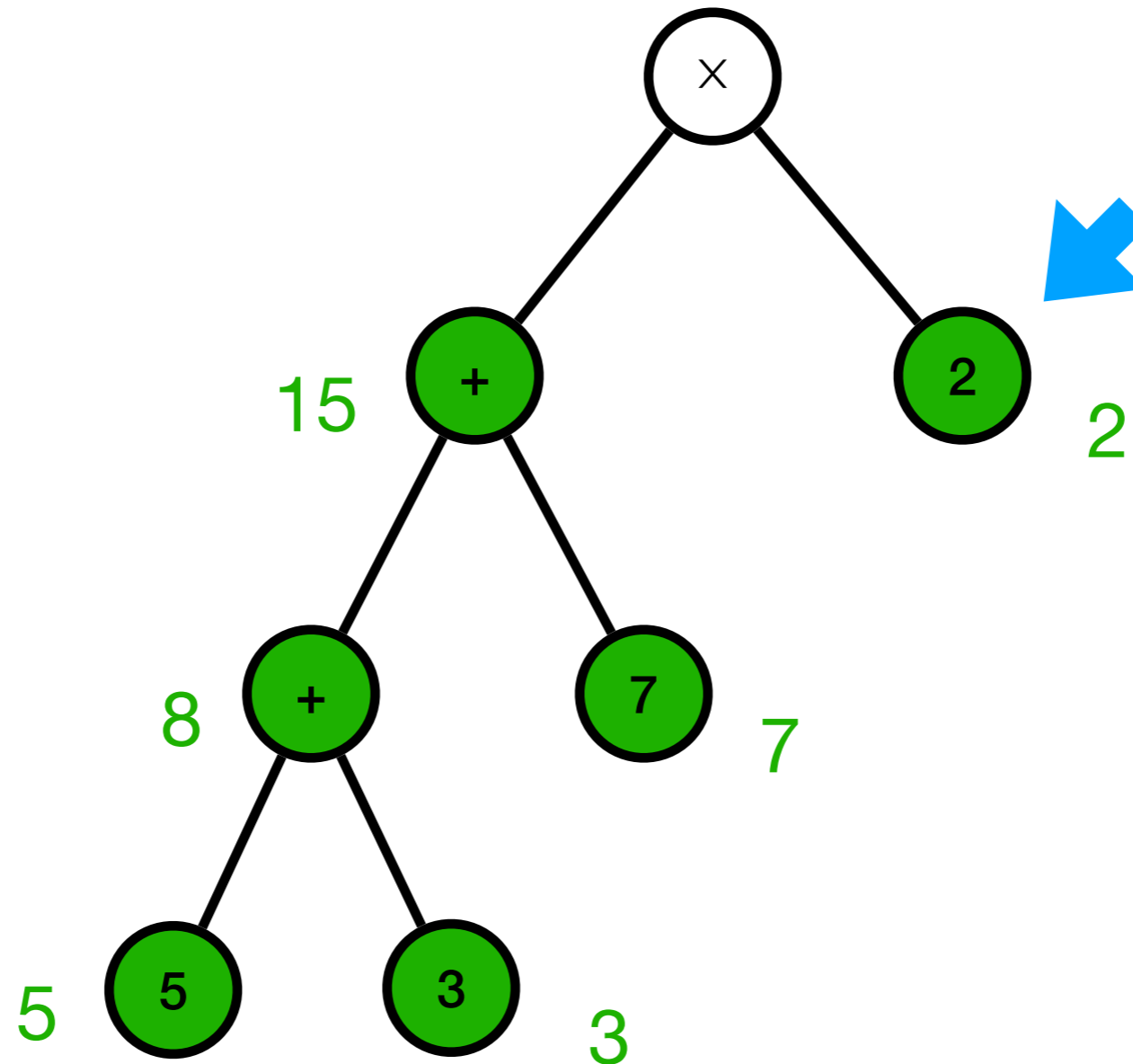
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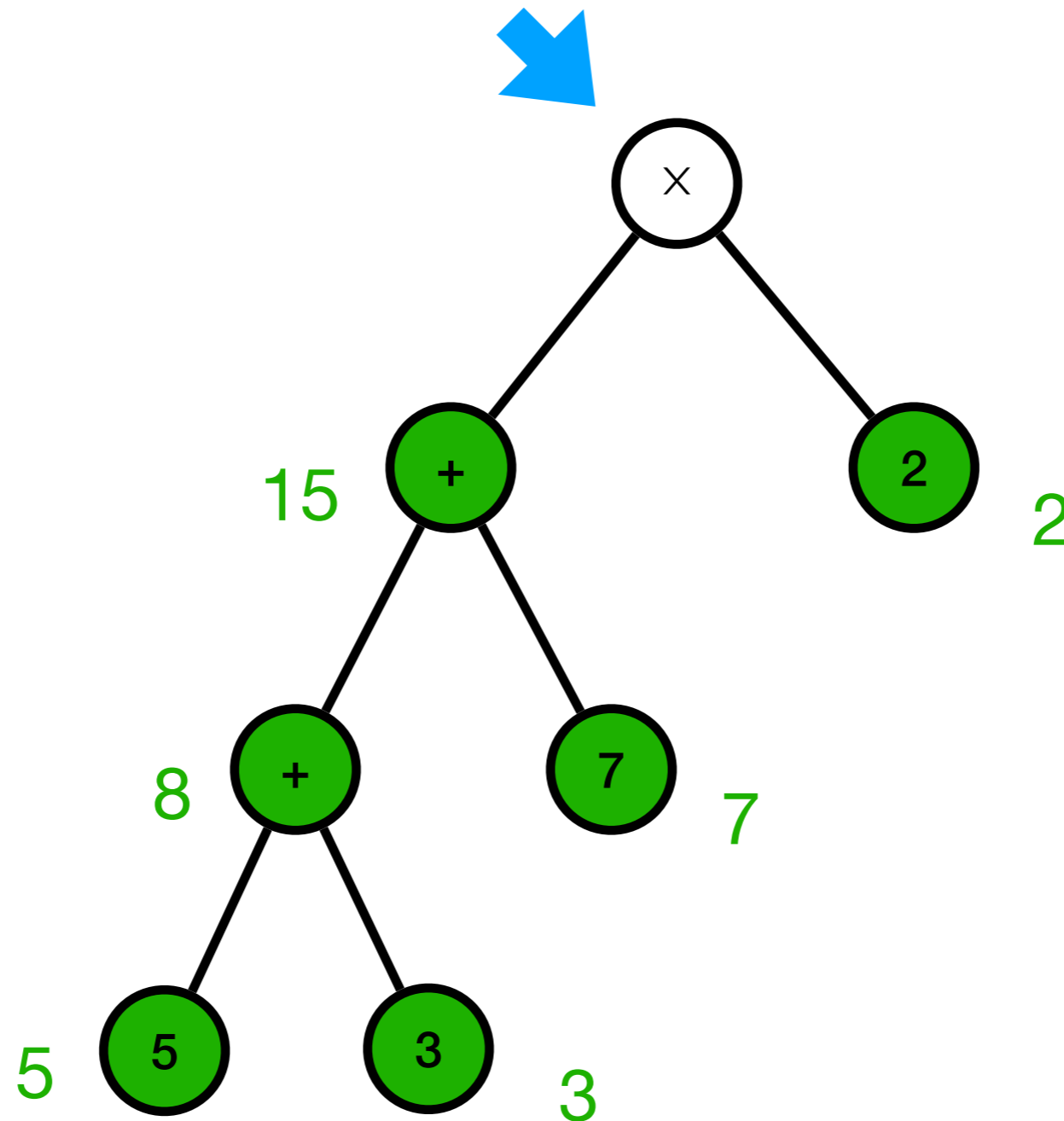
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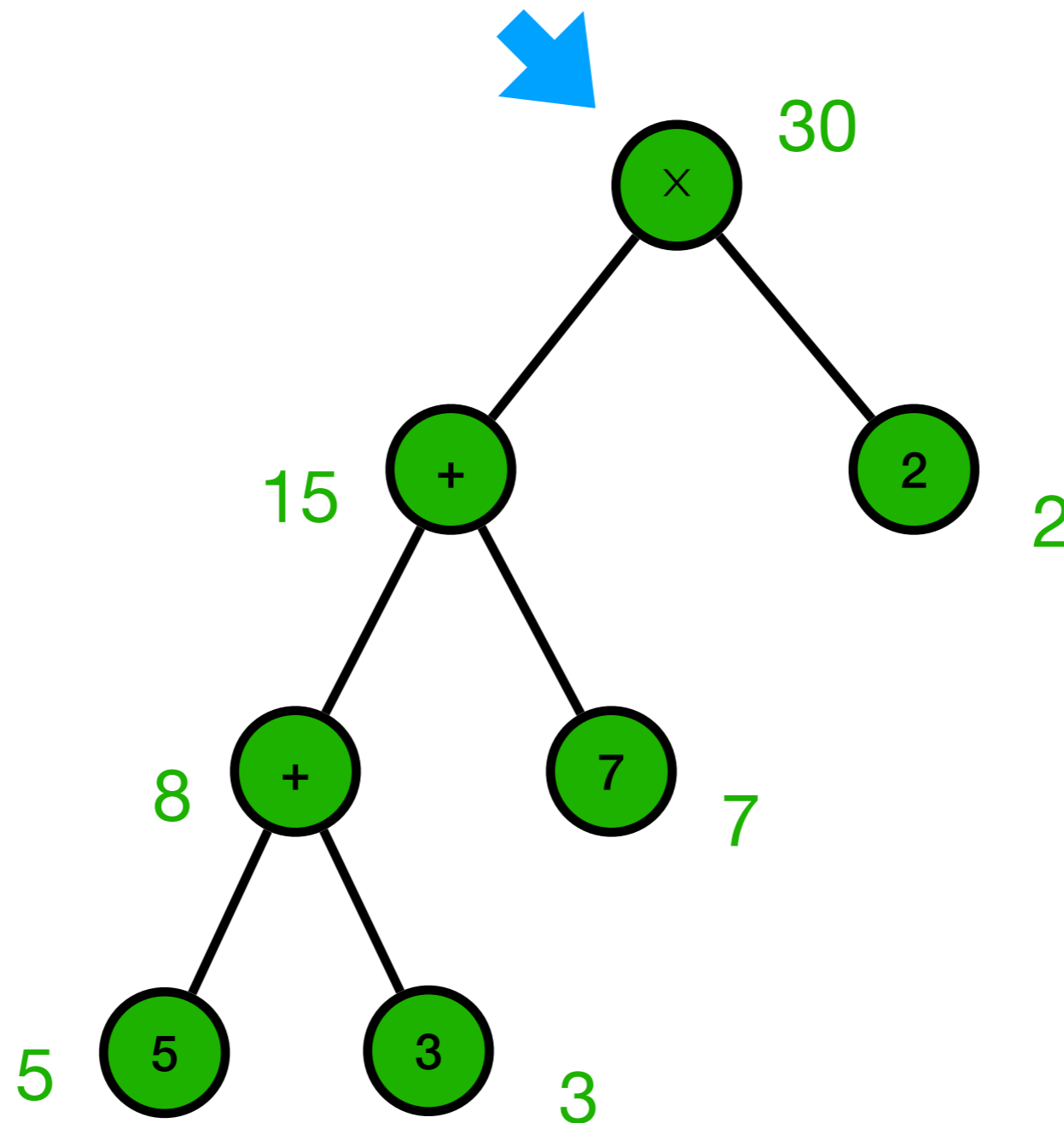
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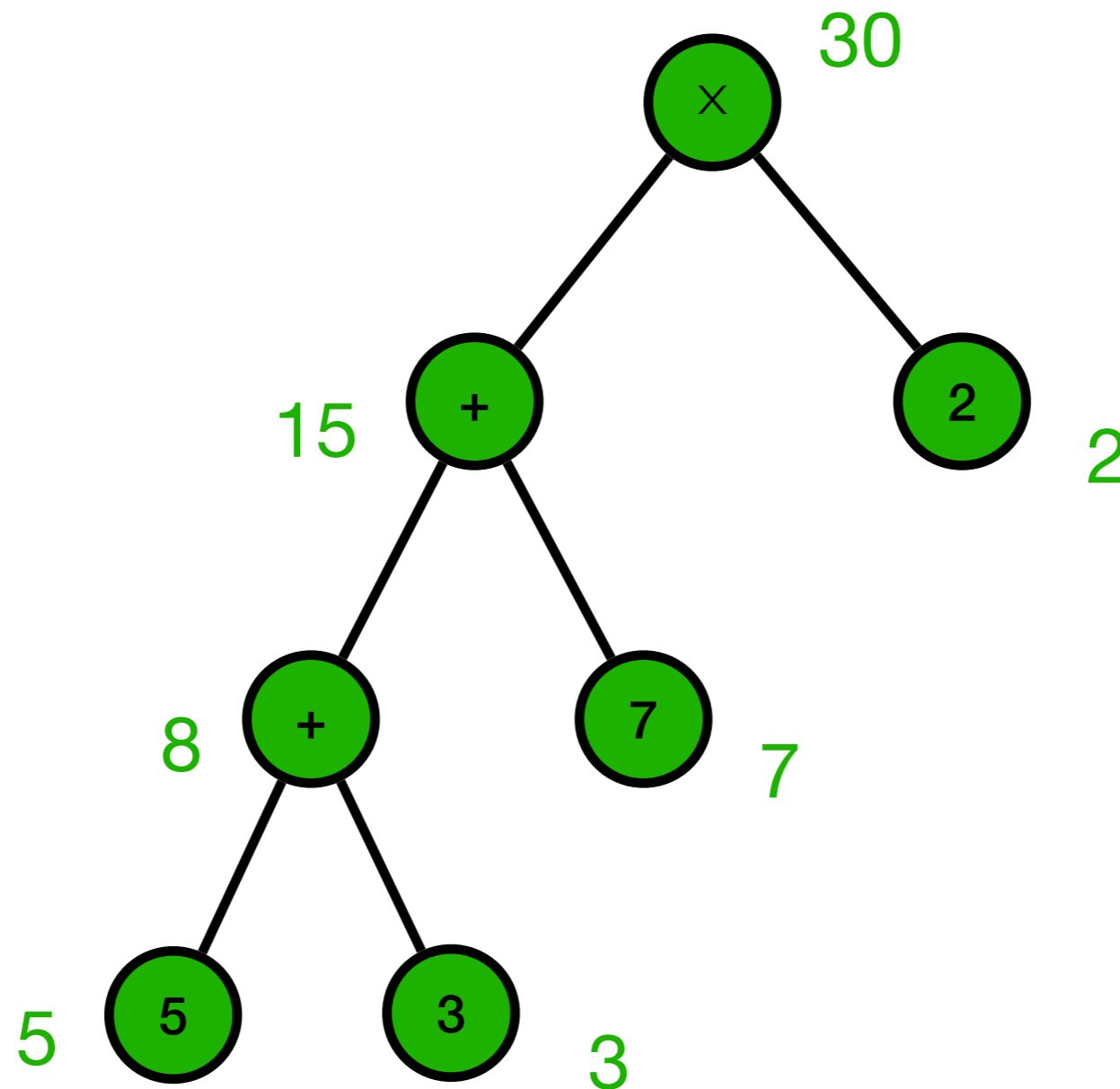
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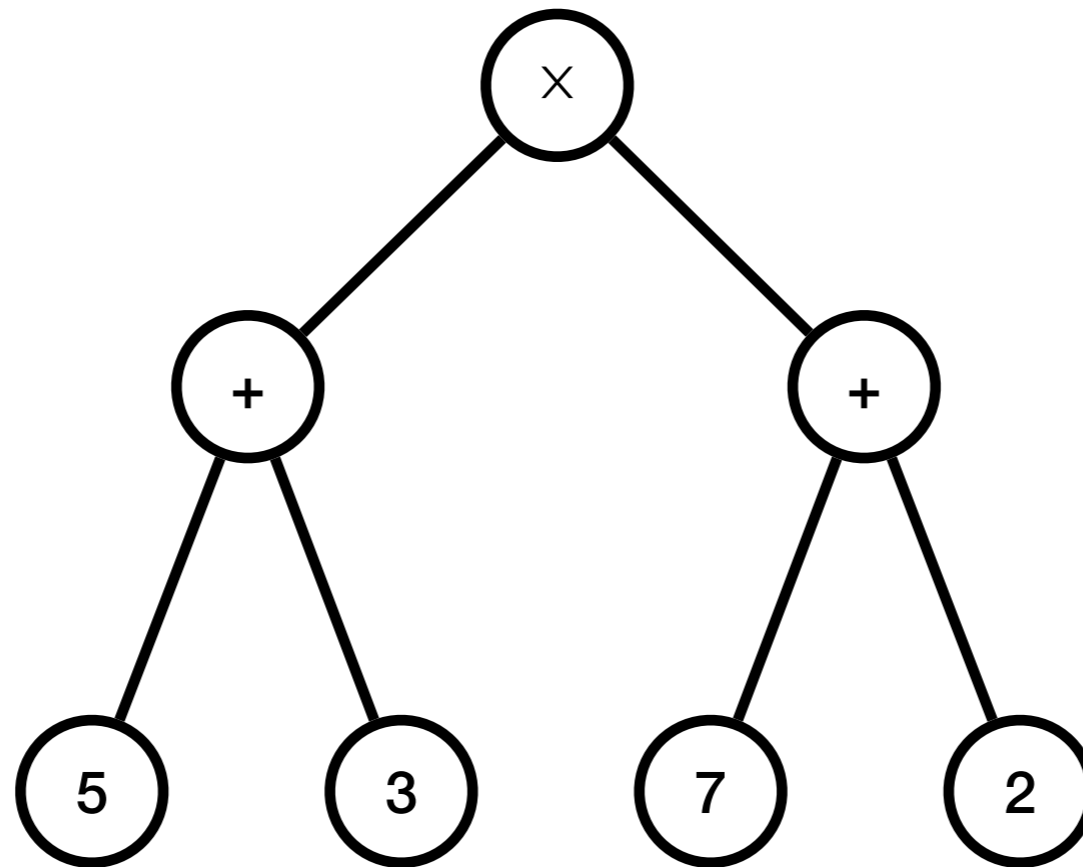
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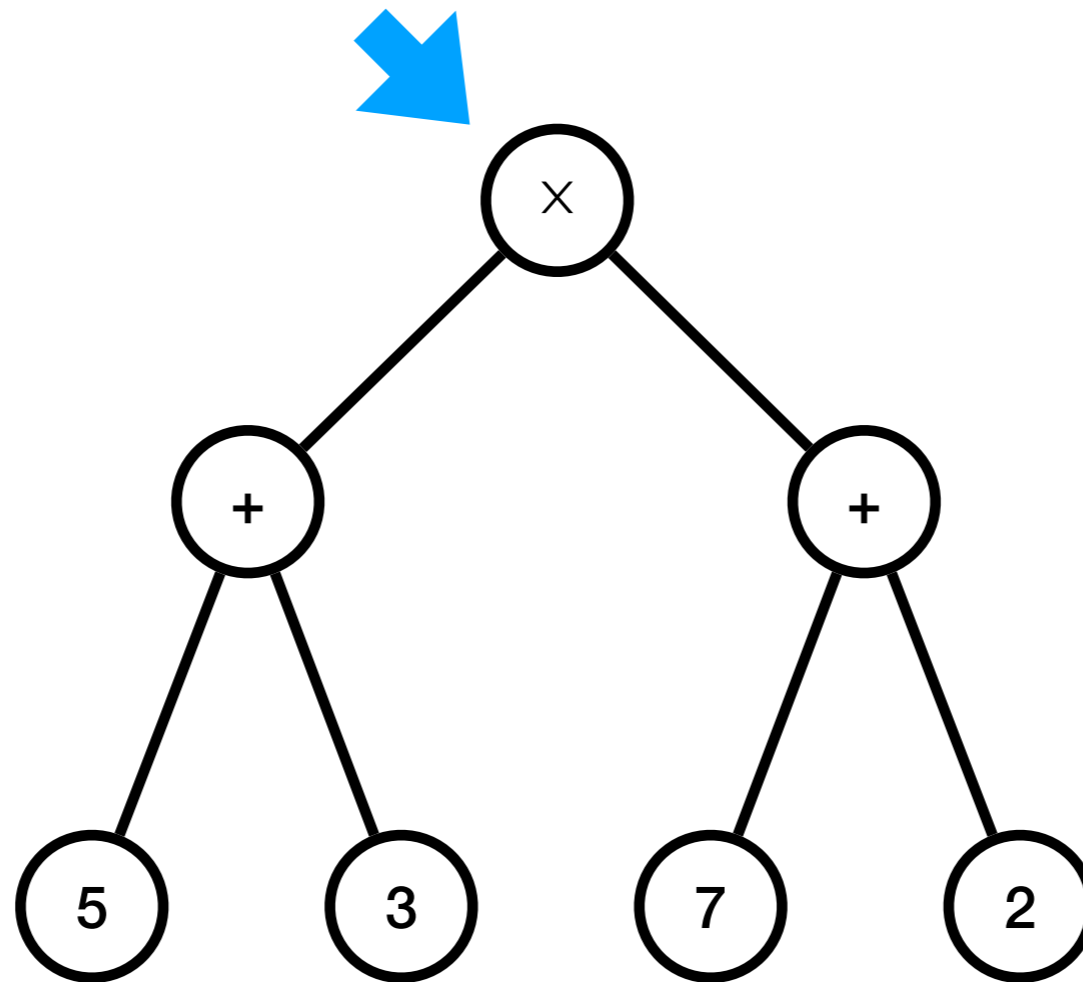


# Exercices 3.2 et 3.3 du TD5

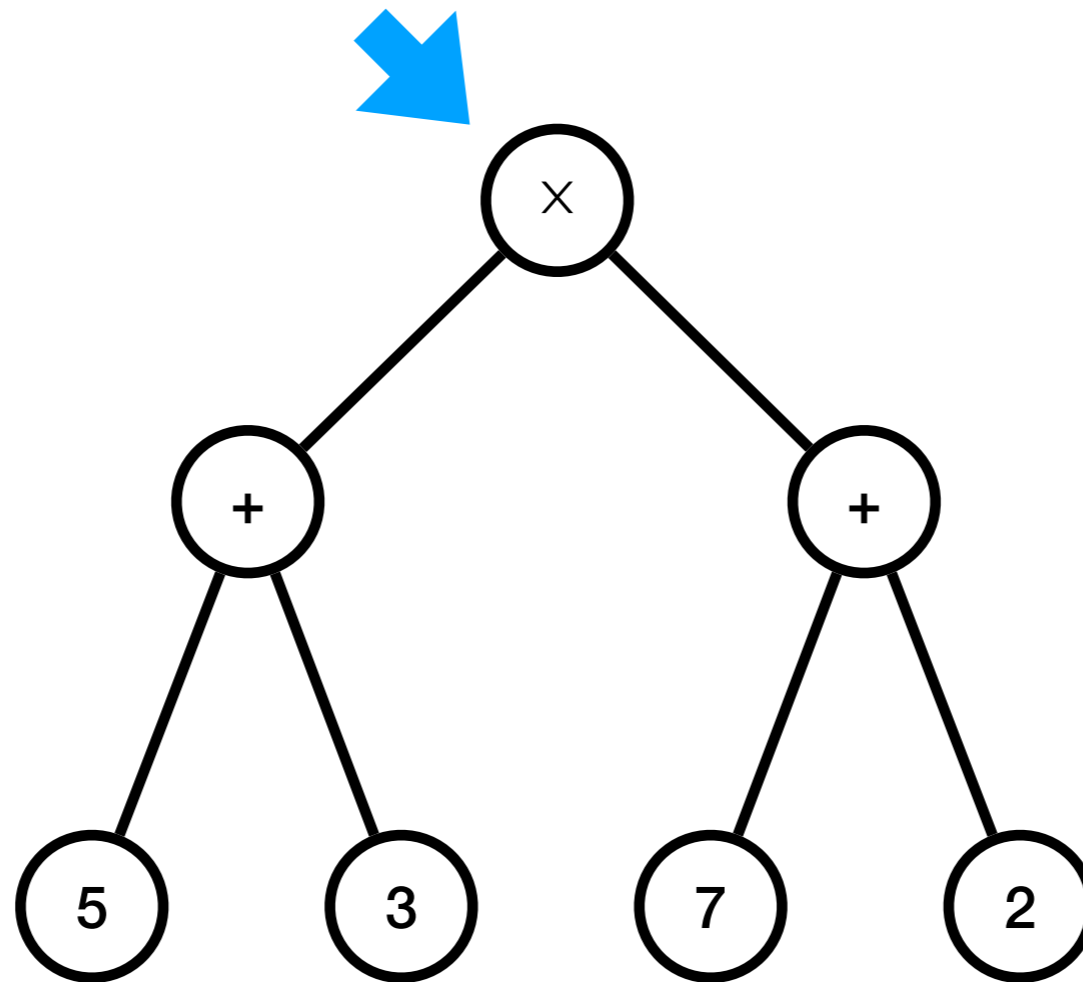
**Afficher  $((5 + 3) \times (7 + 2))$**



Afficher  $((5 + 3) \times (7 + 2))$

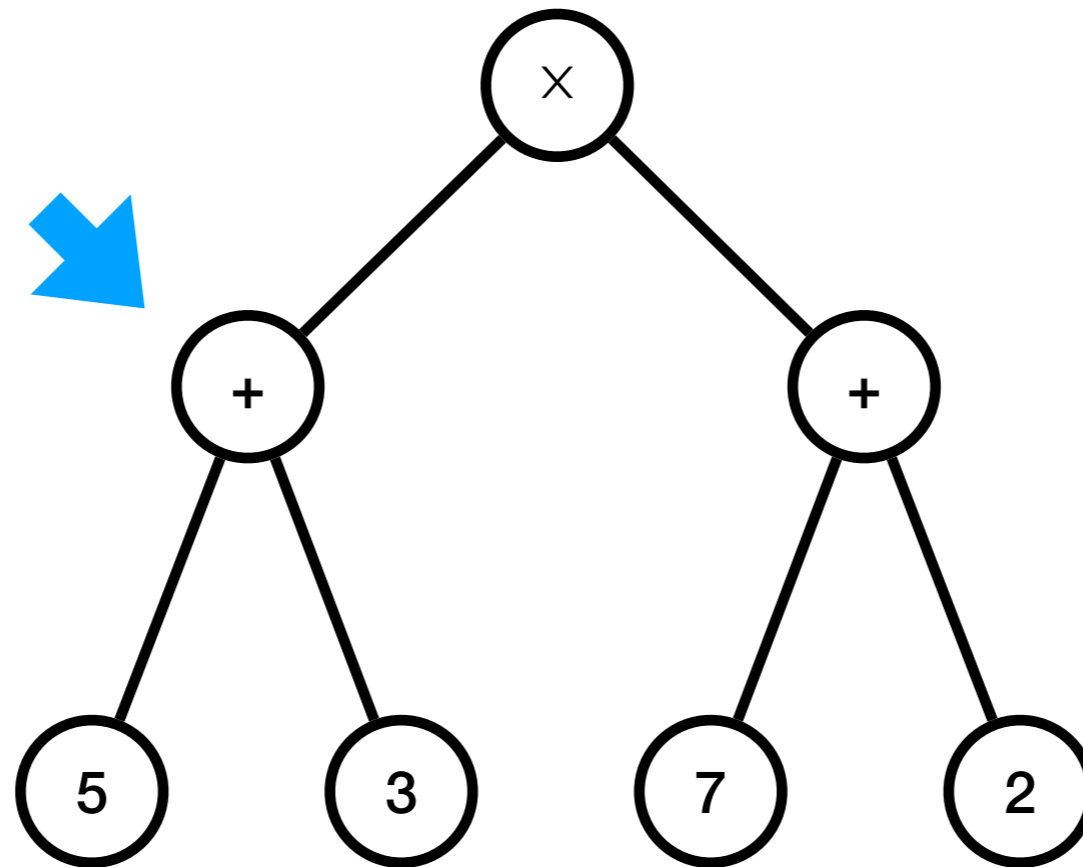


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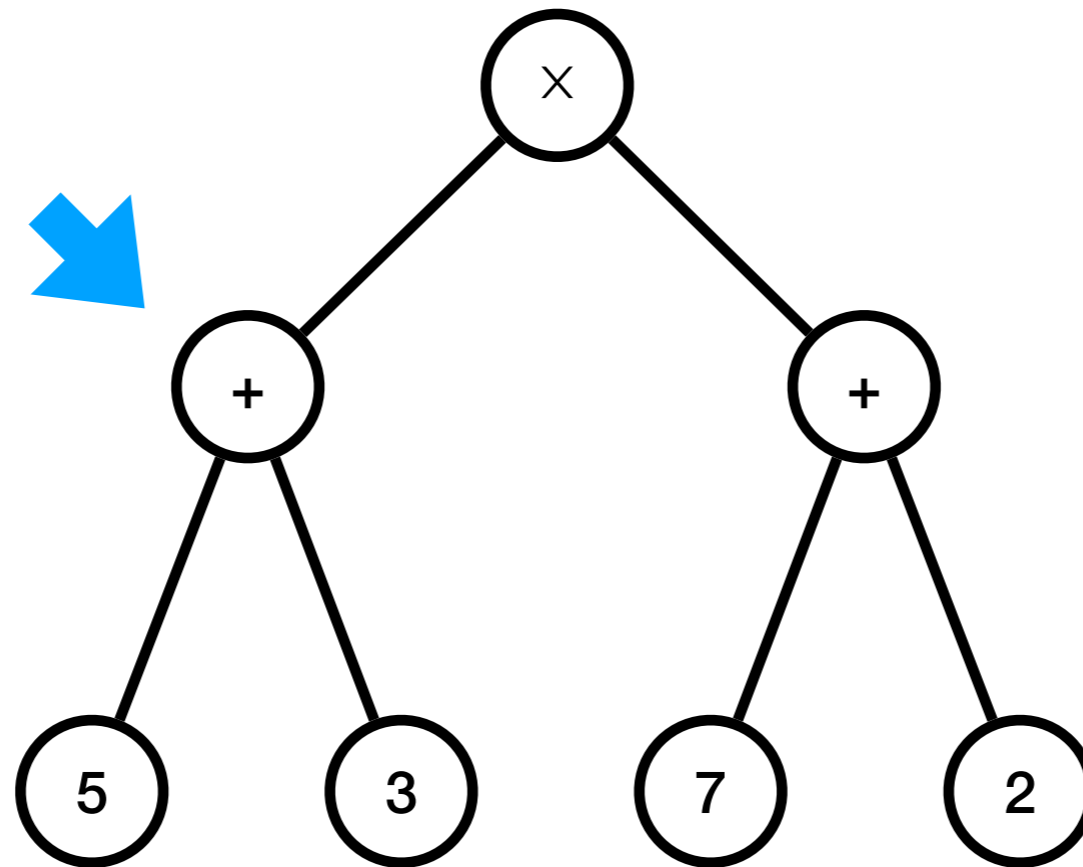
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**Afficher  $((5 + 3) \times (7 + 2))$**



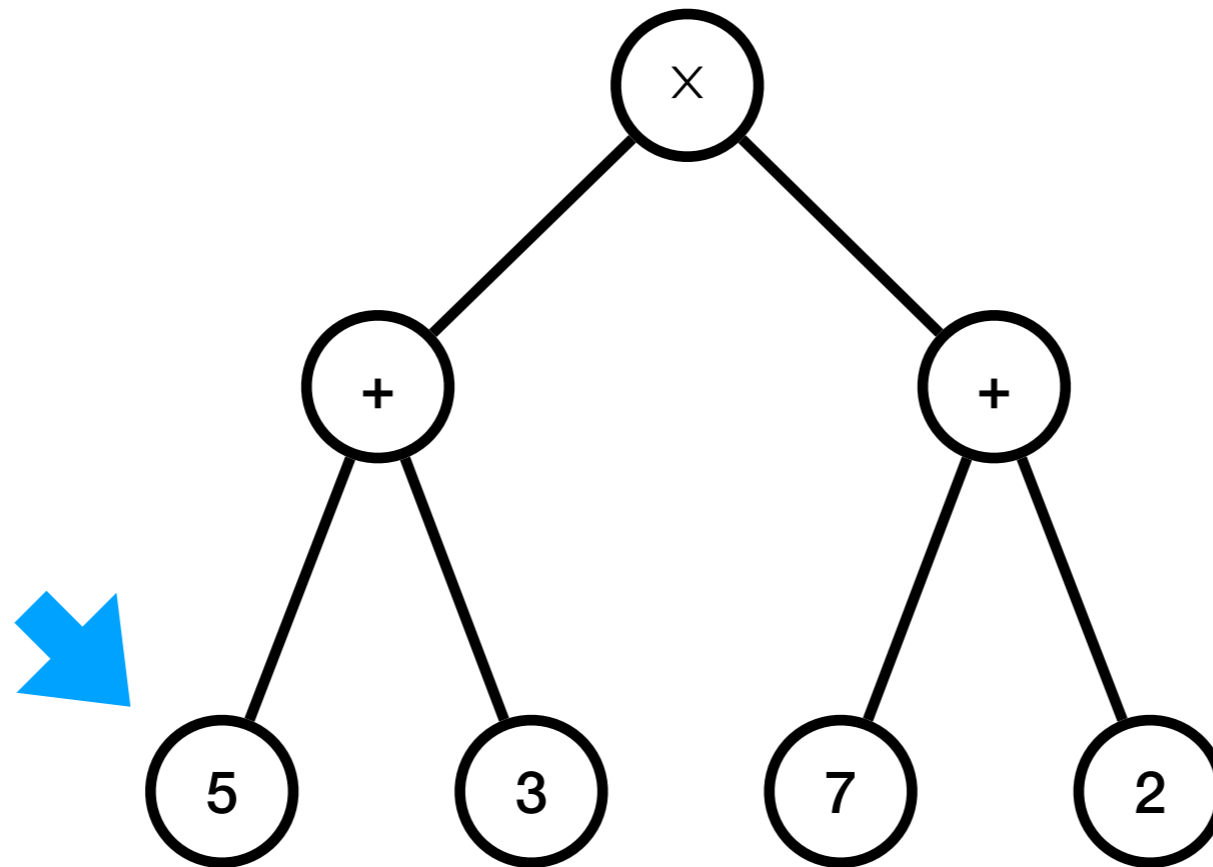
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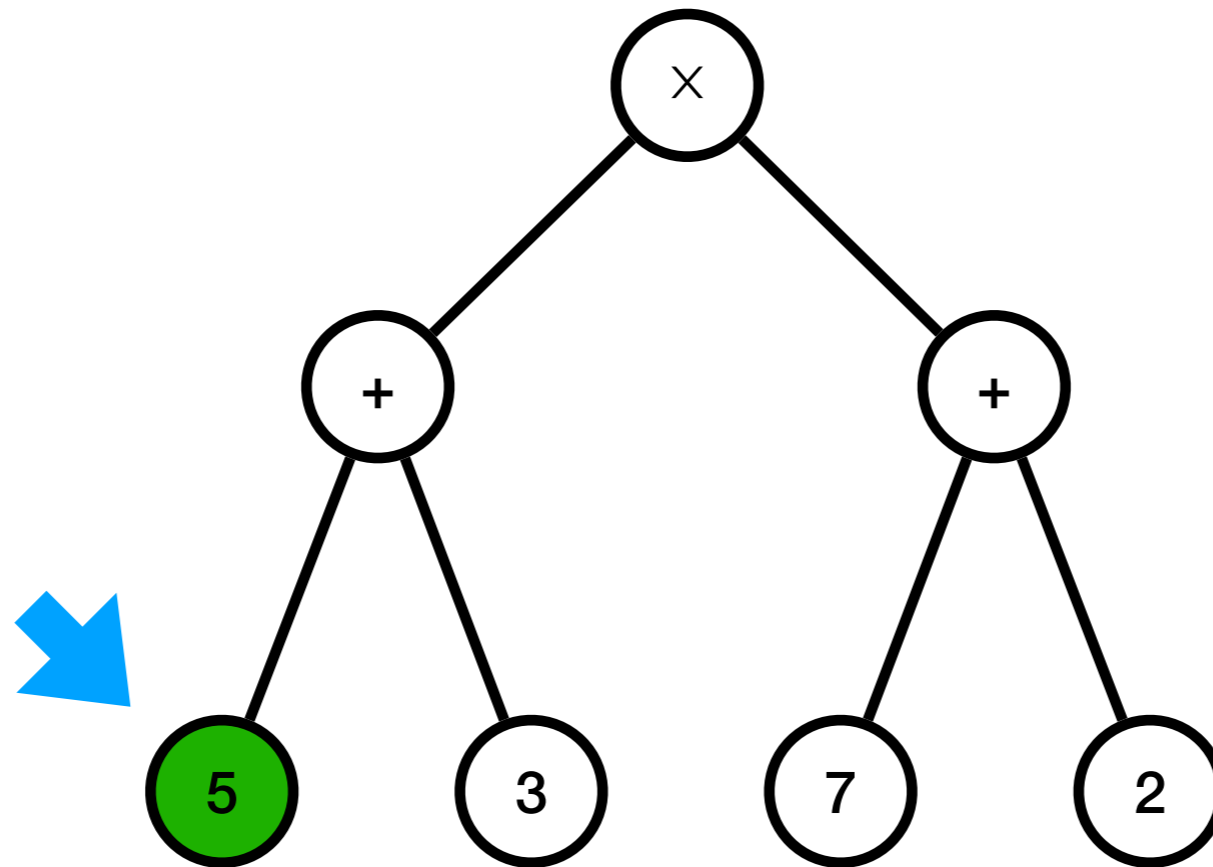
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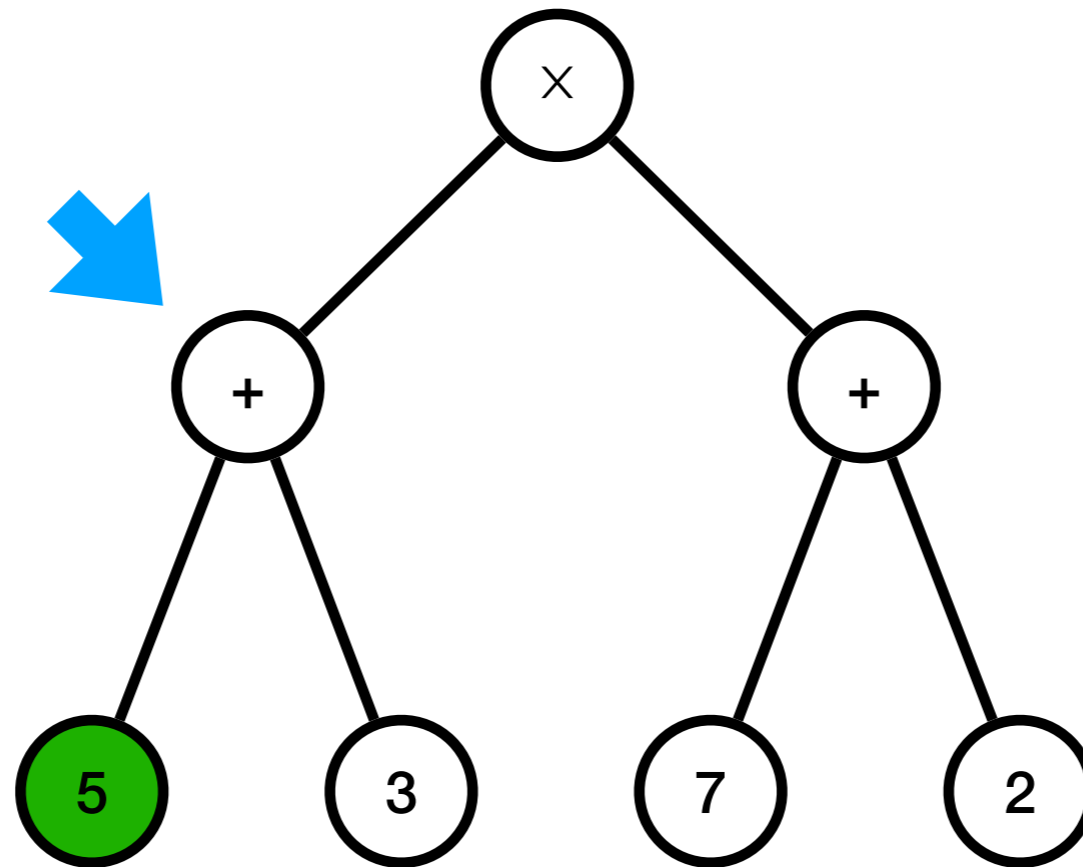
Afficher  $((5 + 3) \times (7 + 2))$



$((5$

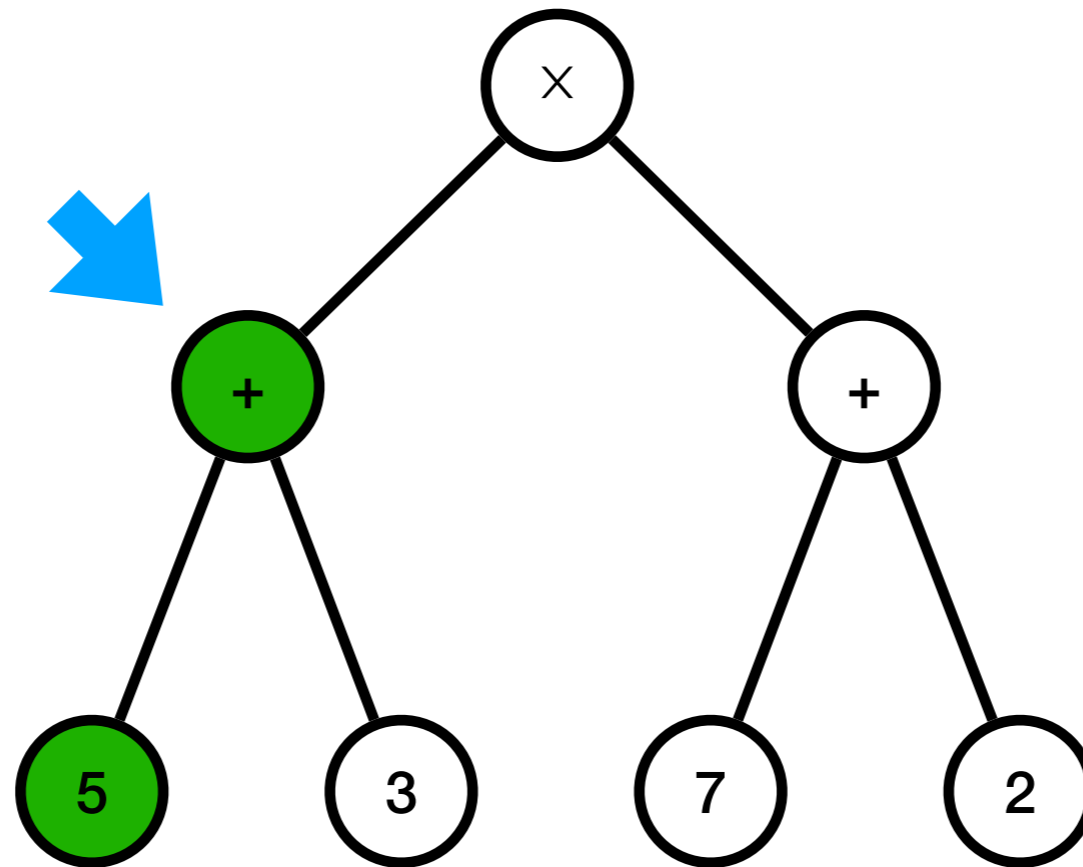


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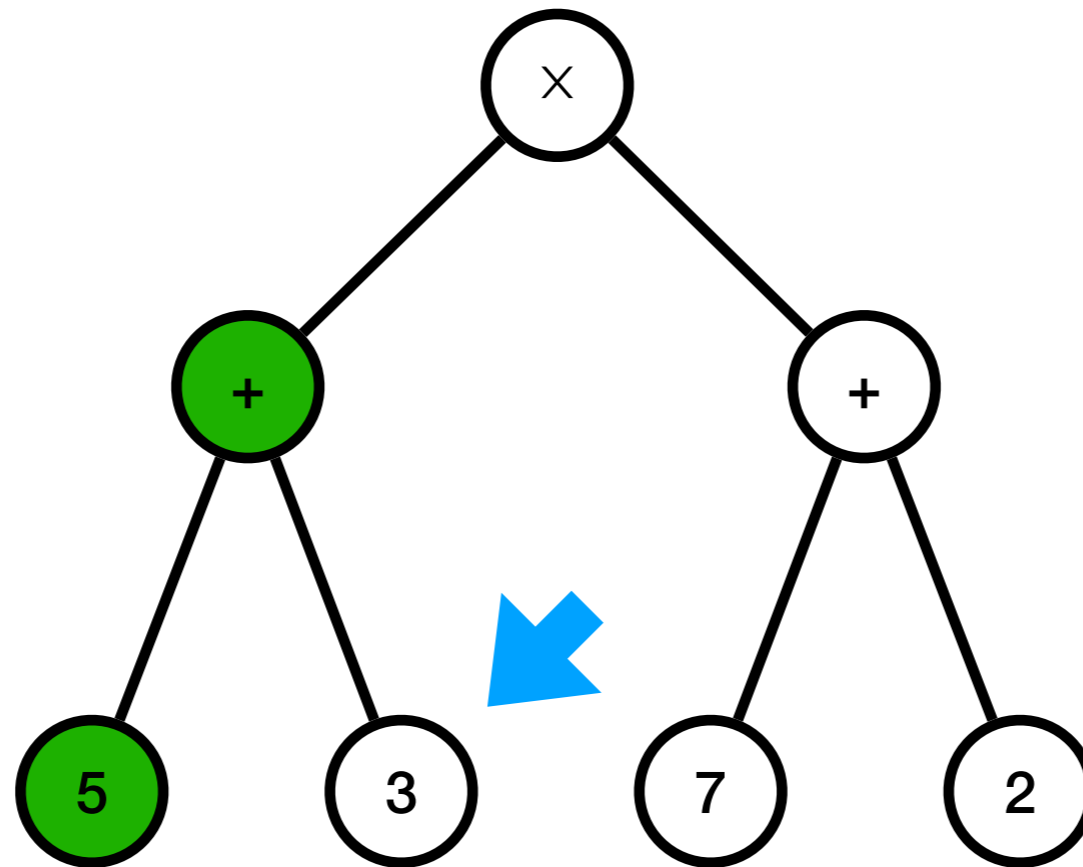
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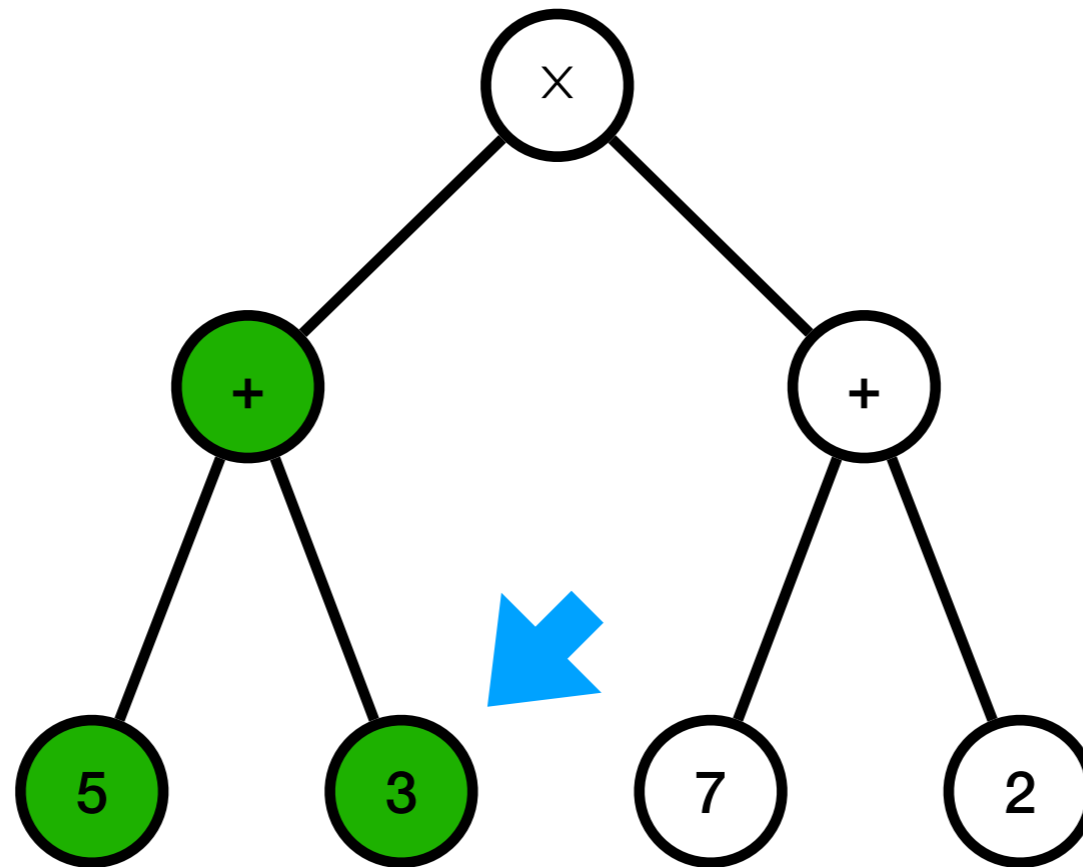
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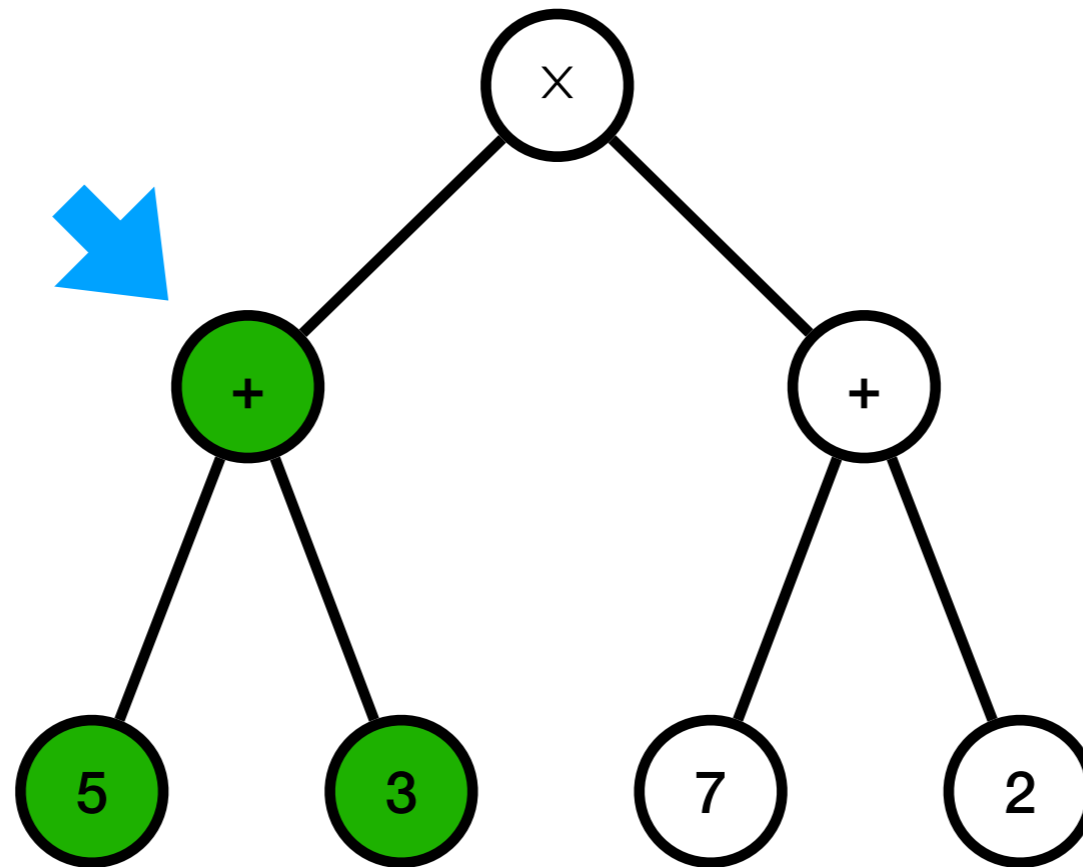
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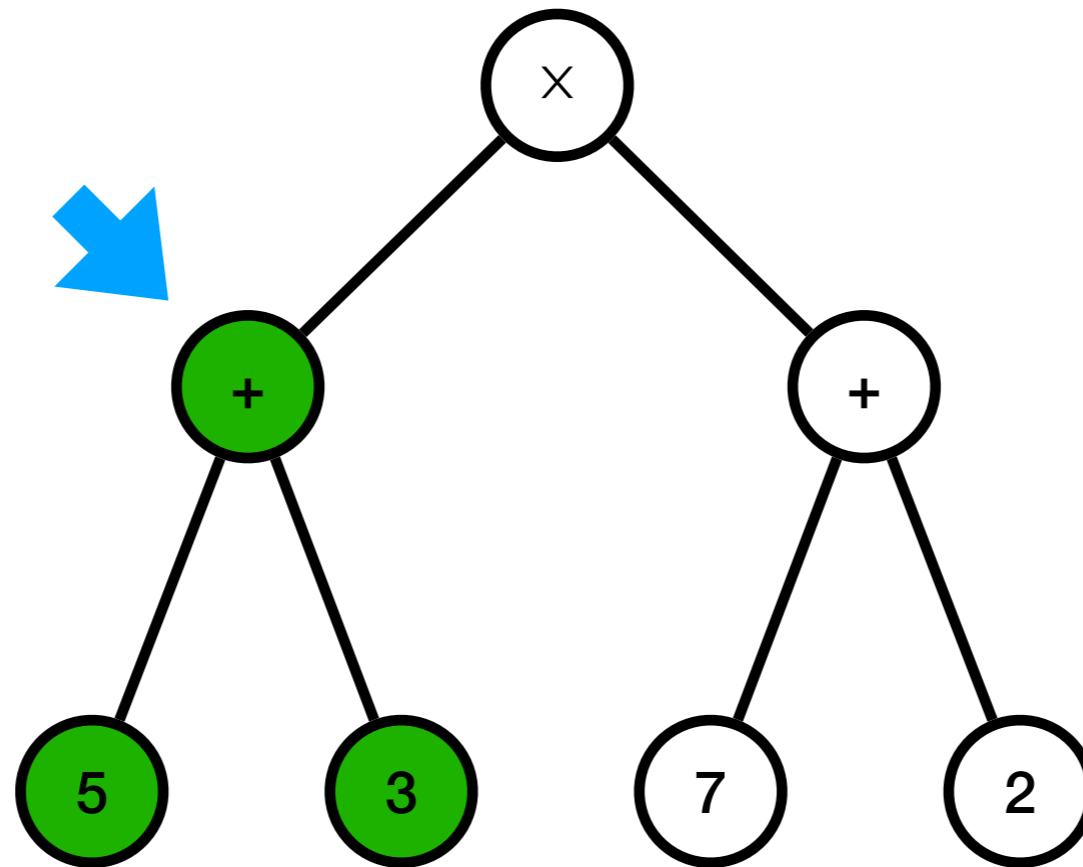
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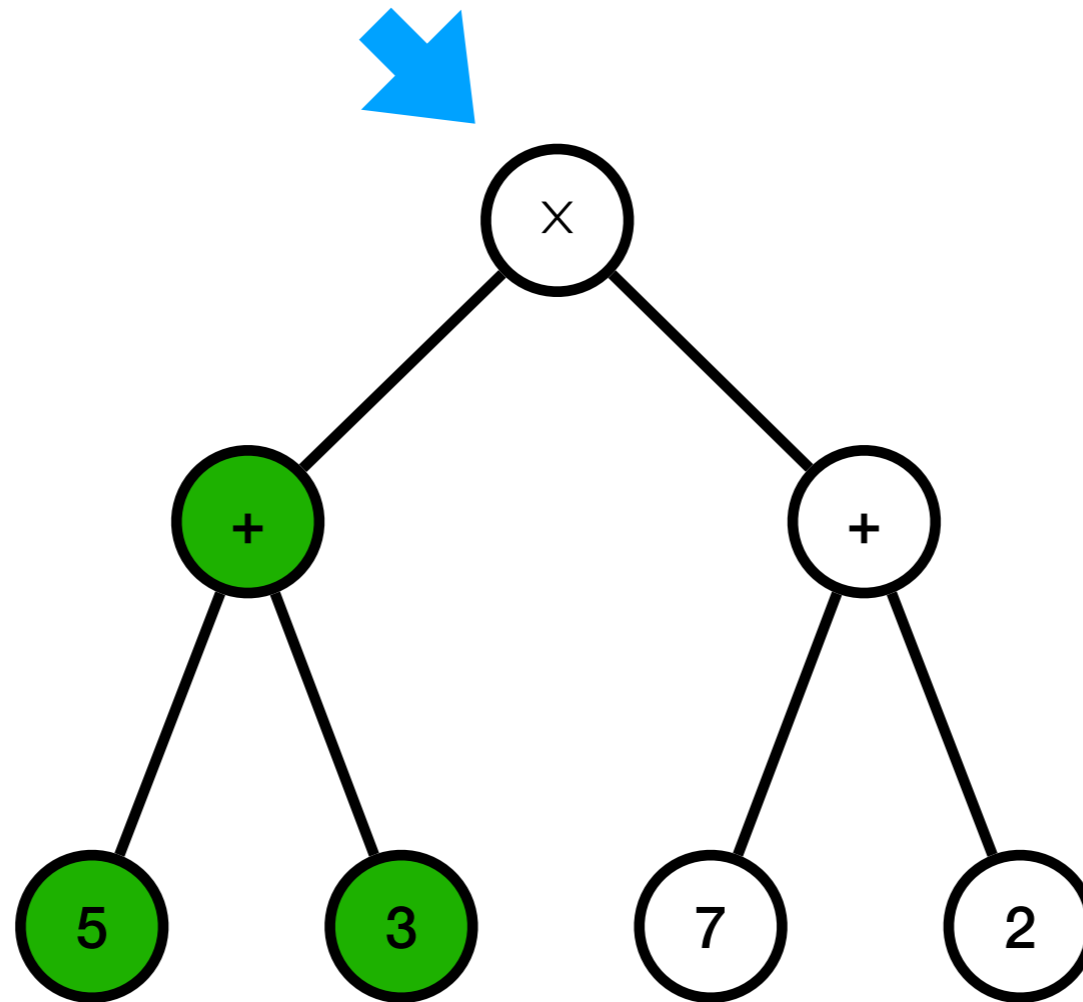
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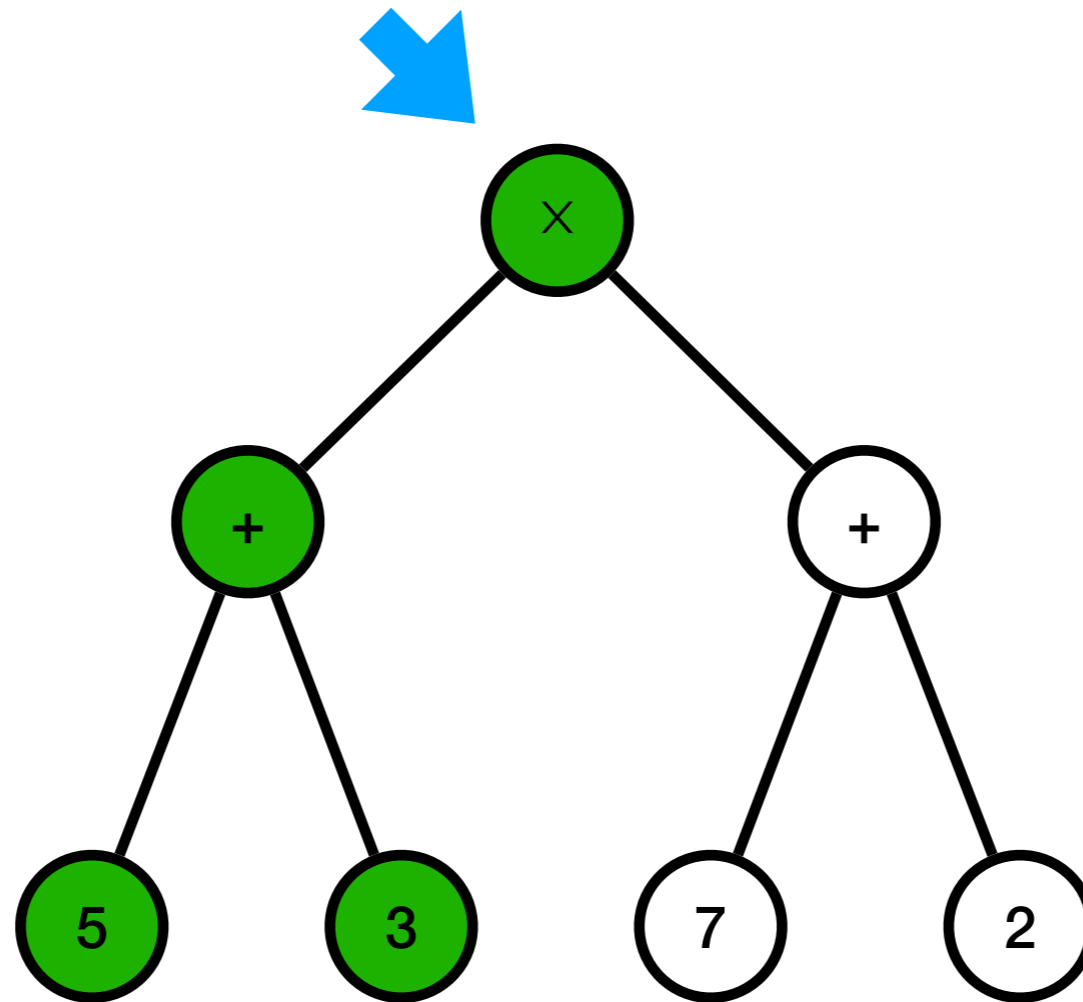
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Afficher  $((5 + 3) \times (7 + 2))$



$((5 + 3))$

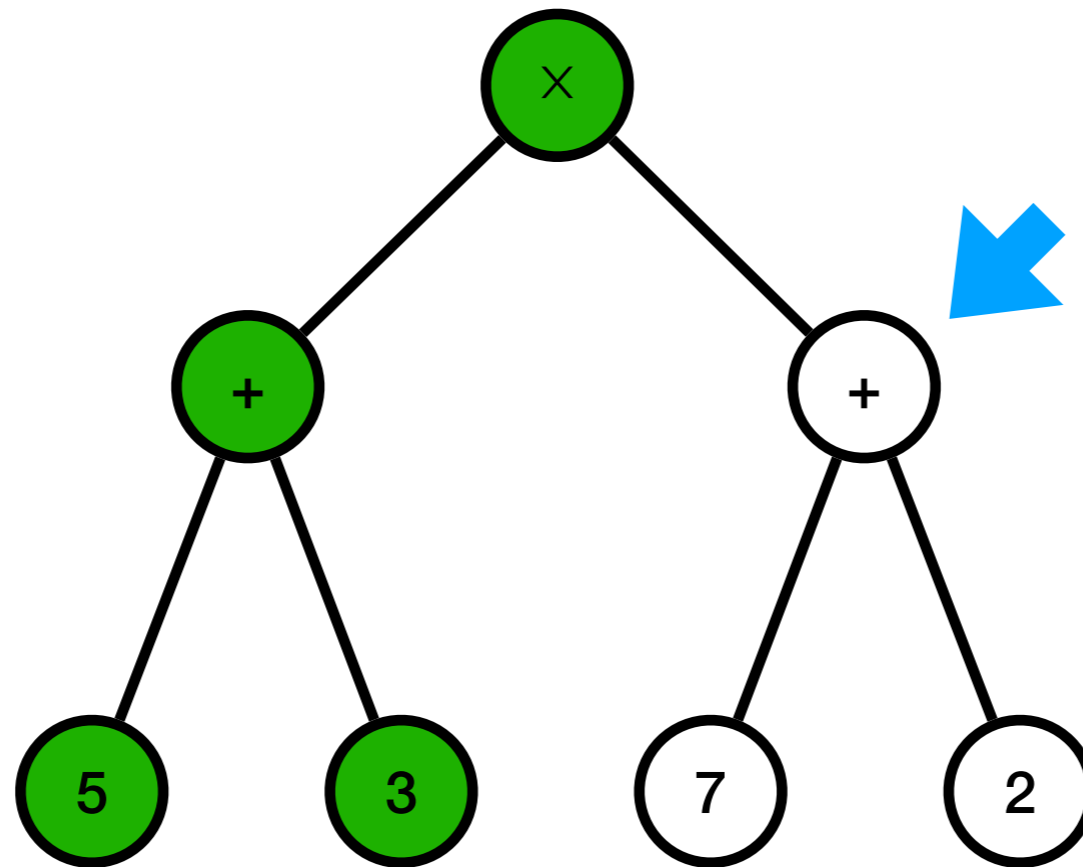
Afficher  $((5 + 3) \times (7 + 2))$



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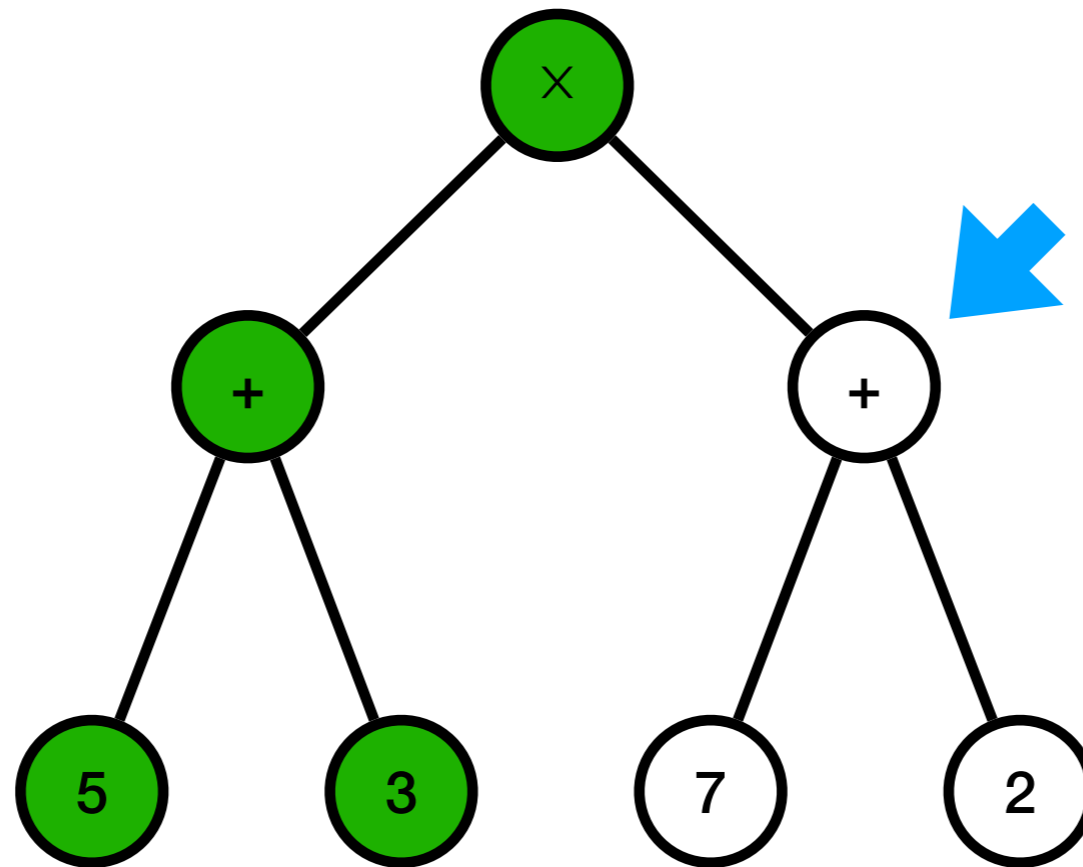


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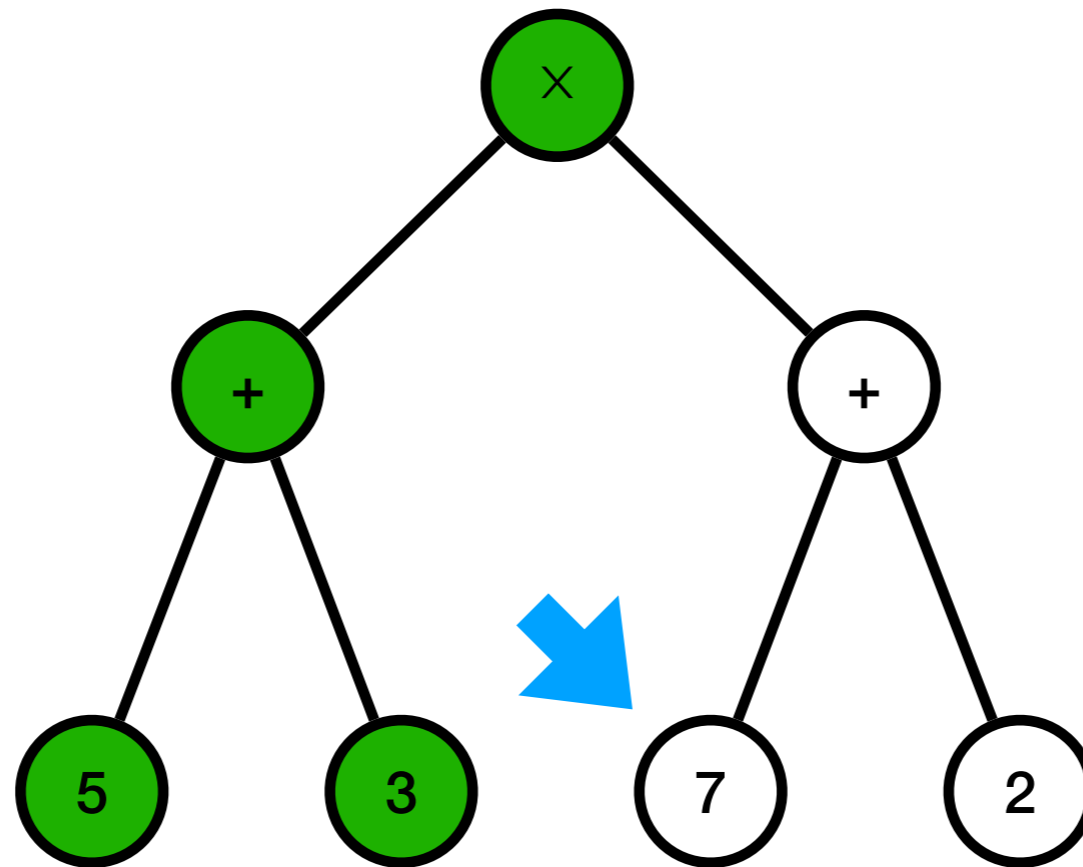
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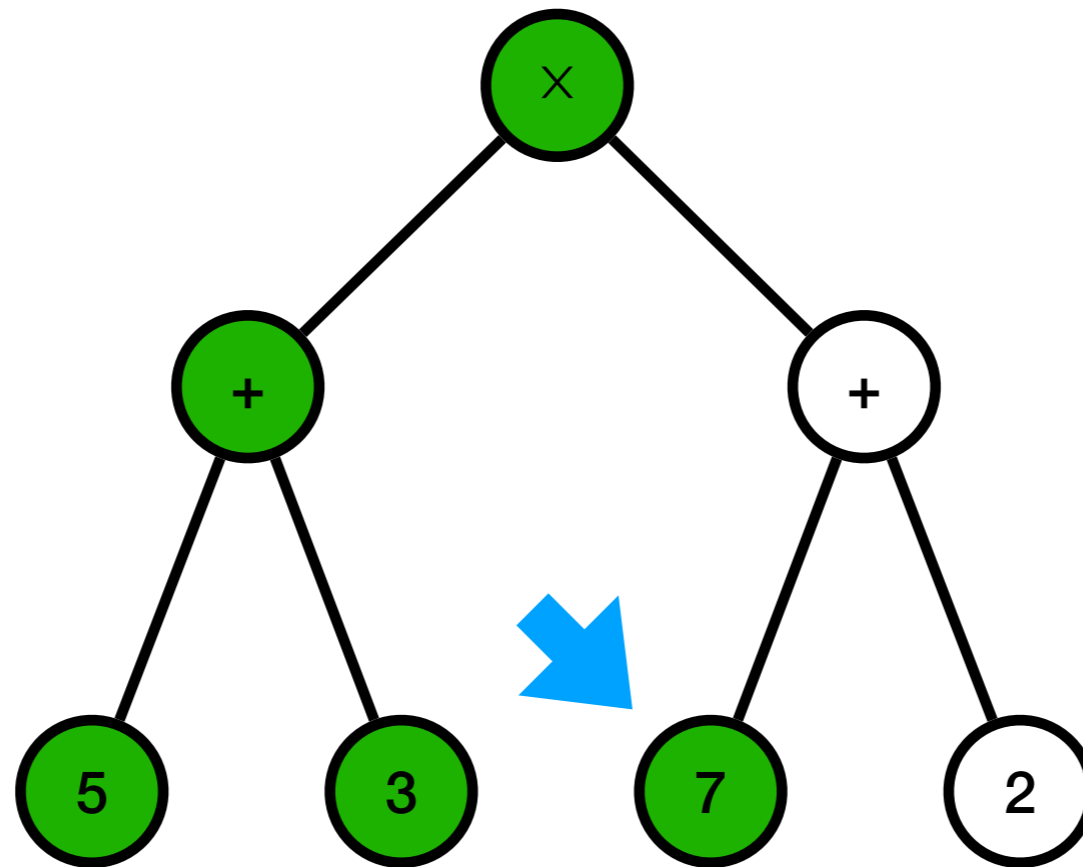
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Afficher  $((5 + 3) \times (7 + 2))$



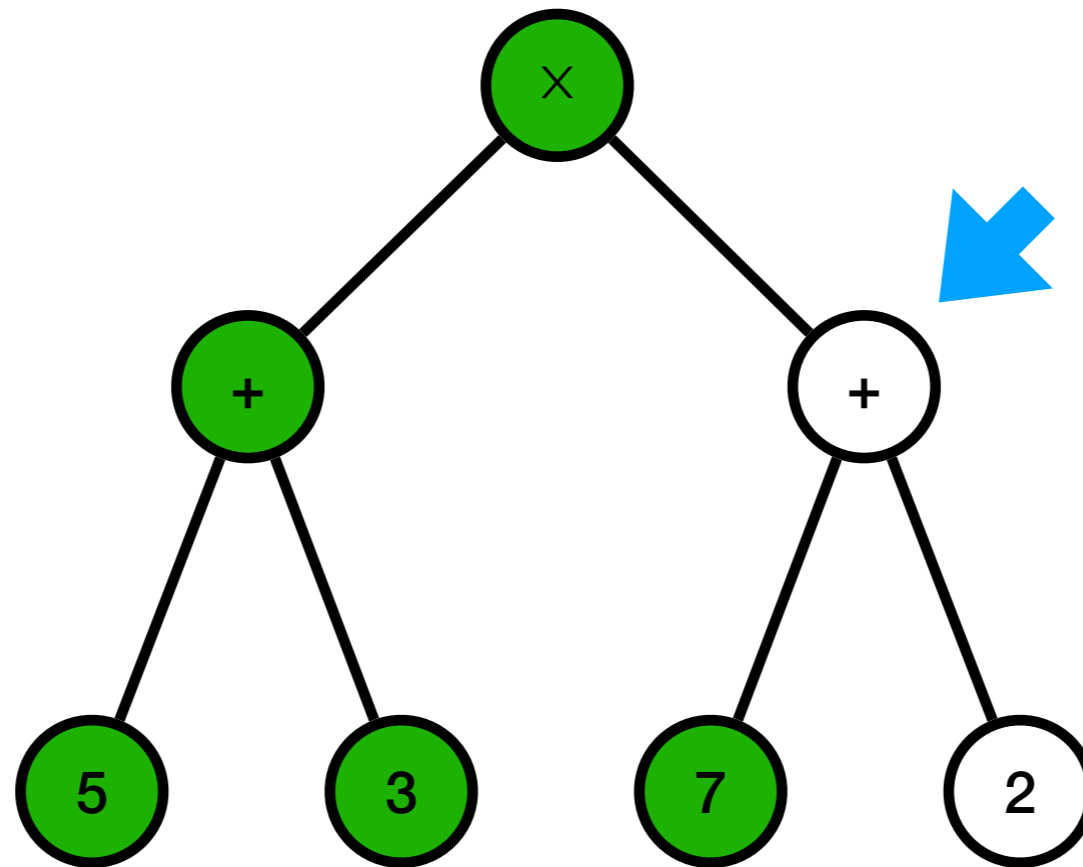
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Afficher  $((5 + 3) \times (7 + 2))$



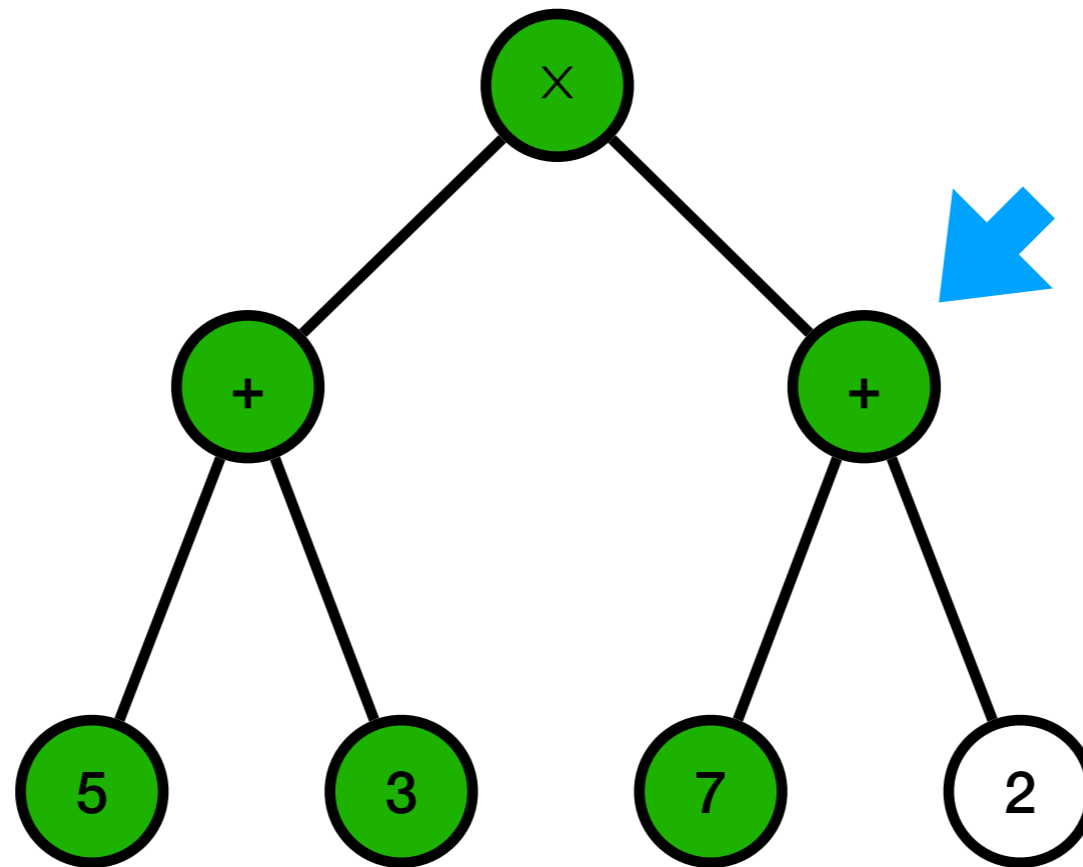
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Afficher  $((5 + 3) \times (7 + 2))$



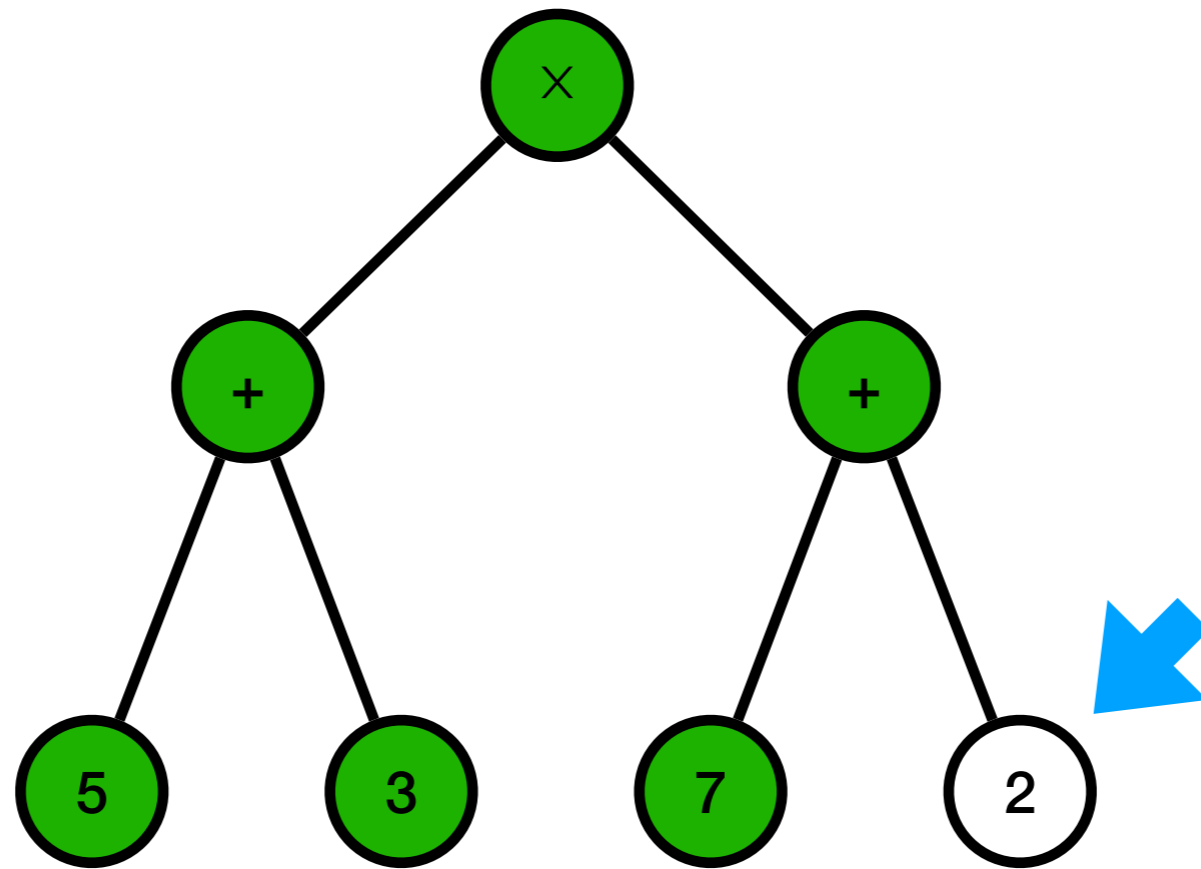
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Afficher  $((5 + 3) \times (7 + 2))$



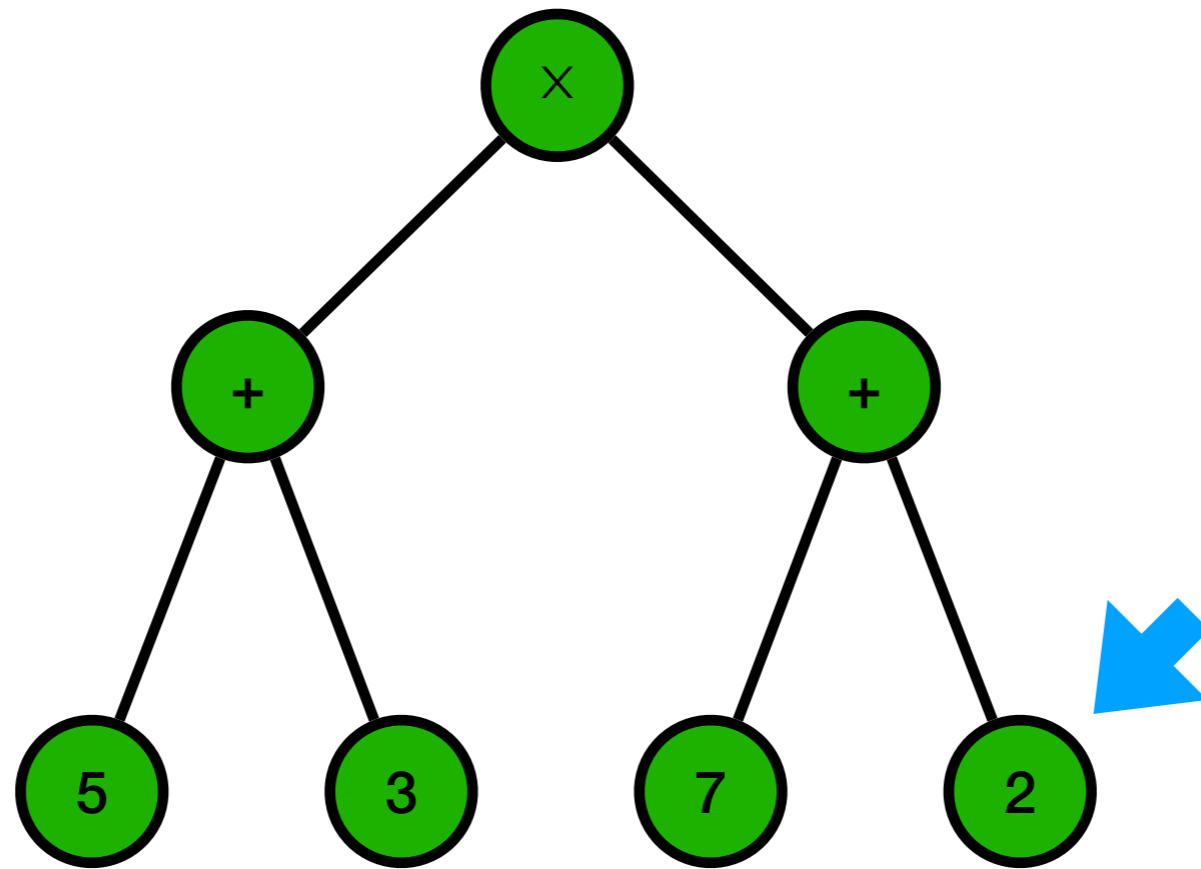
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Afficher  $((5 + 3) \times (7 + 2))$



$((5 + 3) \times (7 +$

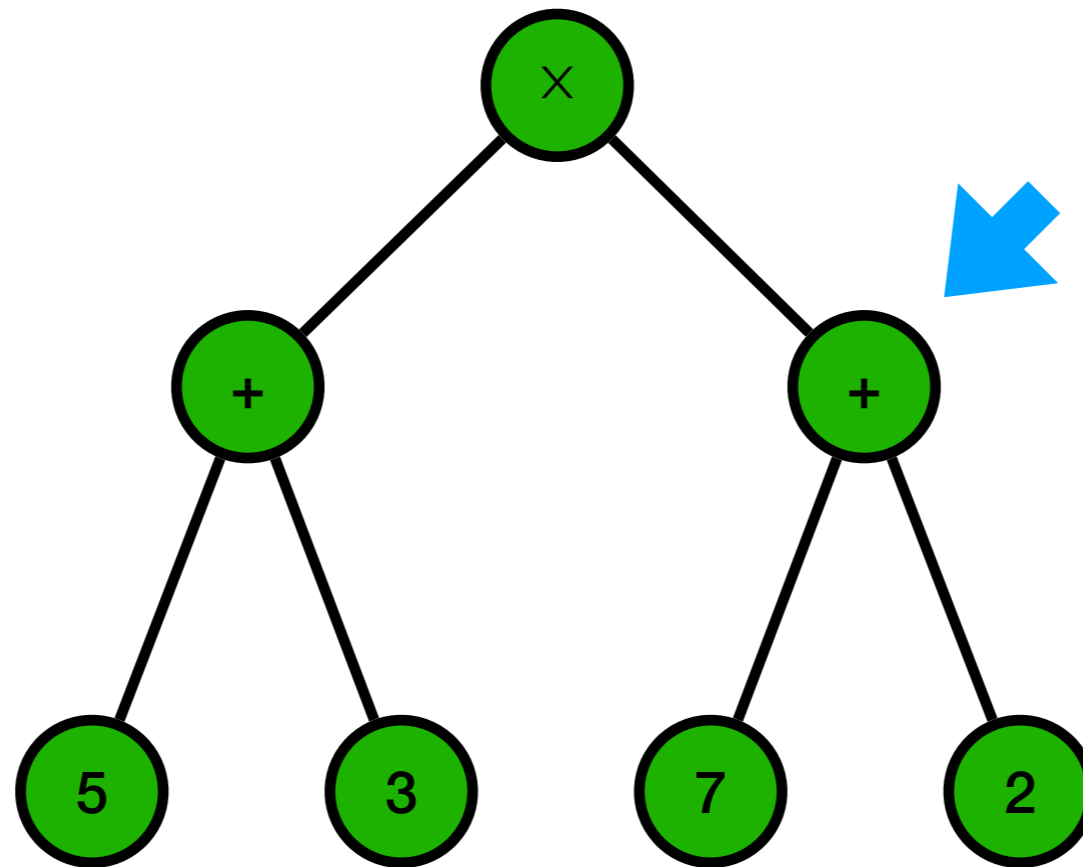
Afficher  $((5 + 3) \times (7 + 2))$



$((5 + 3) \times (7 + 2$

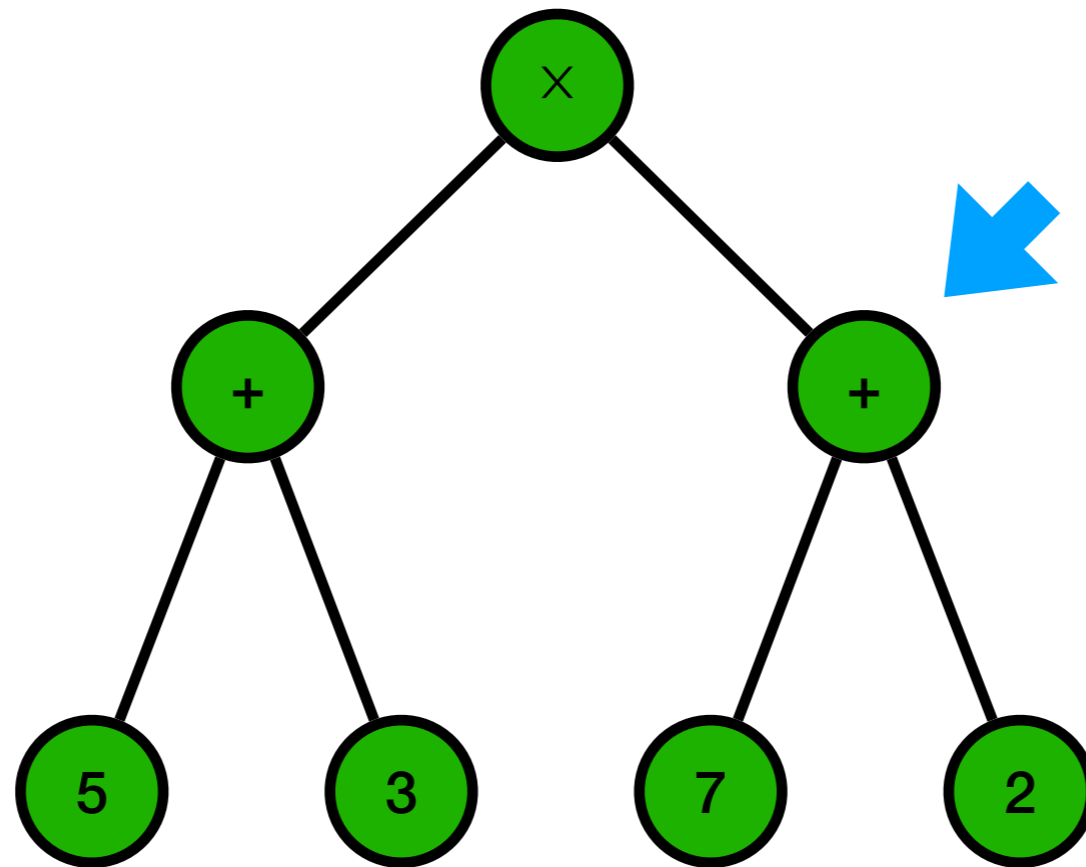


Afficher  $((5 + 3) \times (7 + 2))$



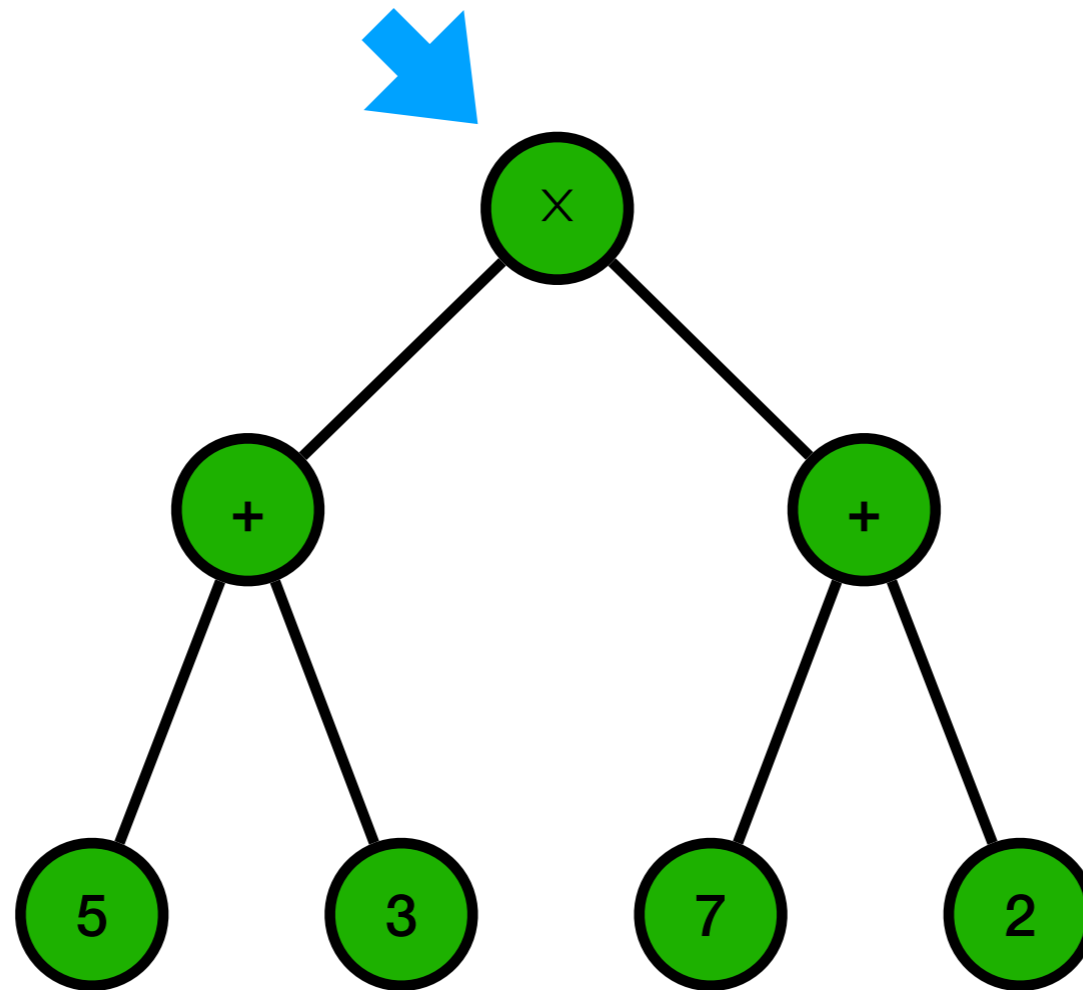
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Afficher  $((5 + 3) \times (7 + 2))$



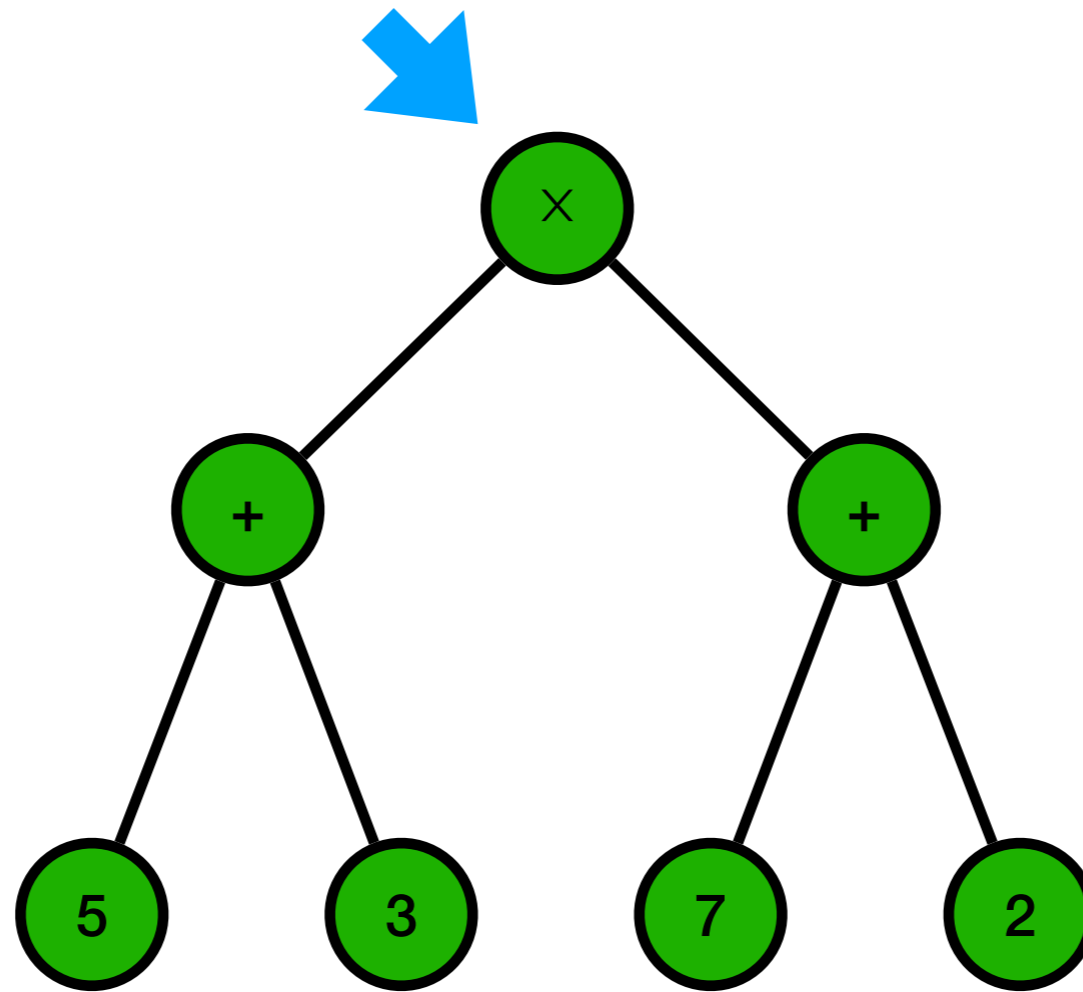
$((5 + 3) \times (7 + 2))$

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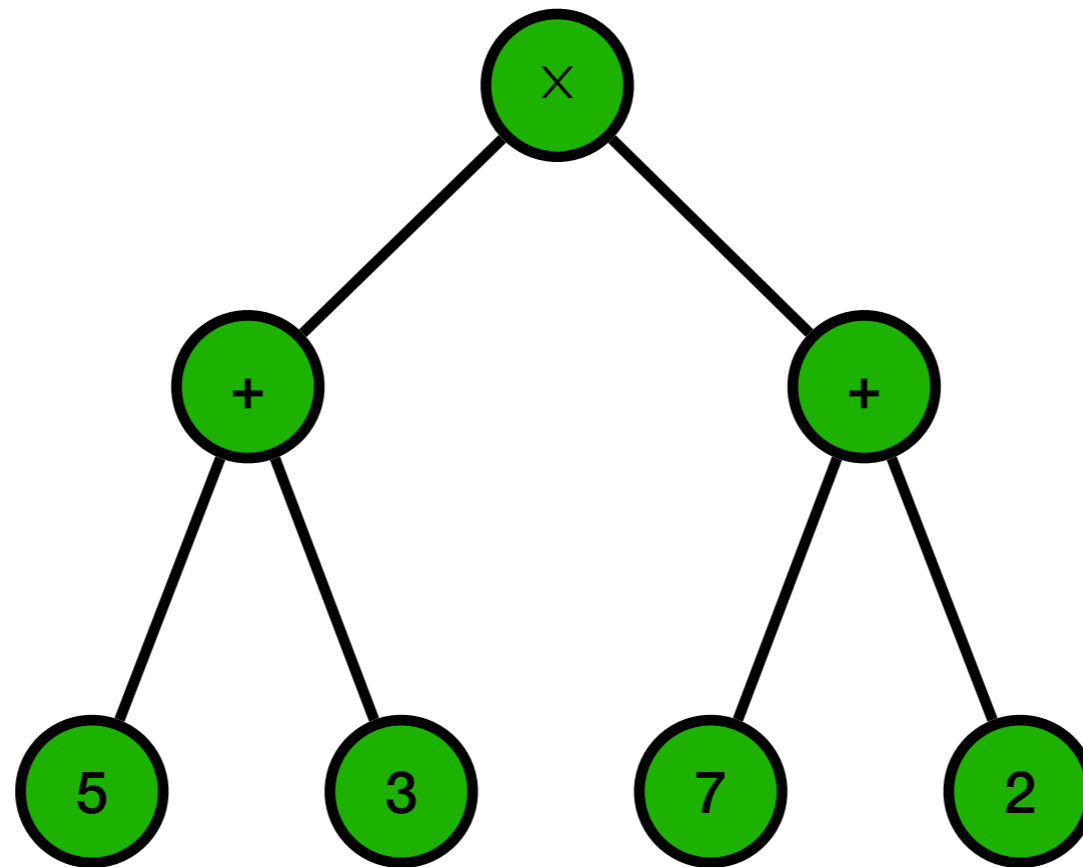
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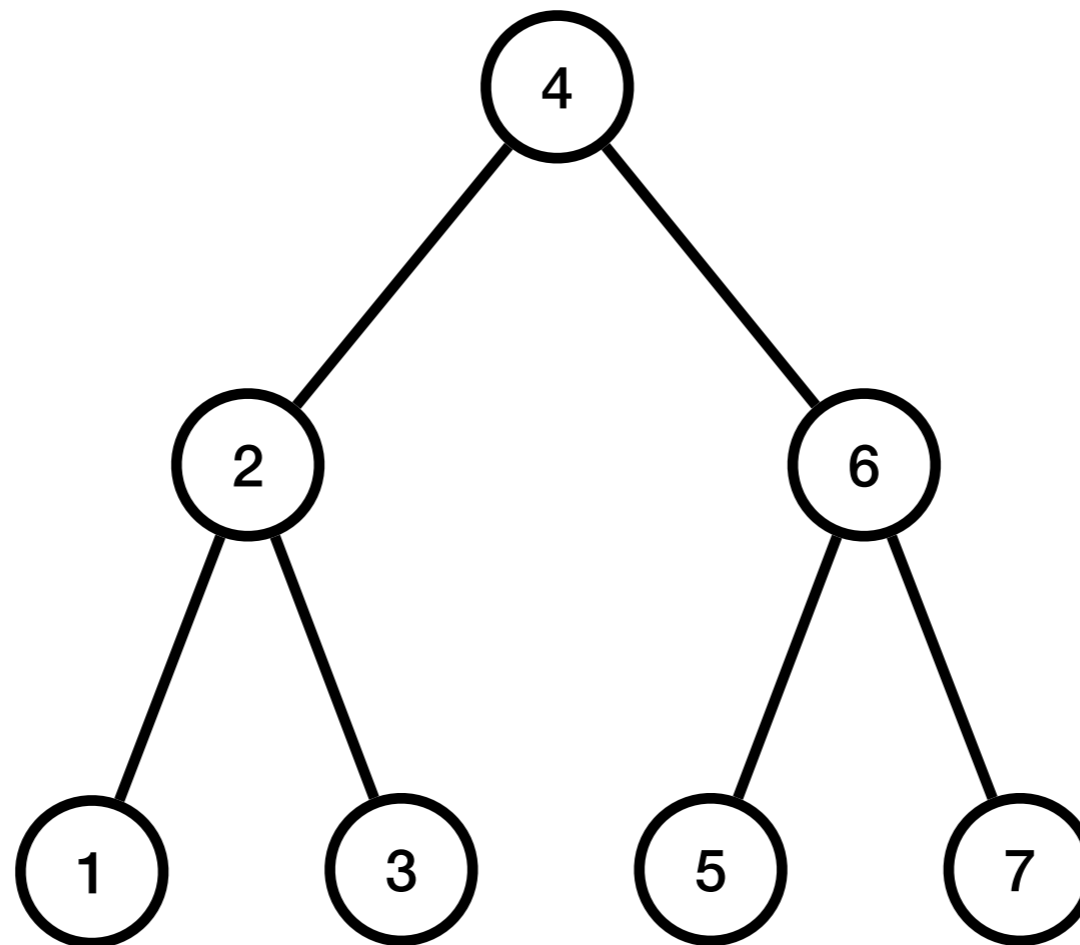
# Exercice 3.4 du TD5

# Exercice 3.5 et 3.6 du TD5

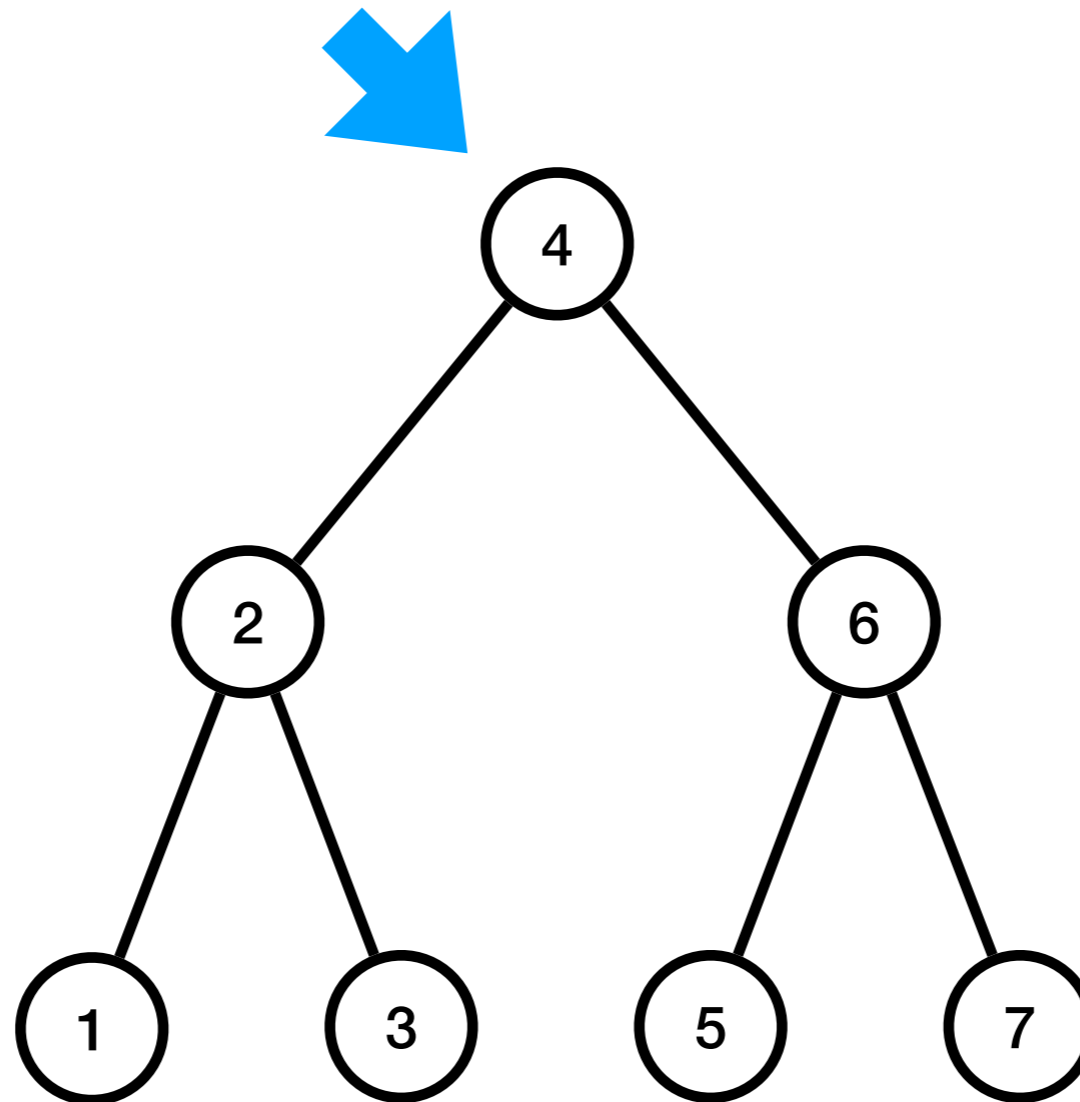
# **Arbres binaires de recherche**



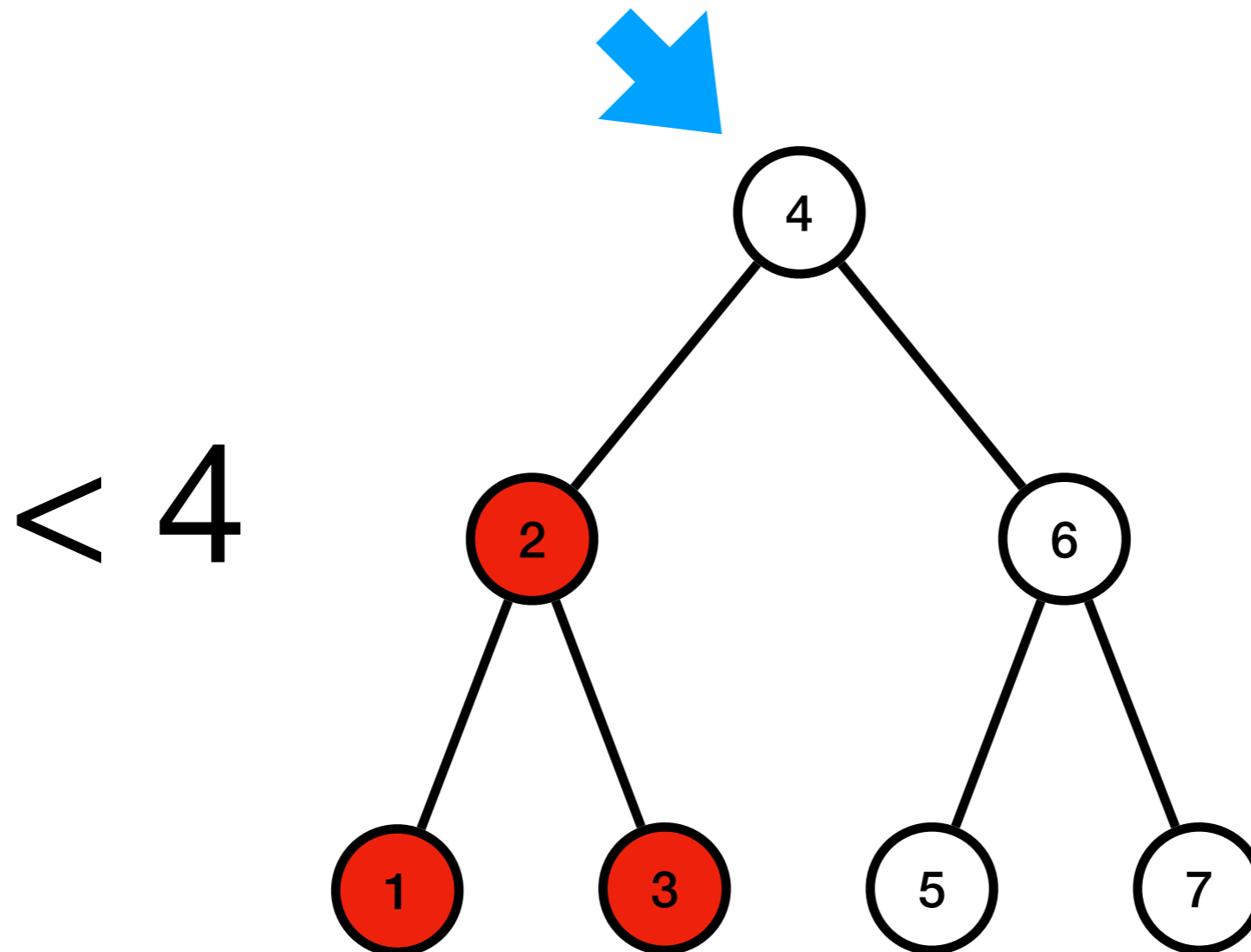
# Arbres binaires de recherche



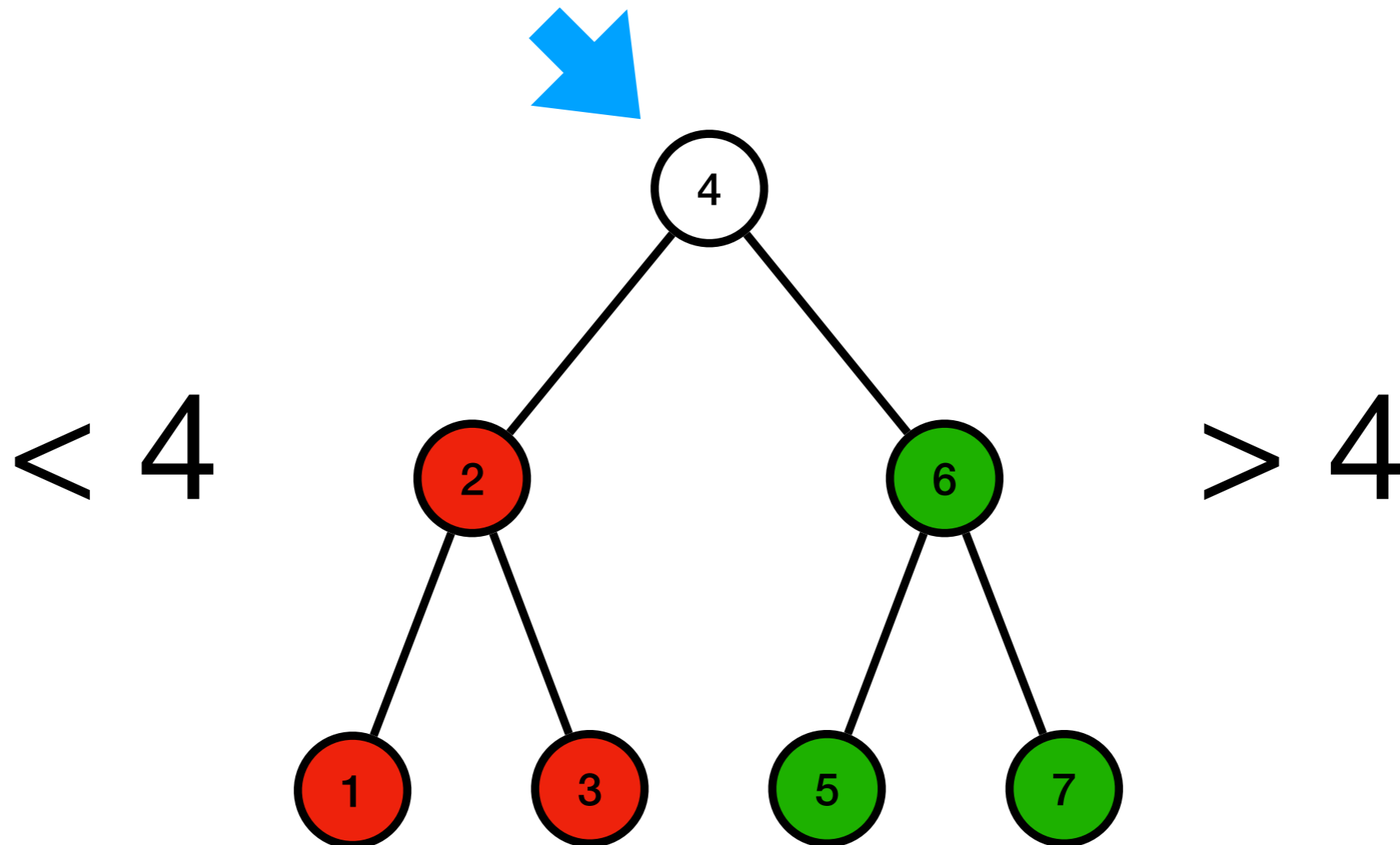
# Arbres binaires de recherche



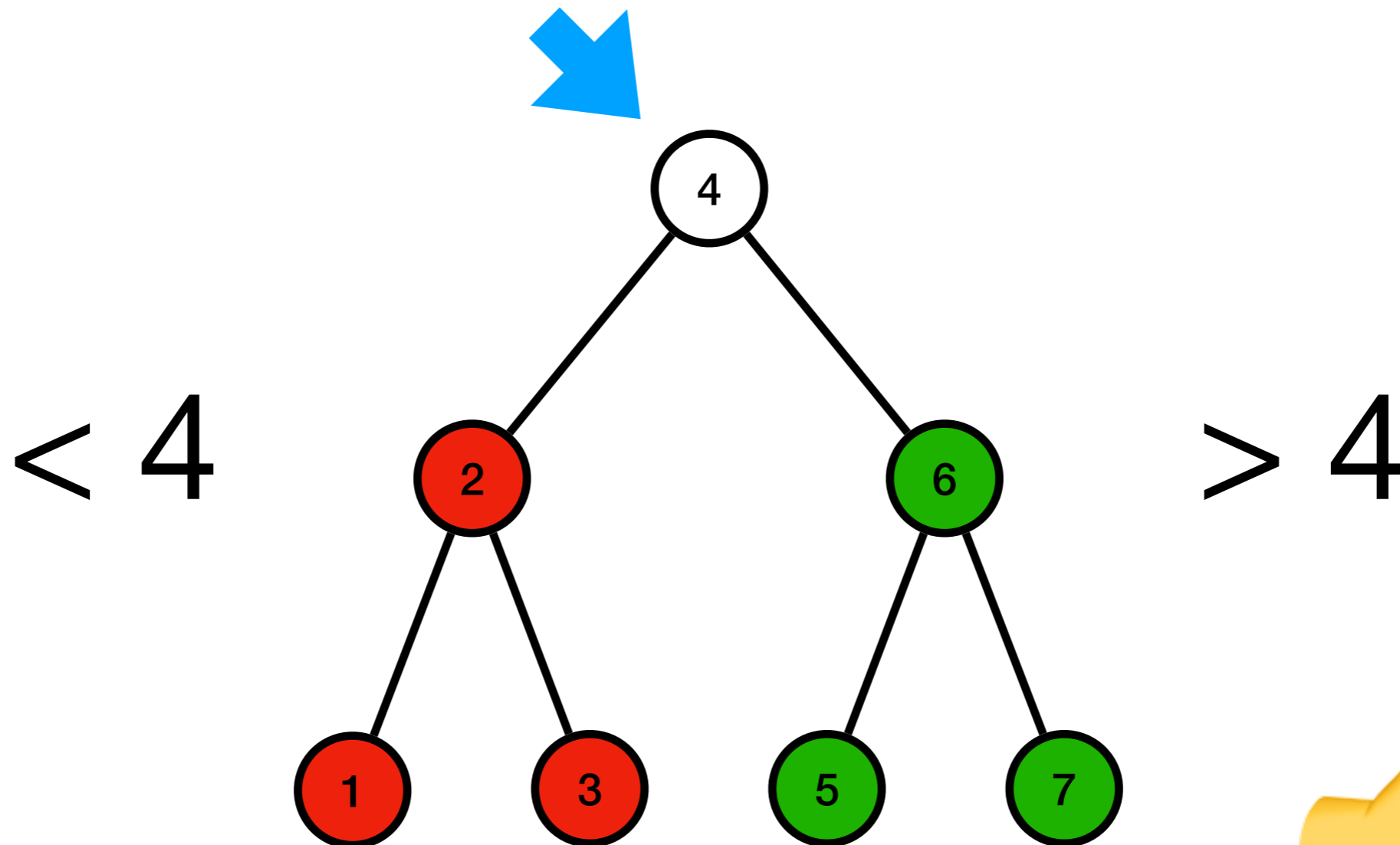
# Arbres binaires de recherche



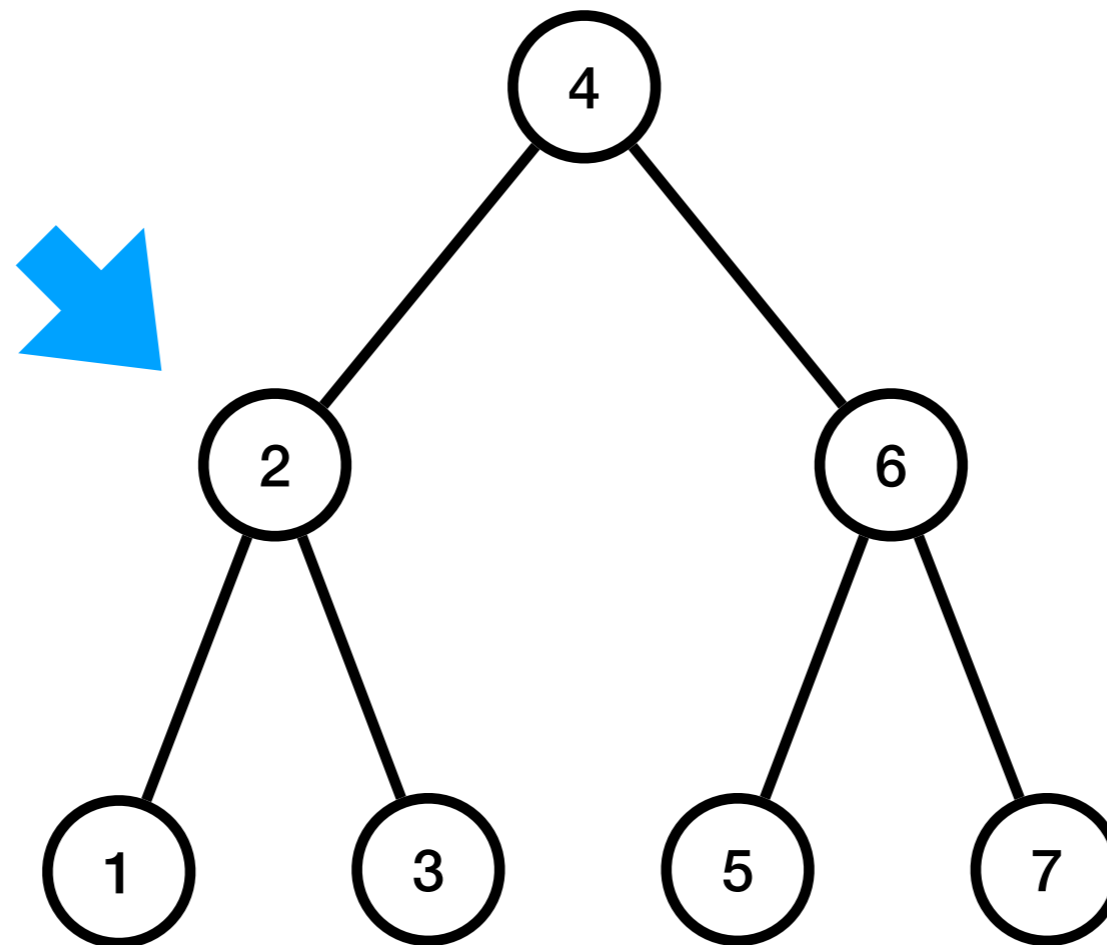
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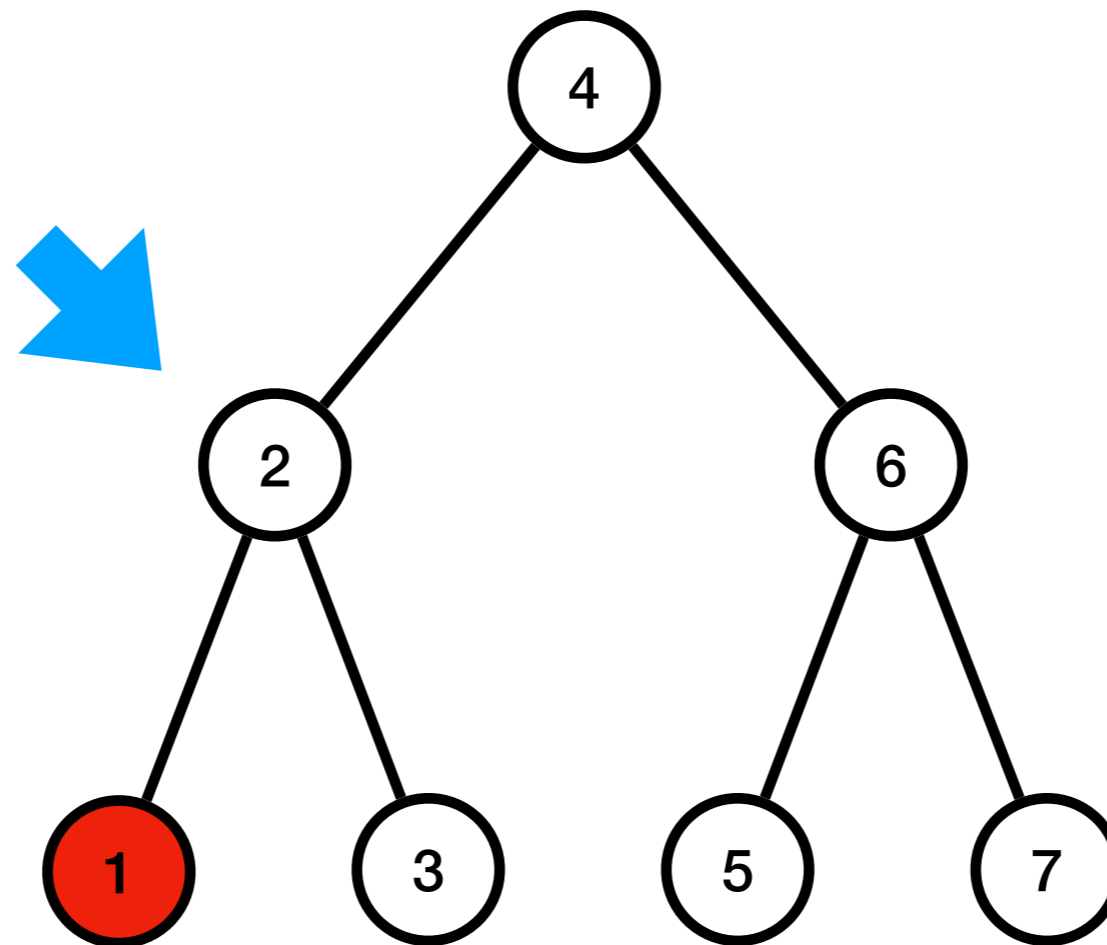
# Arbres binaires de recherche



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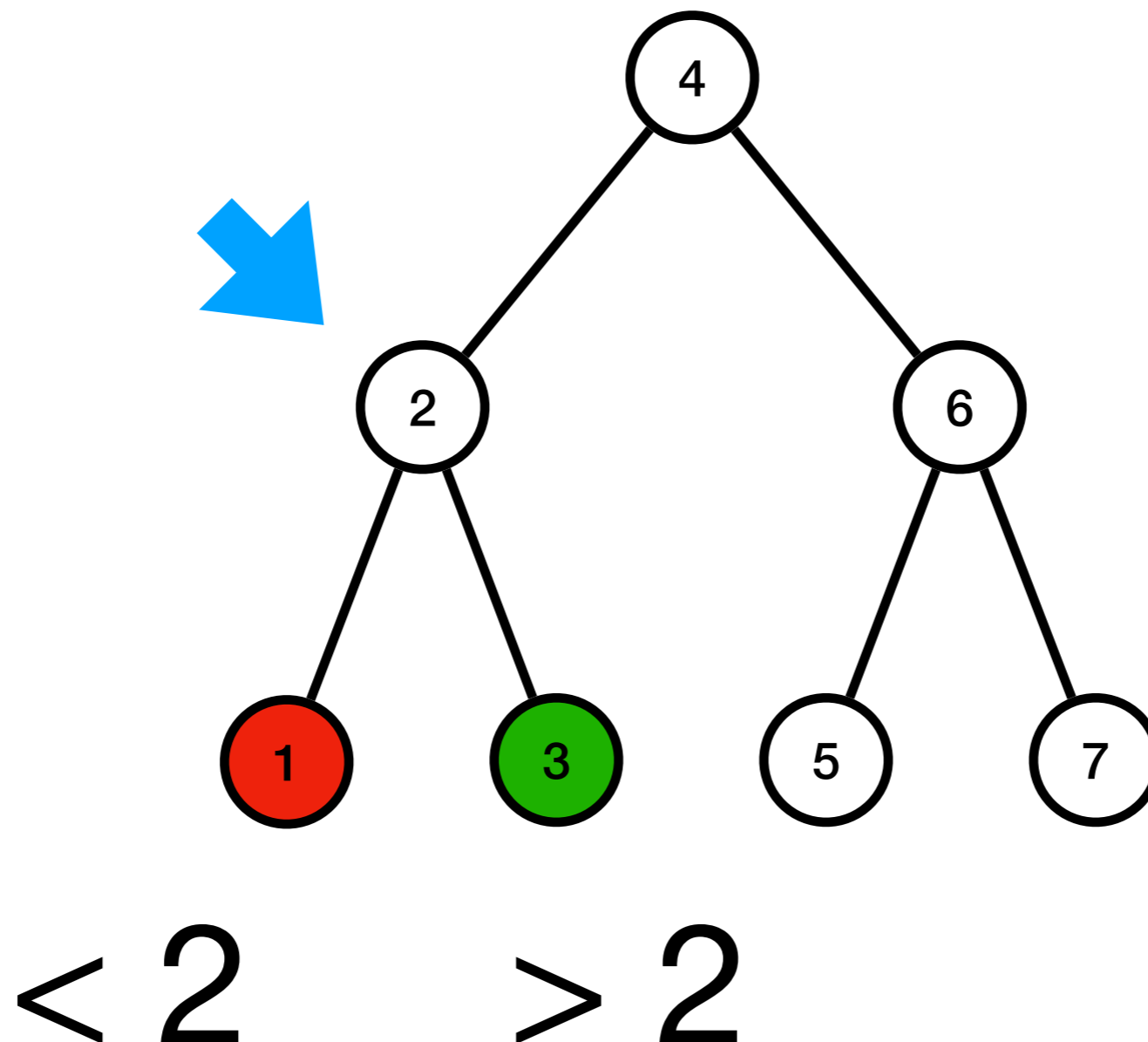


# Arbres binaires de recherche



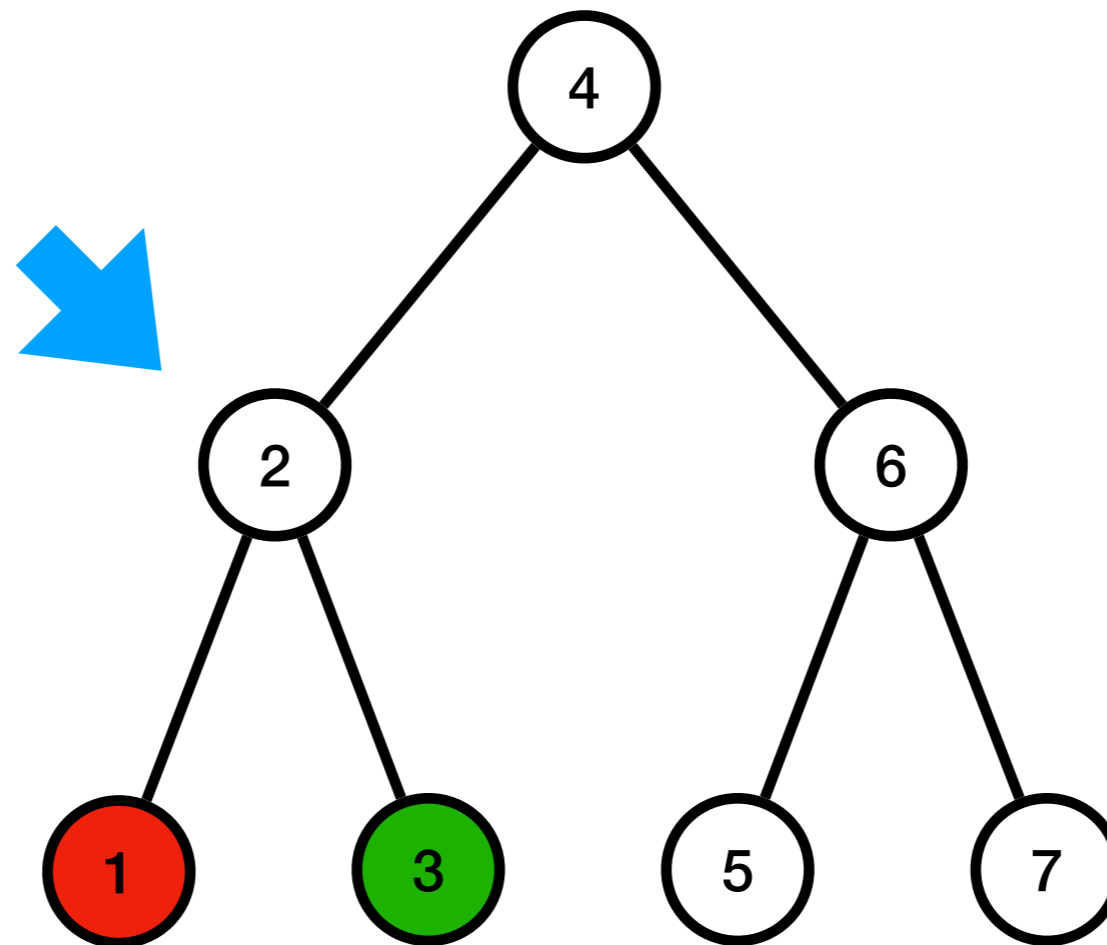
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# Arbres binaires de recherche





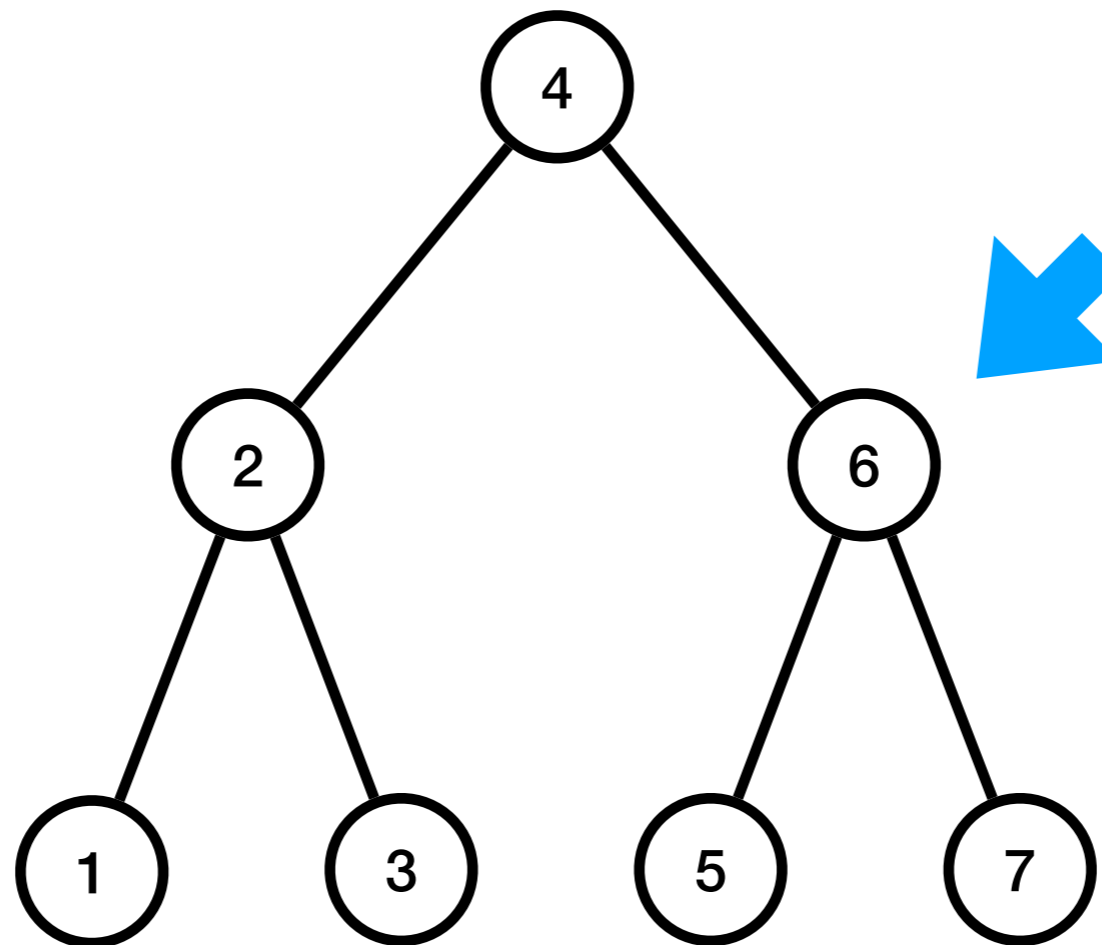
# Arbres binaires de recherche



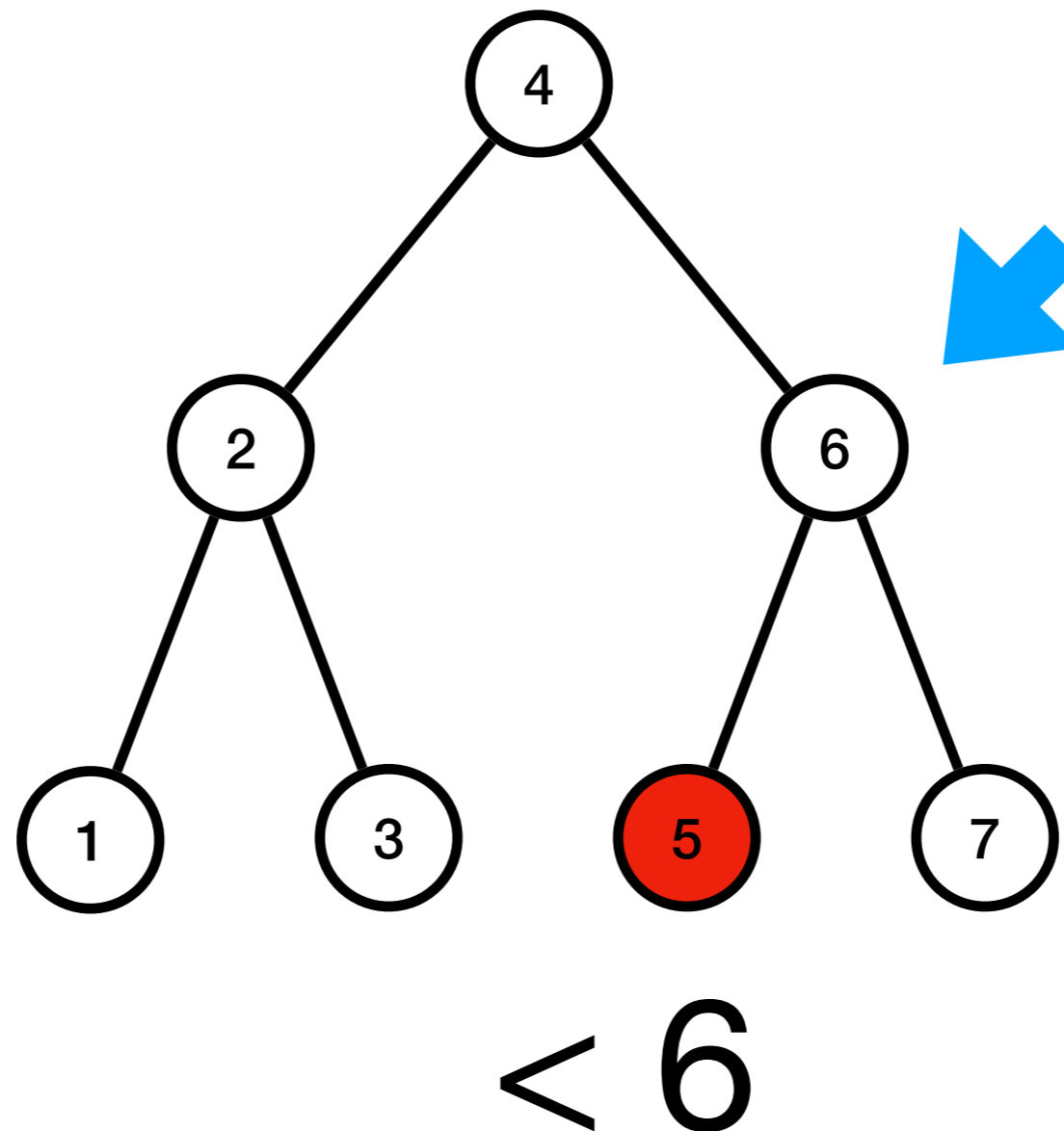
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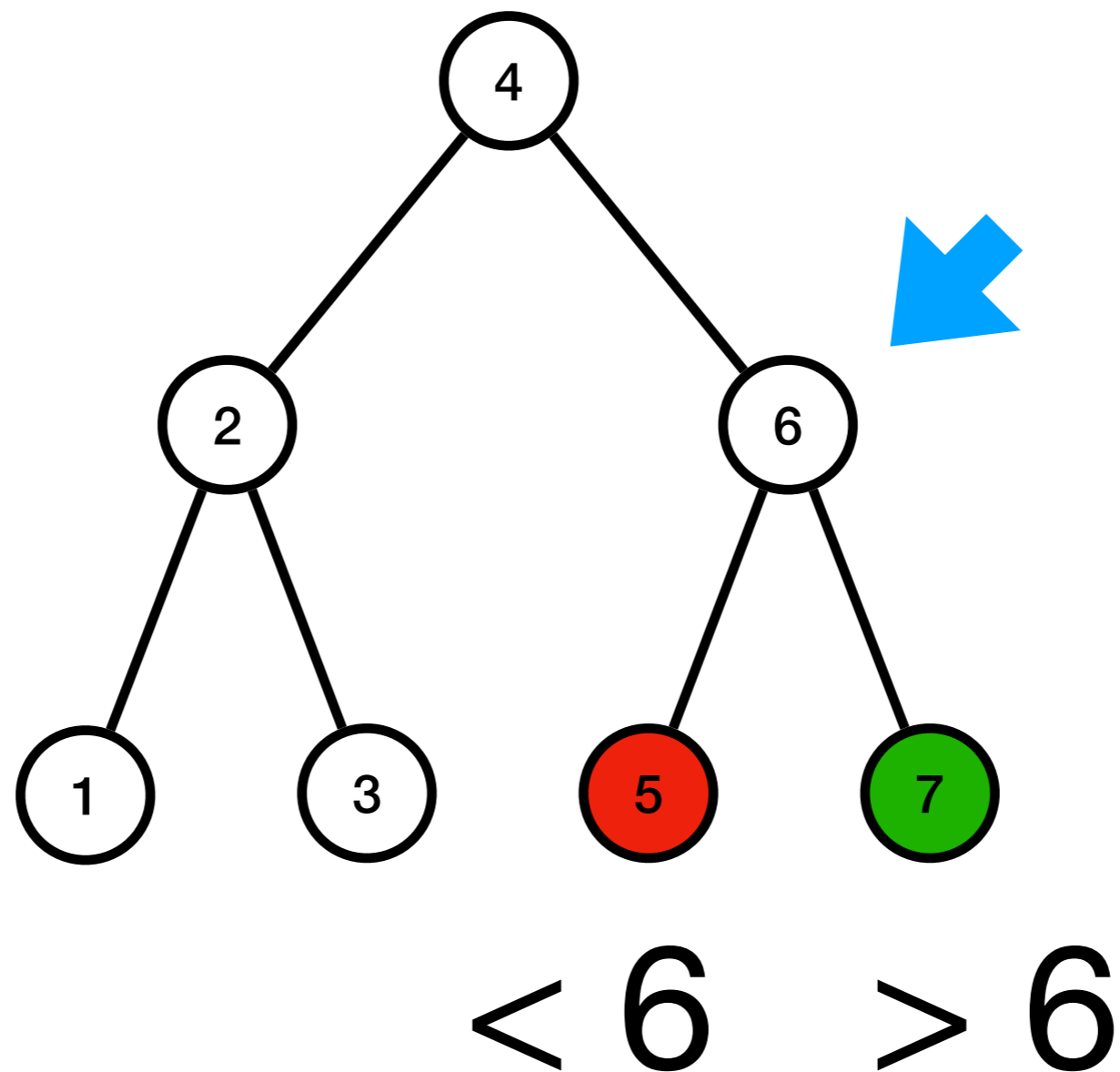
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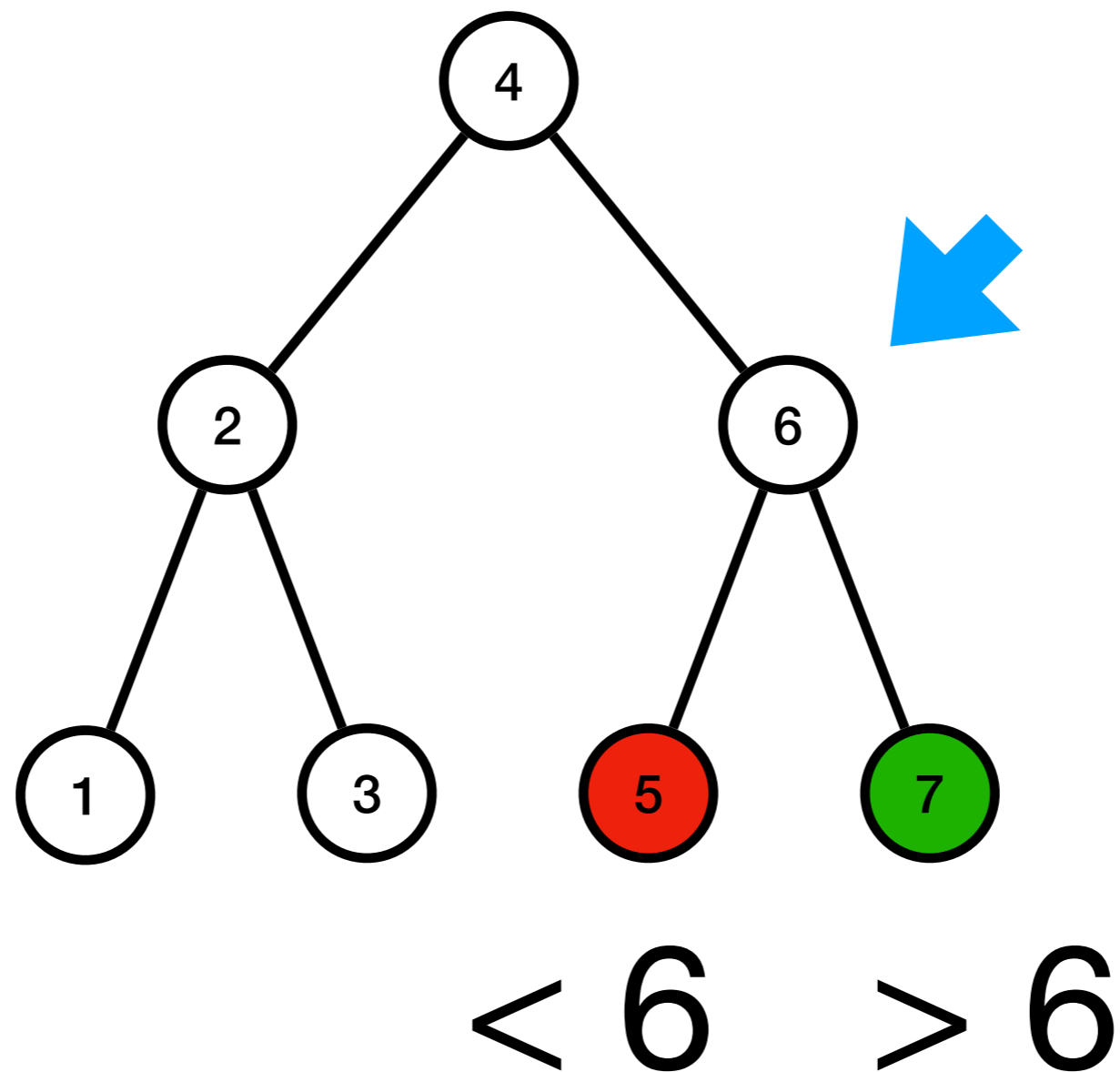
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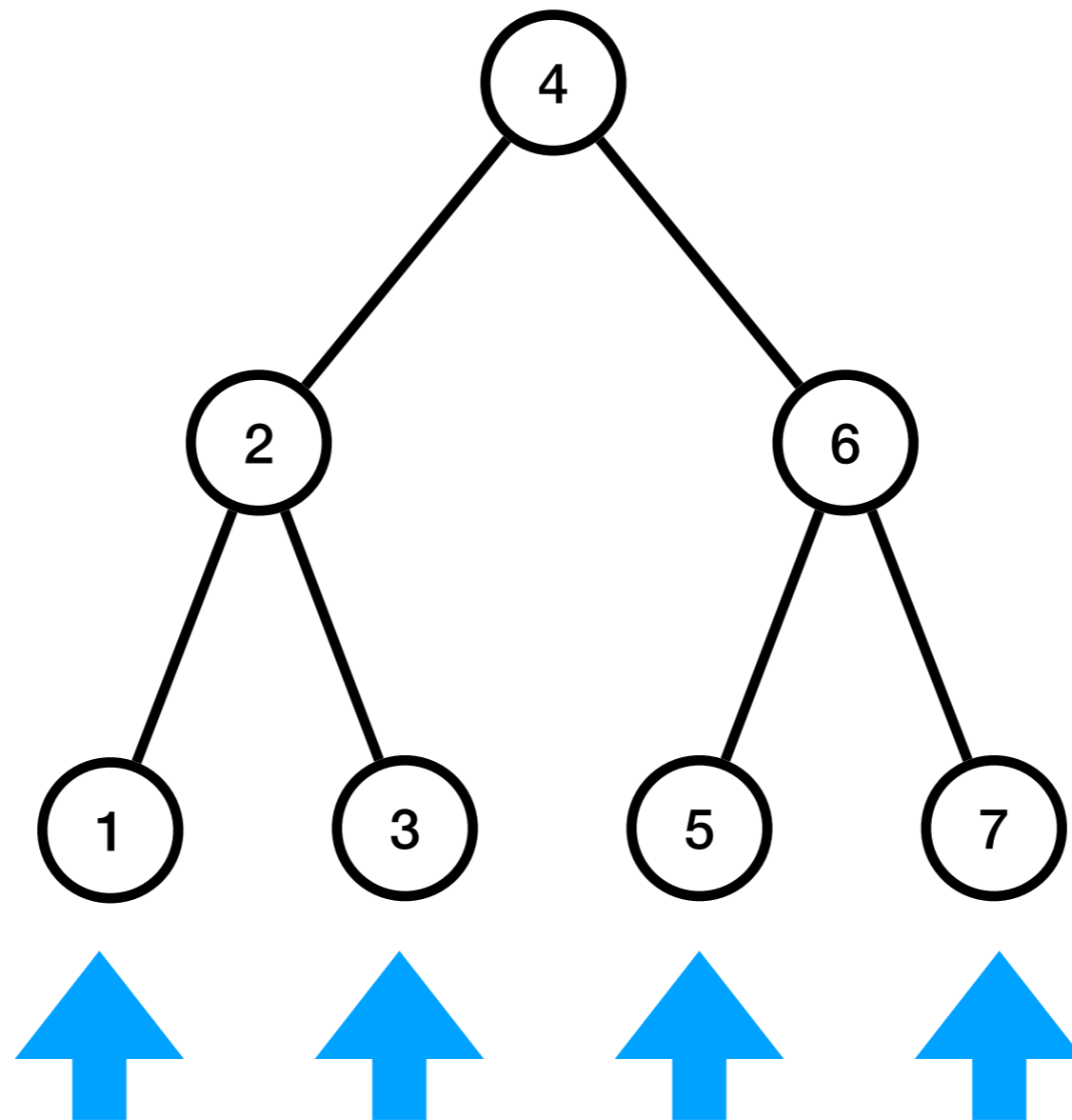
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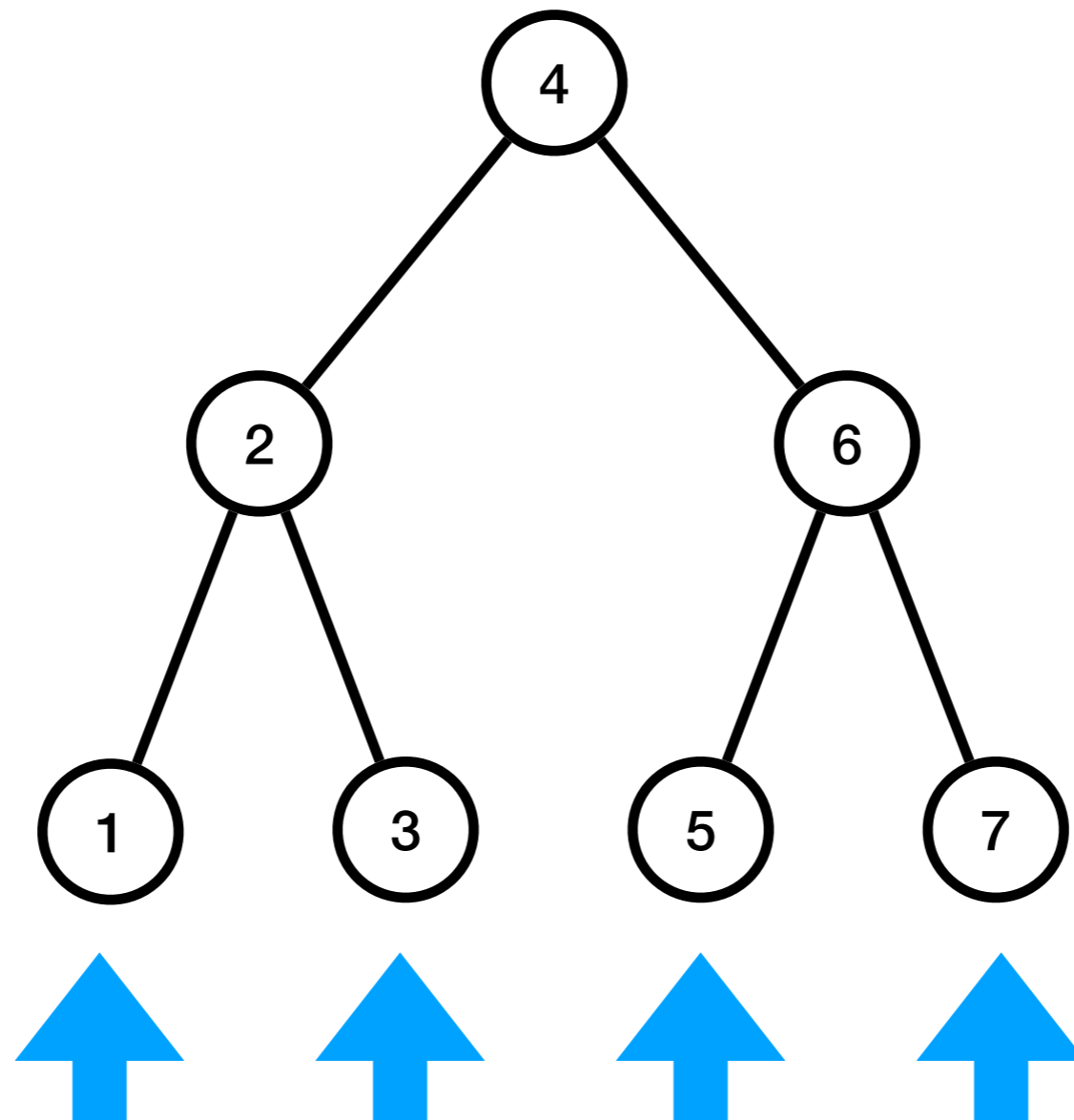
# Arbres binaires de recherche



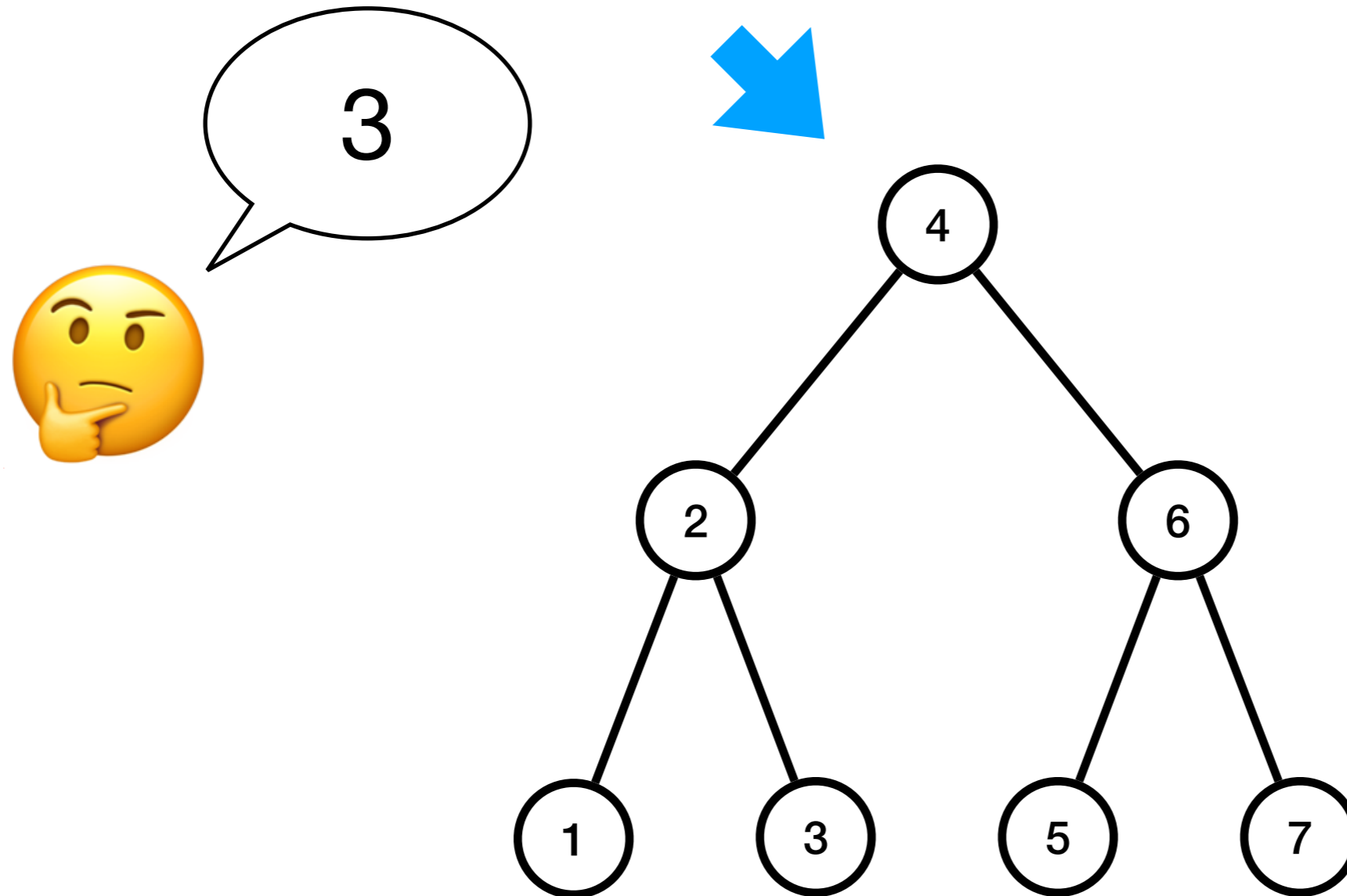
# Arbres binaires de recherche



# Arbres binaires de recherche

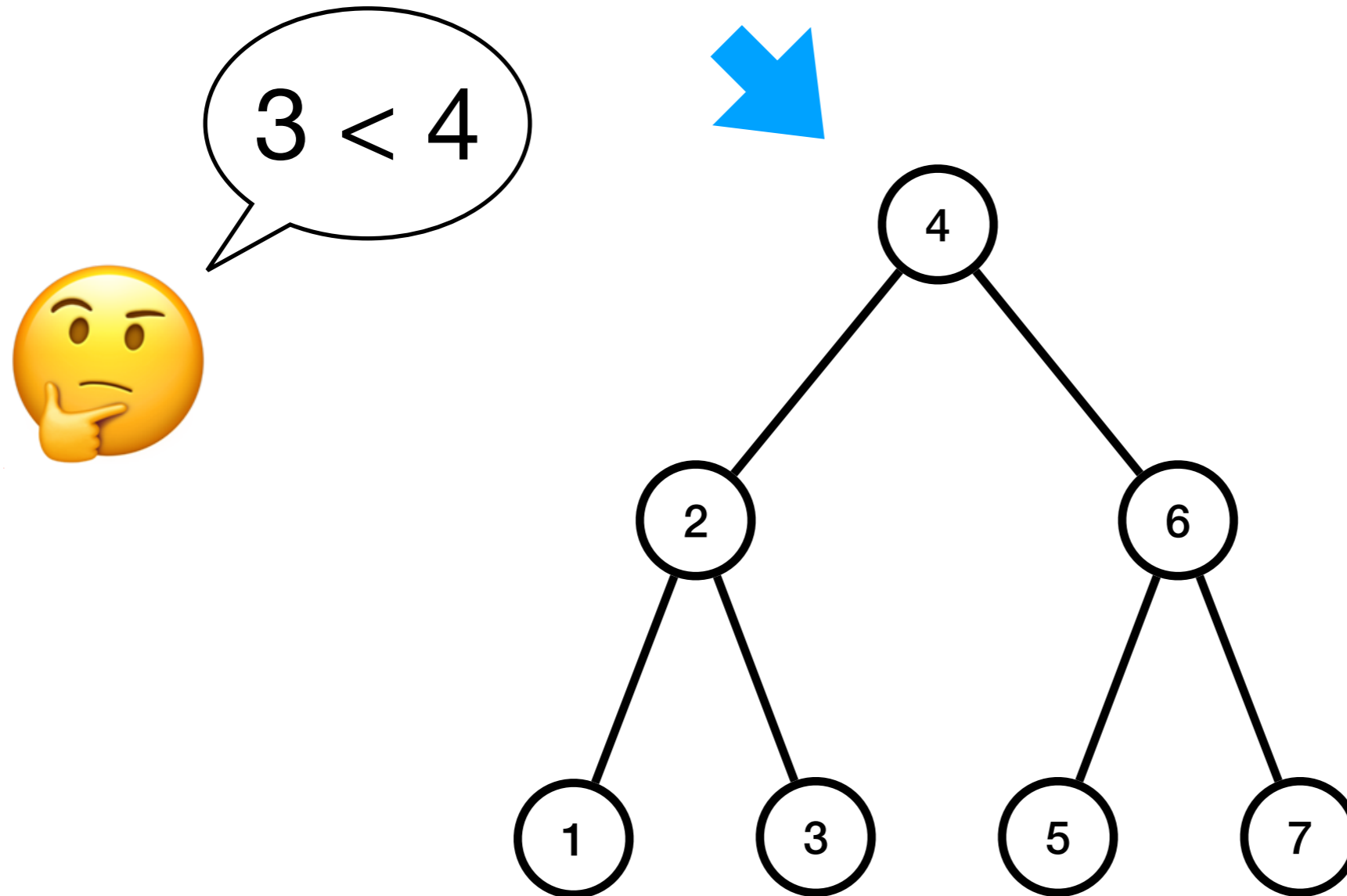


# Recherche dans un ABR

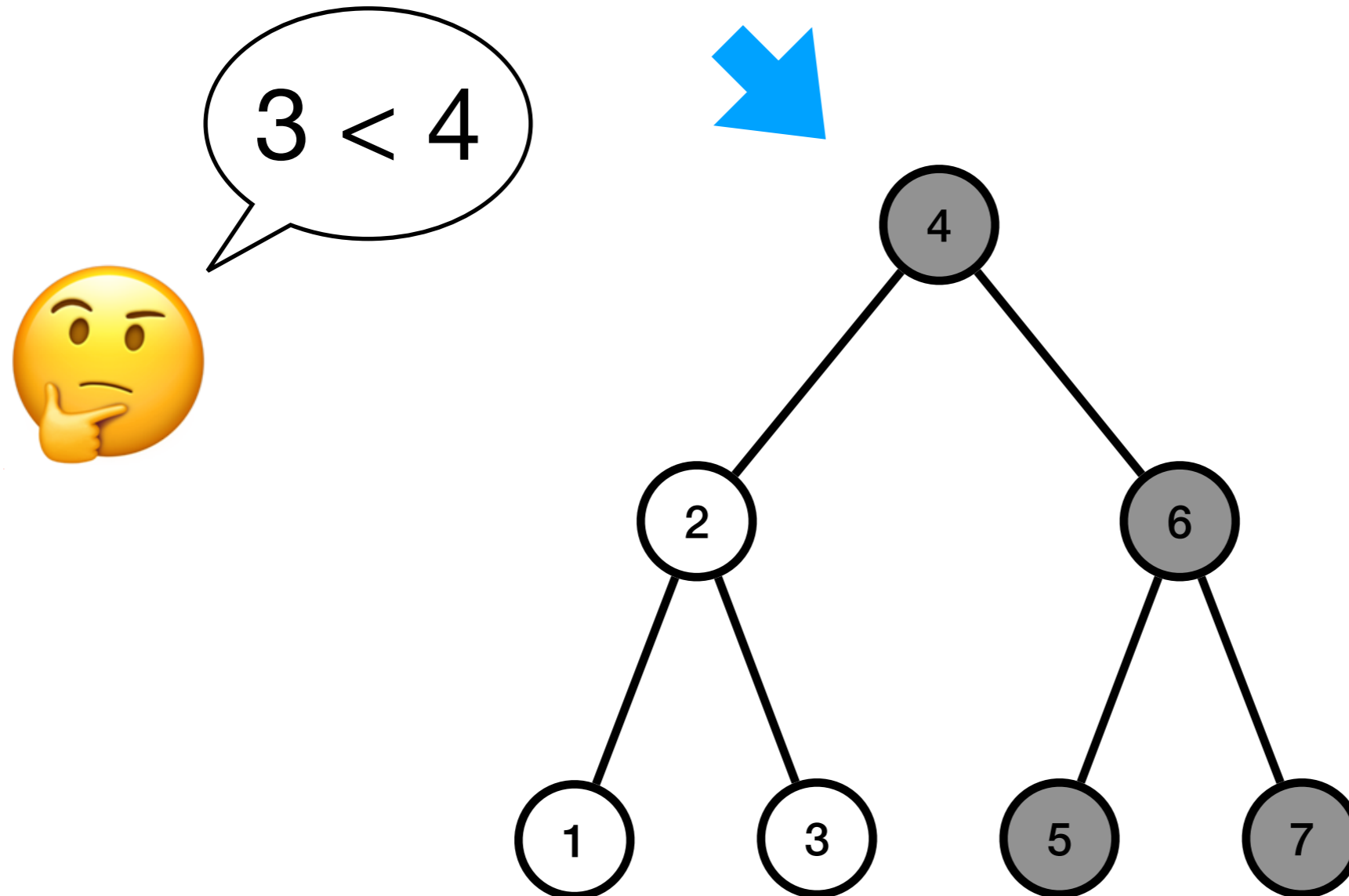




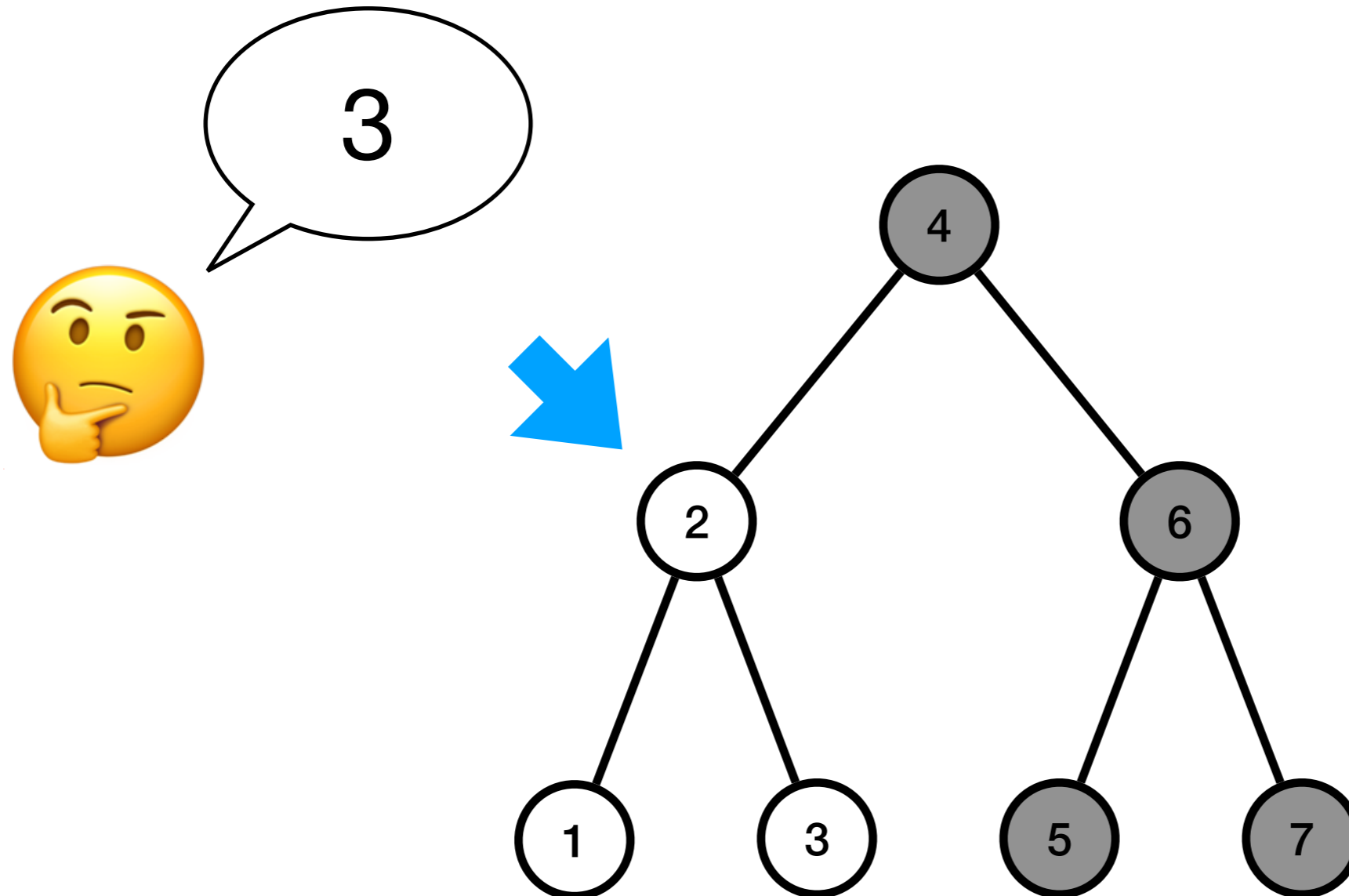
# Recherche dans un ABR



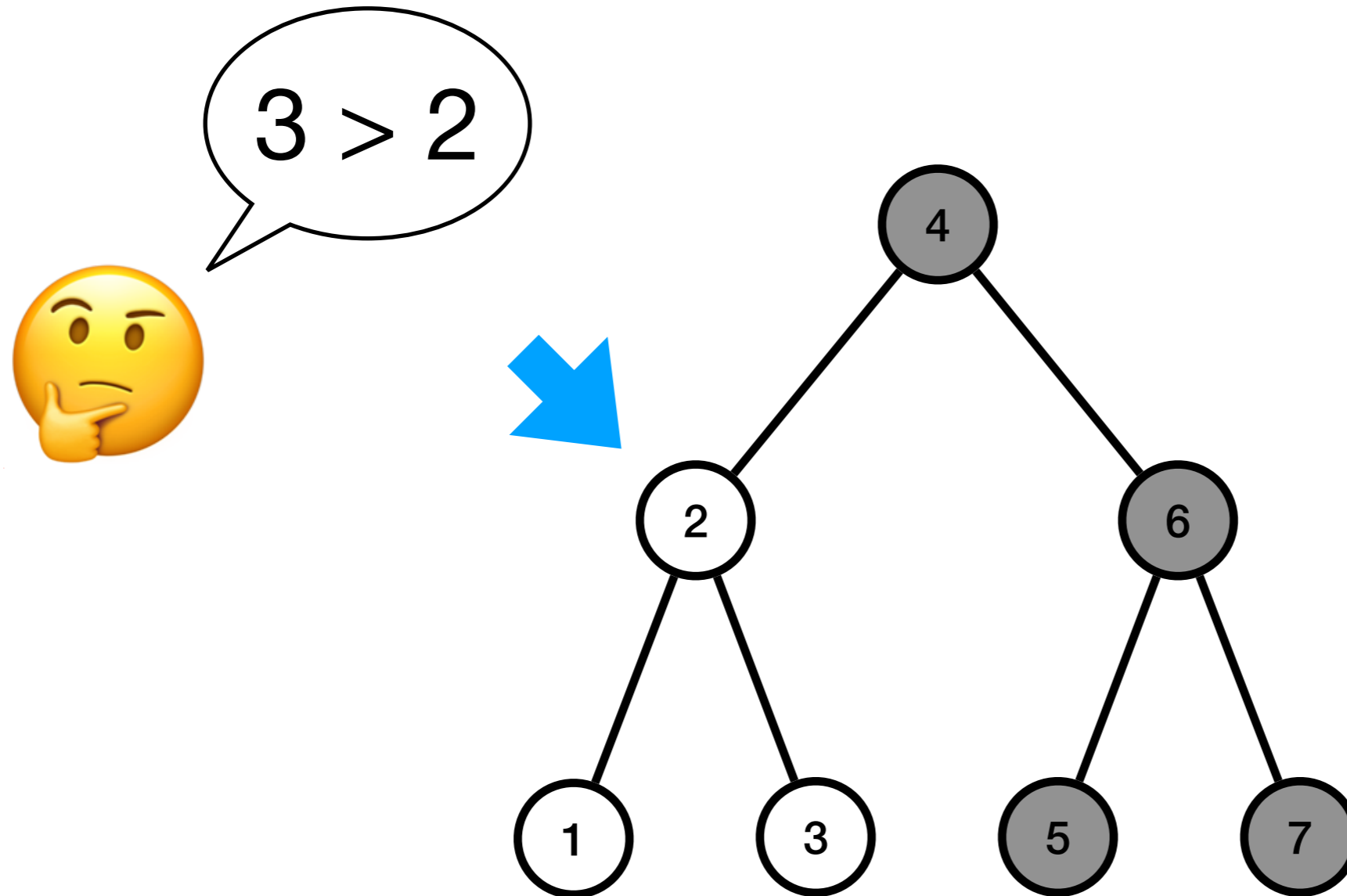
# Recherche dans un ABR



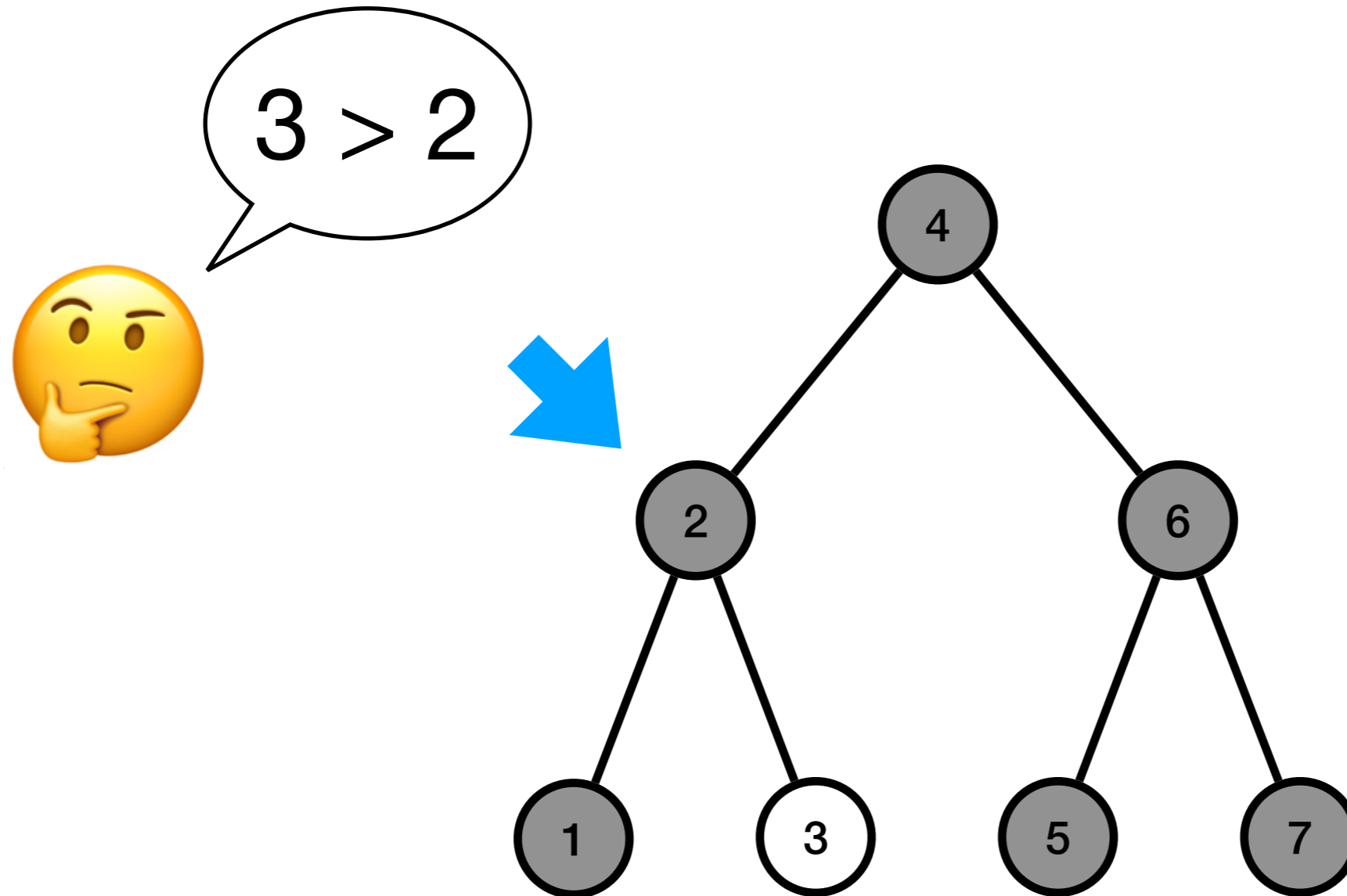
# Recherche dans un ABR



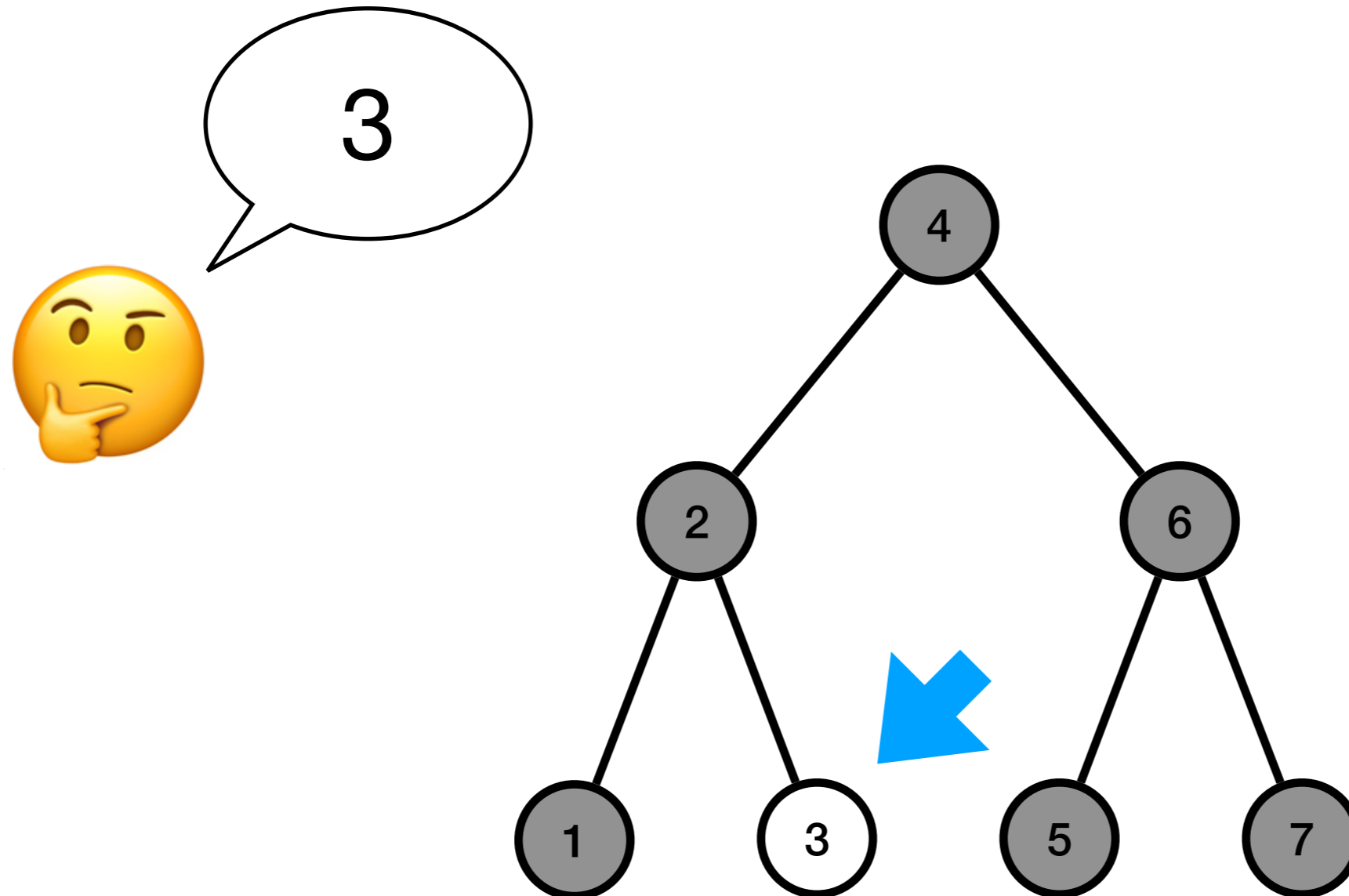
# Recherche dans un ABR



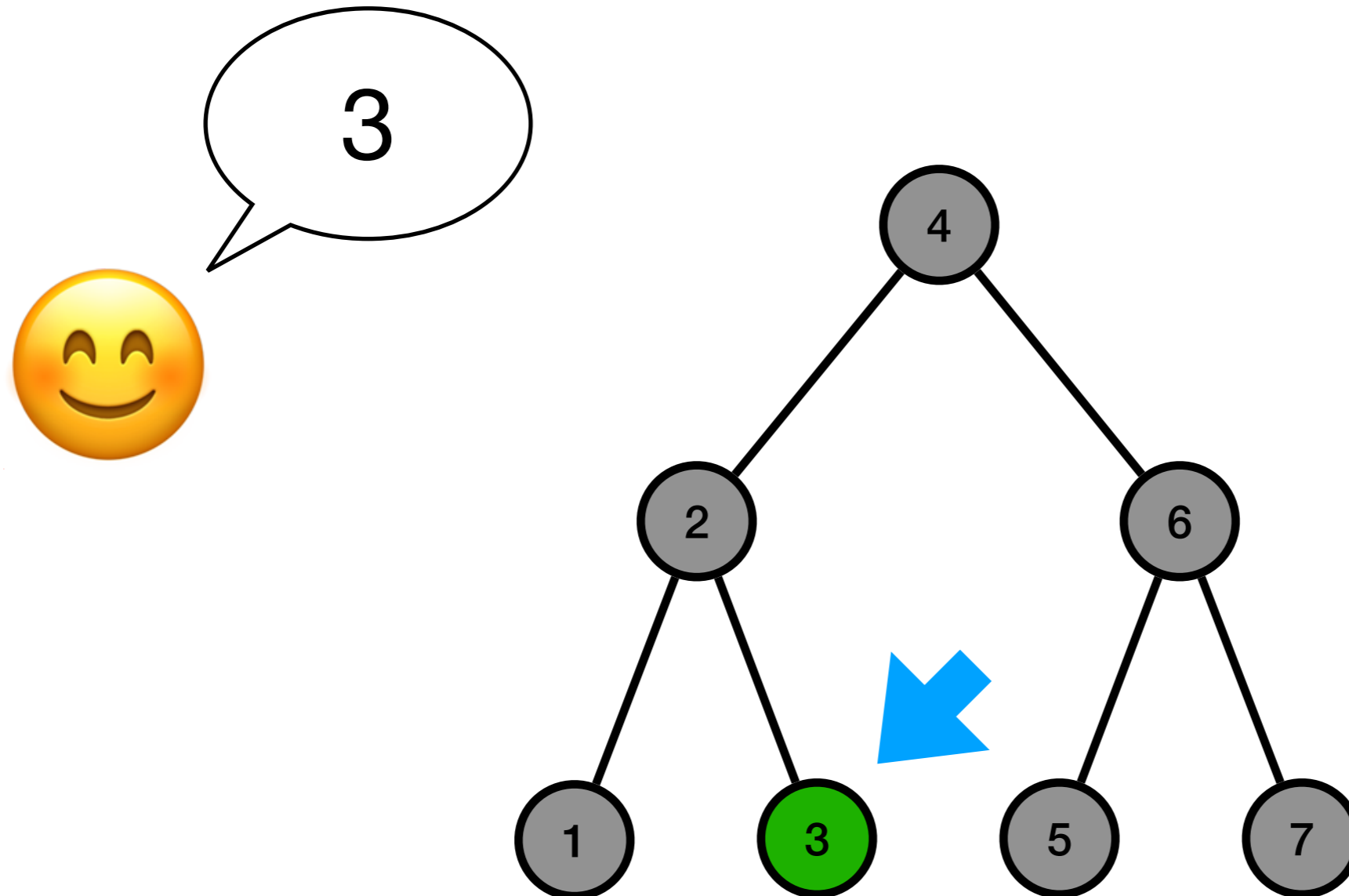
# Recherche dans un ABR



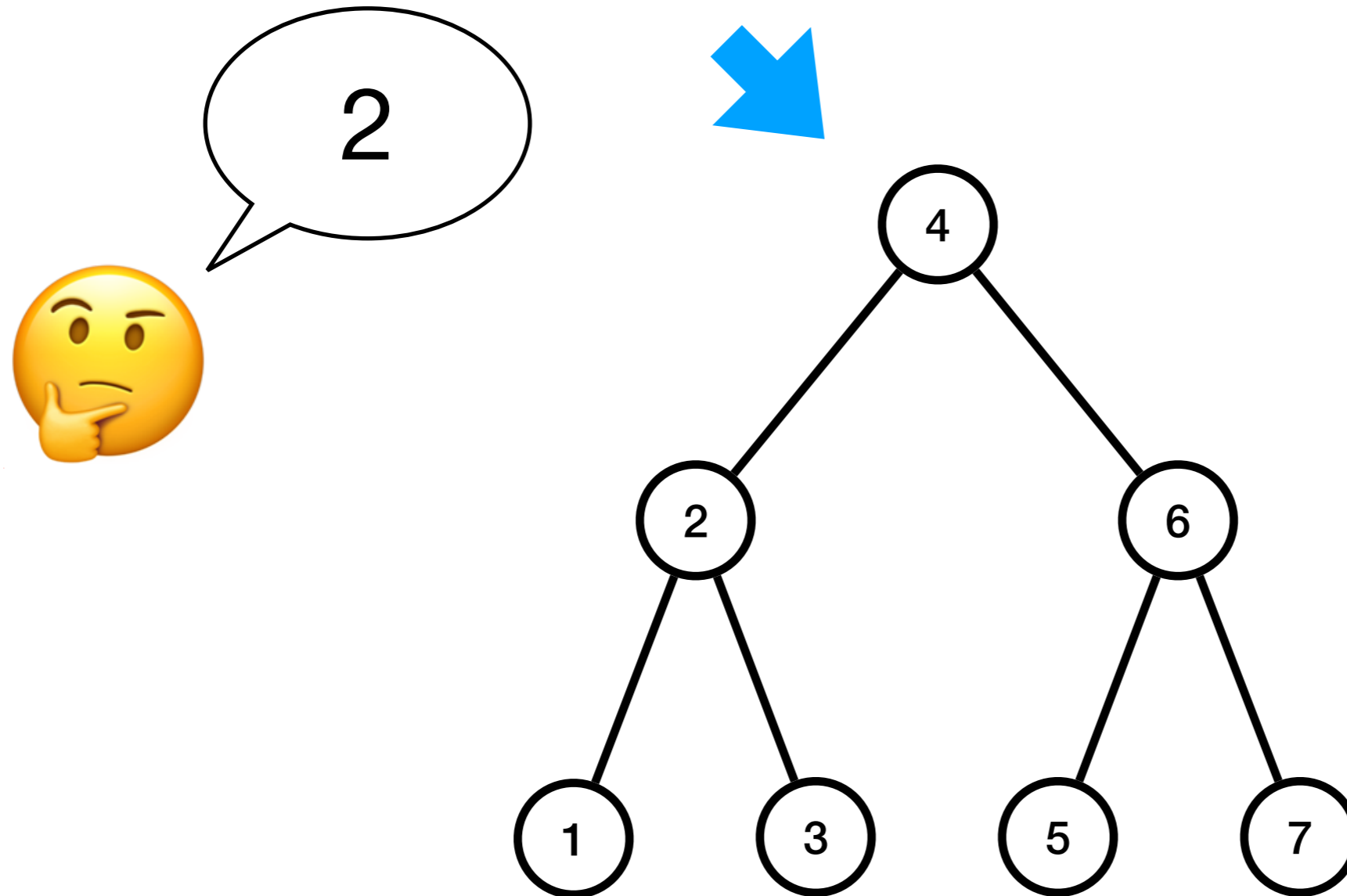
# Recherche dans un ABR



# Recherche dans un ABR

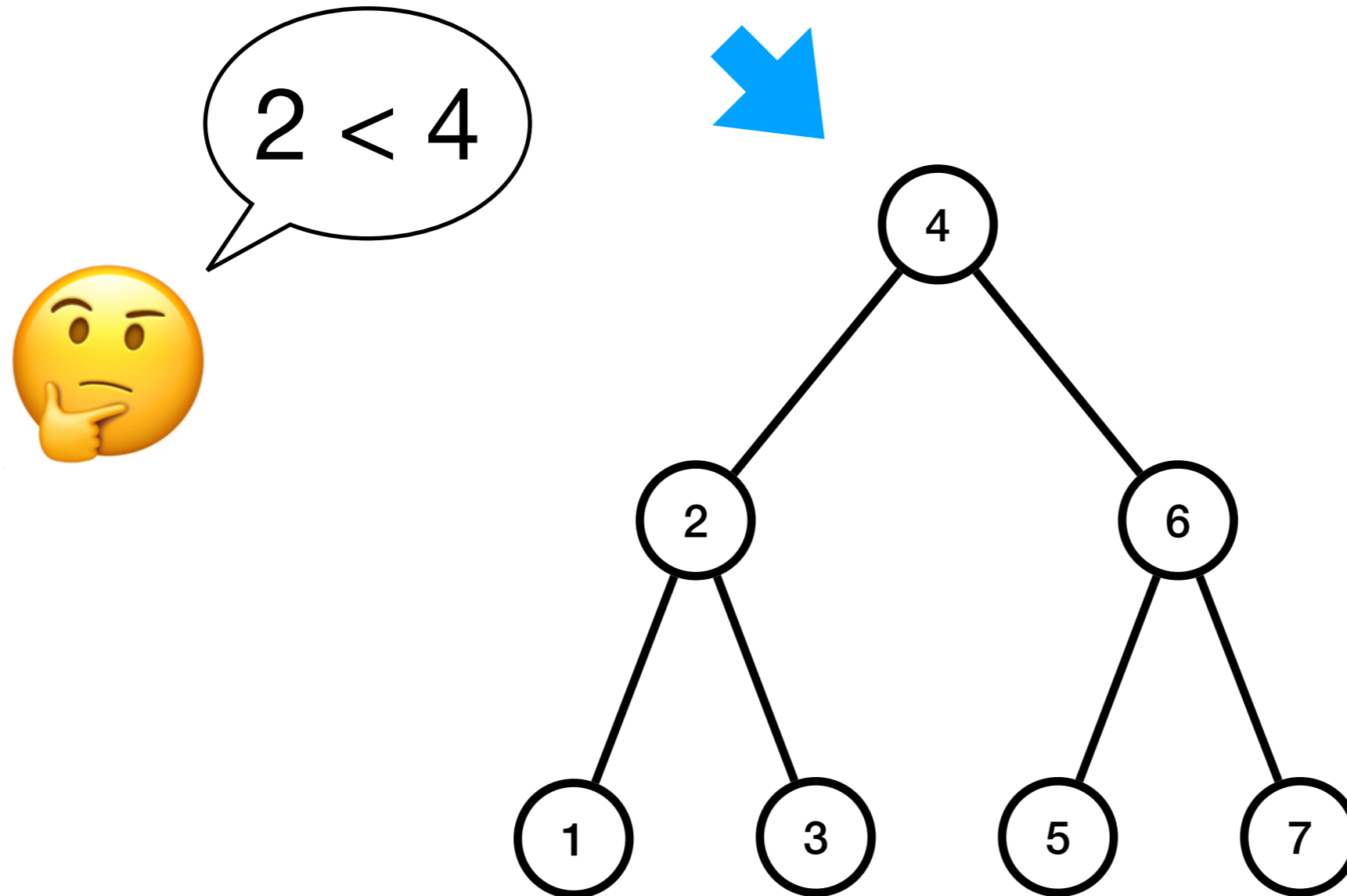


# Recherche dans un ABR

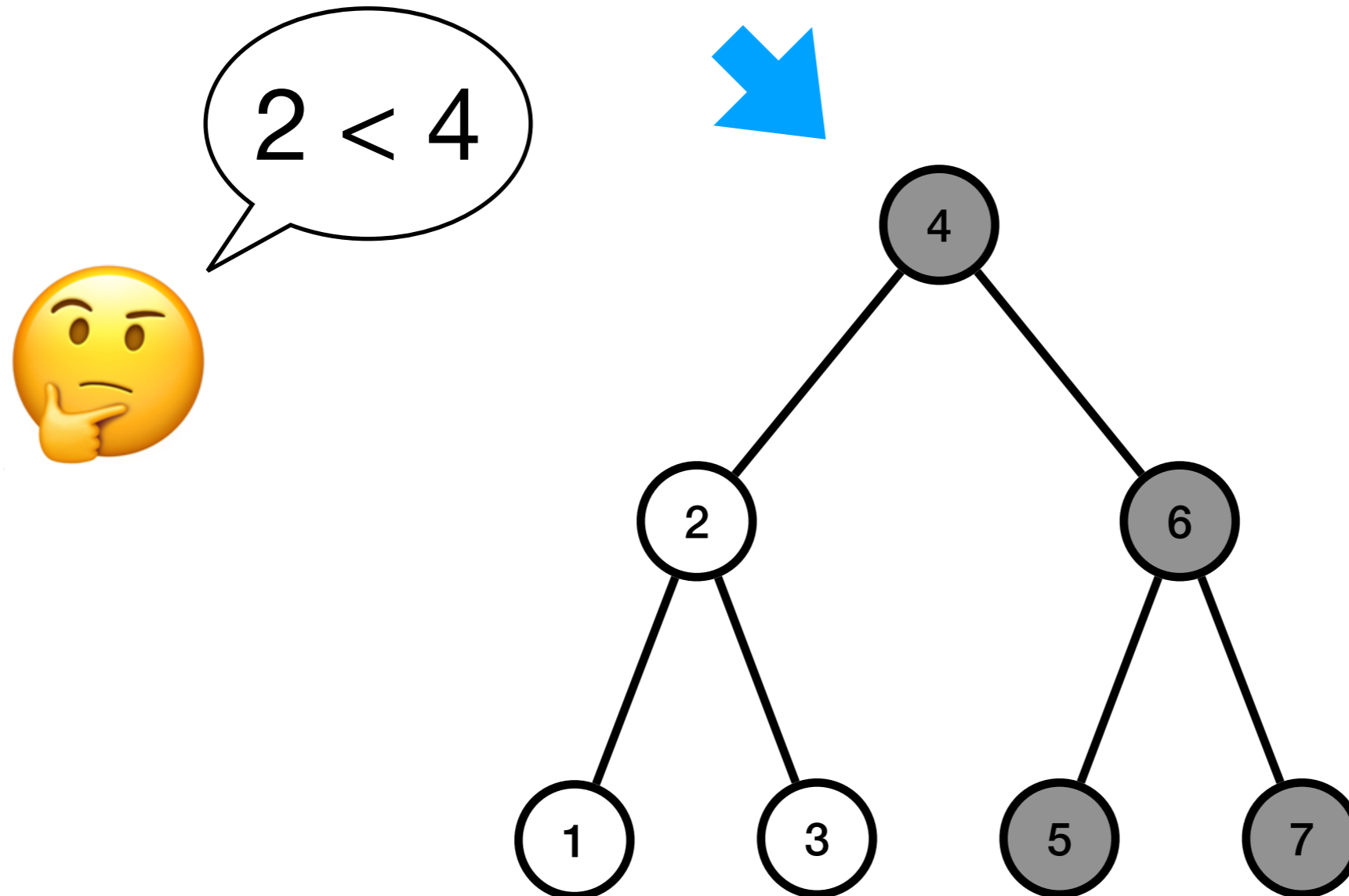




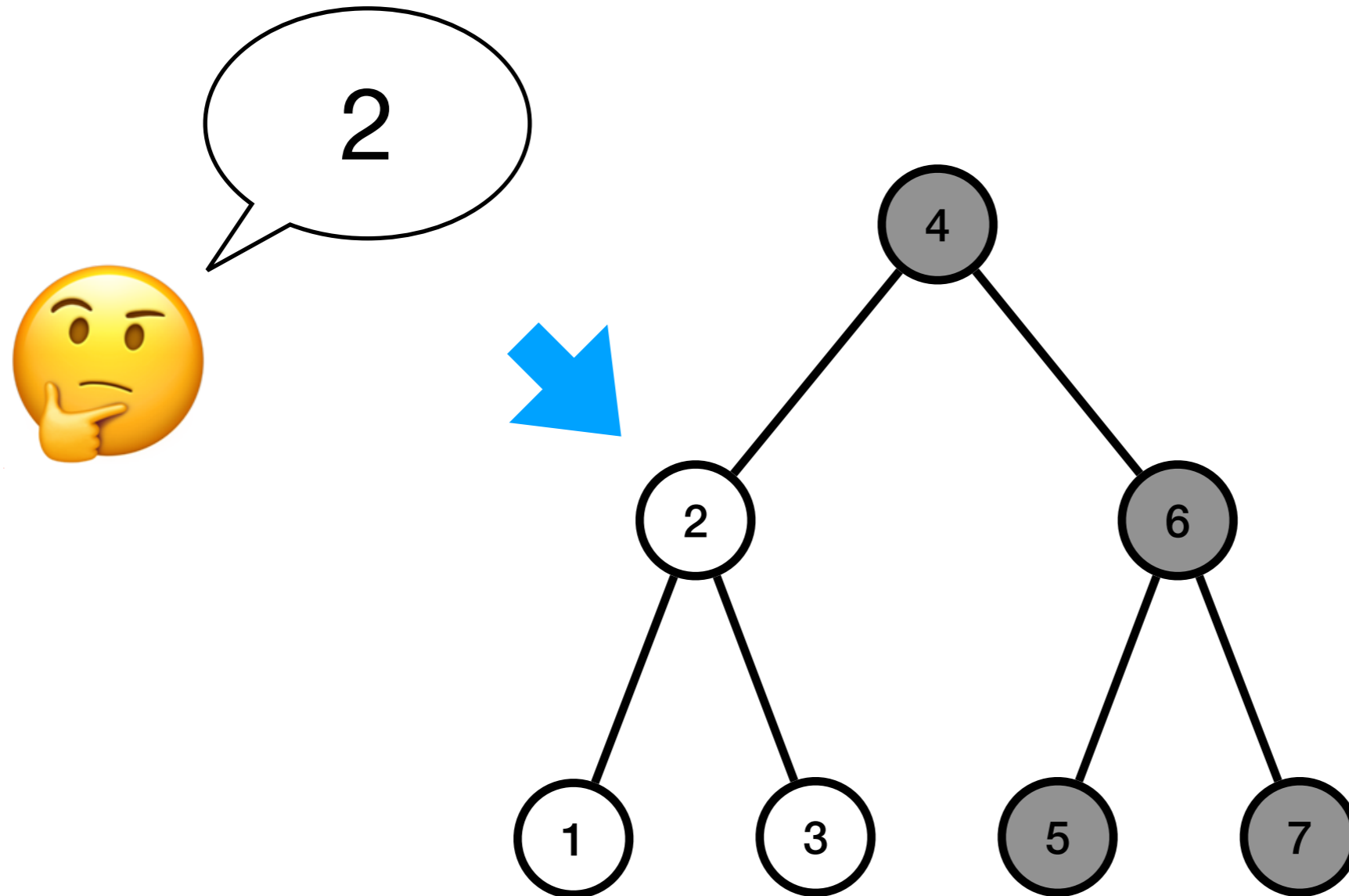
# Recherche dans un ABR



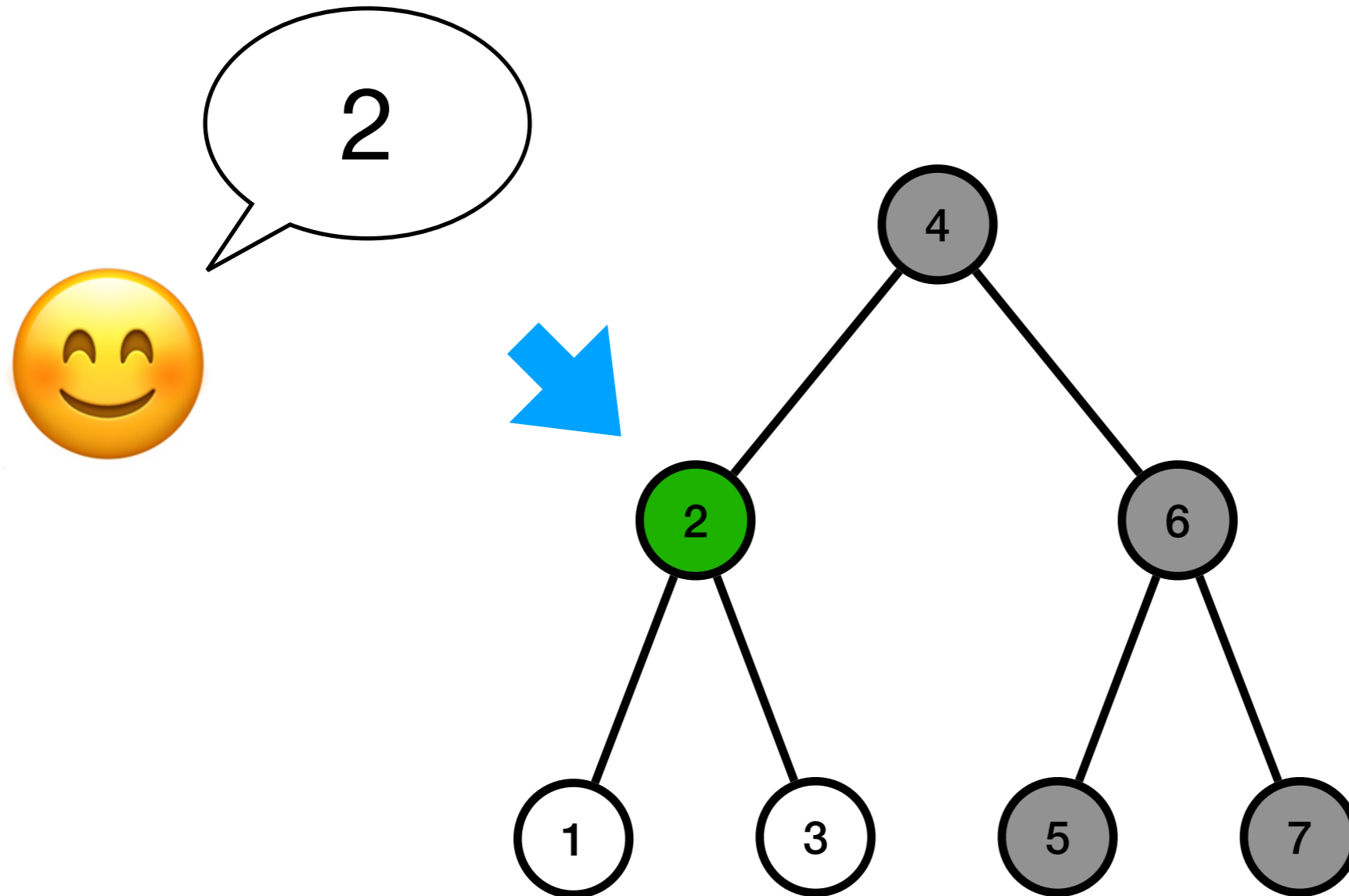
# Recherche dans un ABR



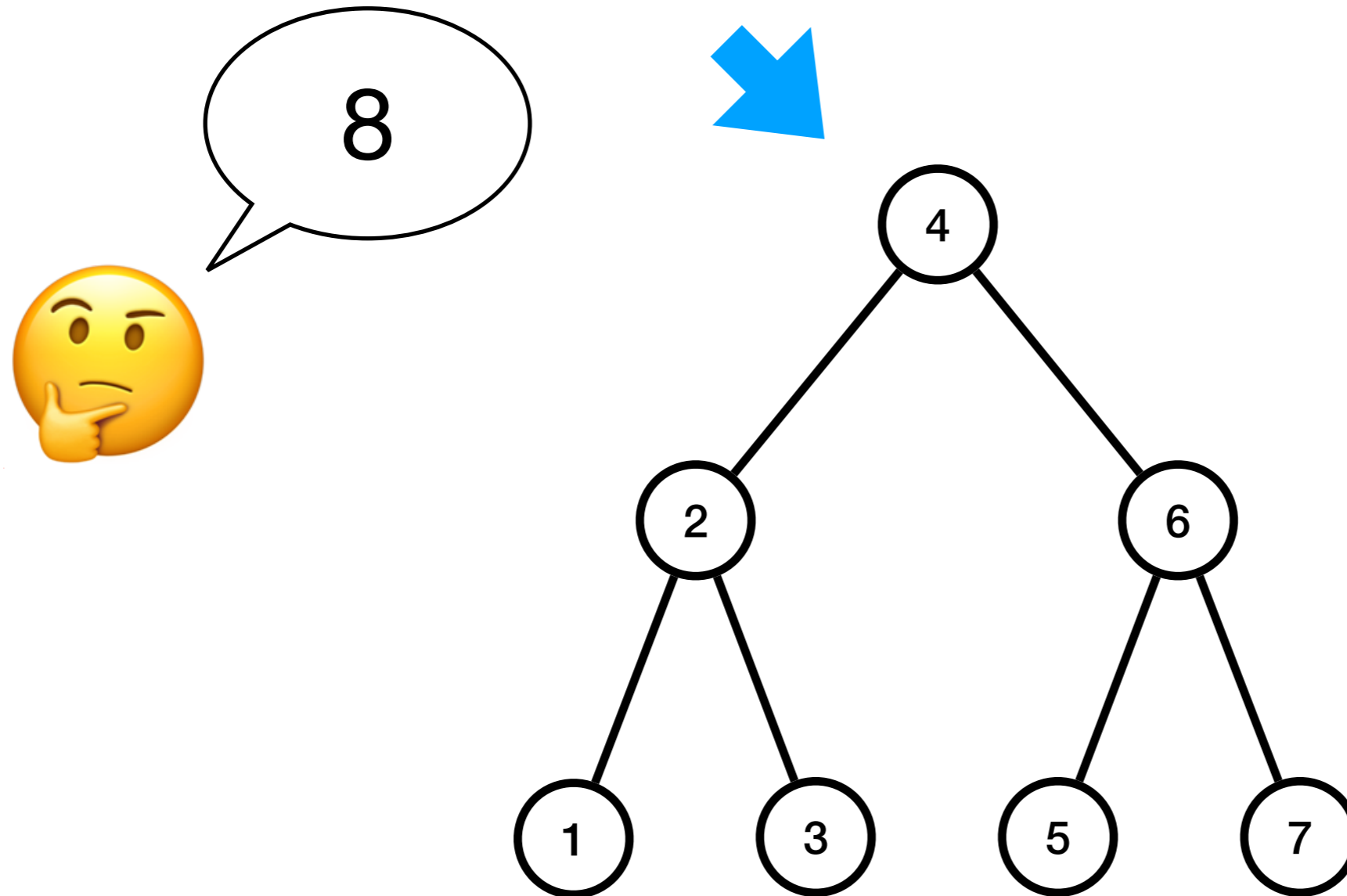
# Recherche dans un ABR



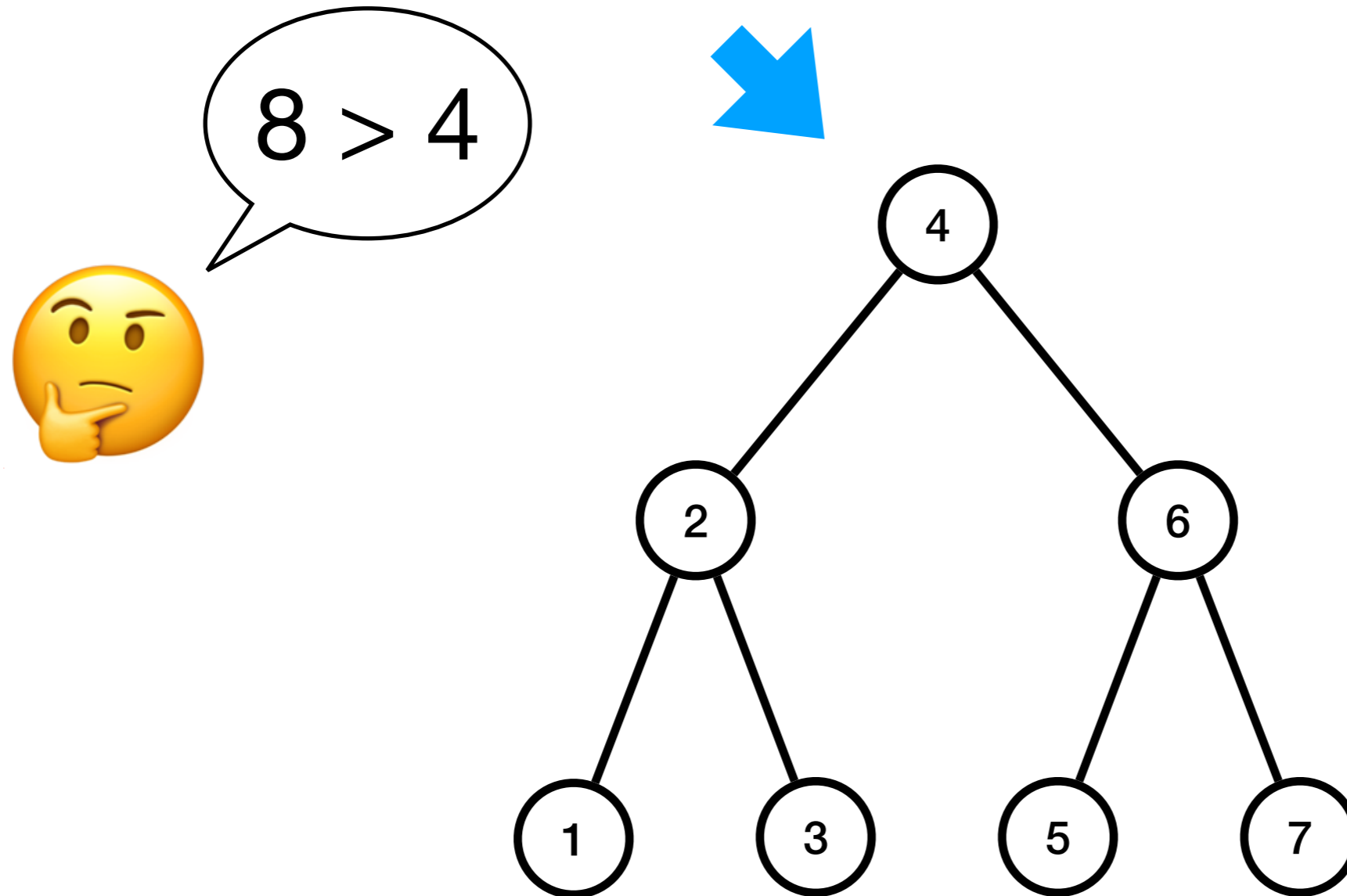
# Recherche dans un ABR



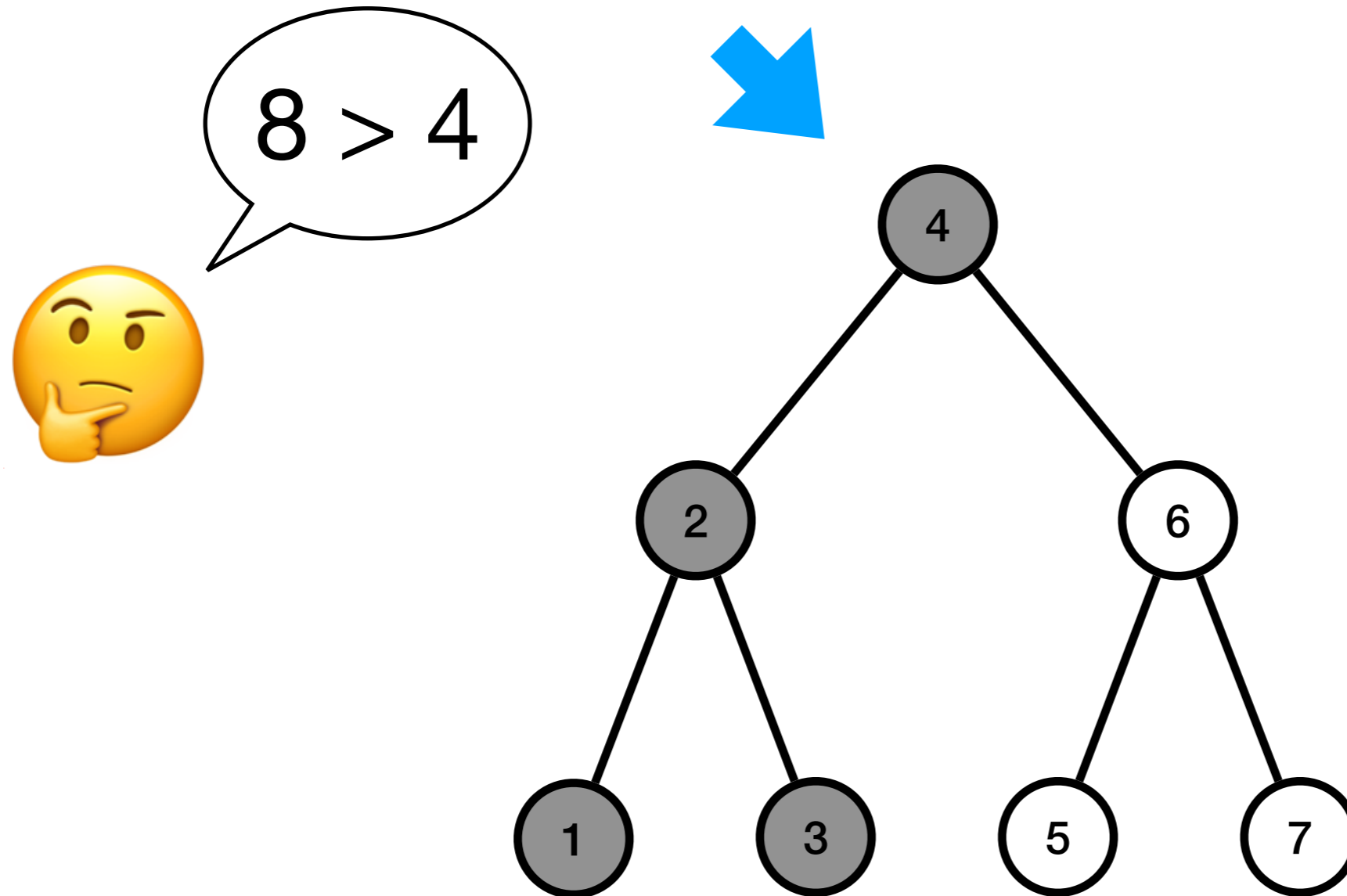
# Recherche dans un ABR



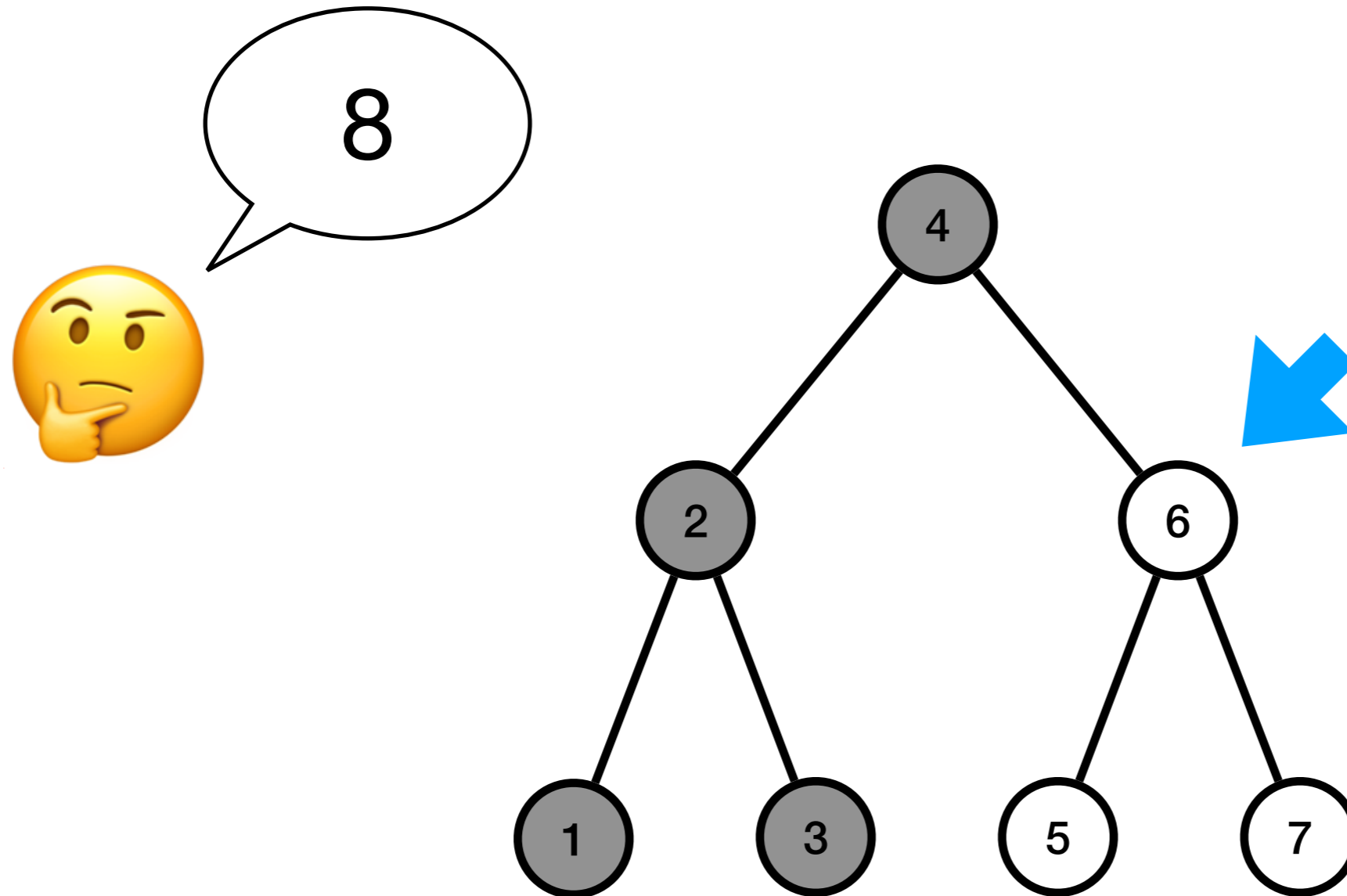
# Recherche dans un ABR



# Recherche dans un ABR

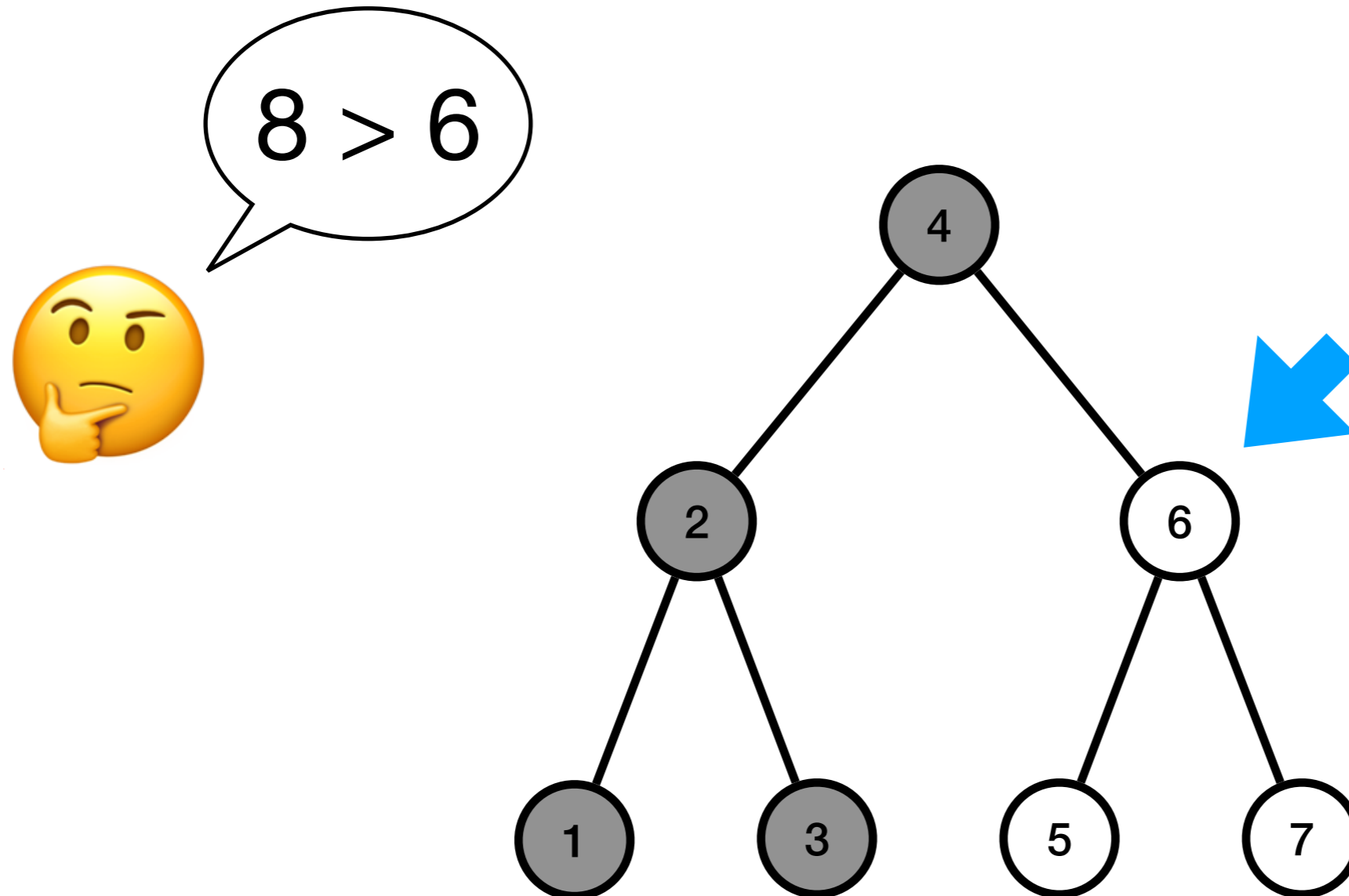


# Recherche dans un ABR

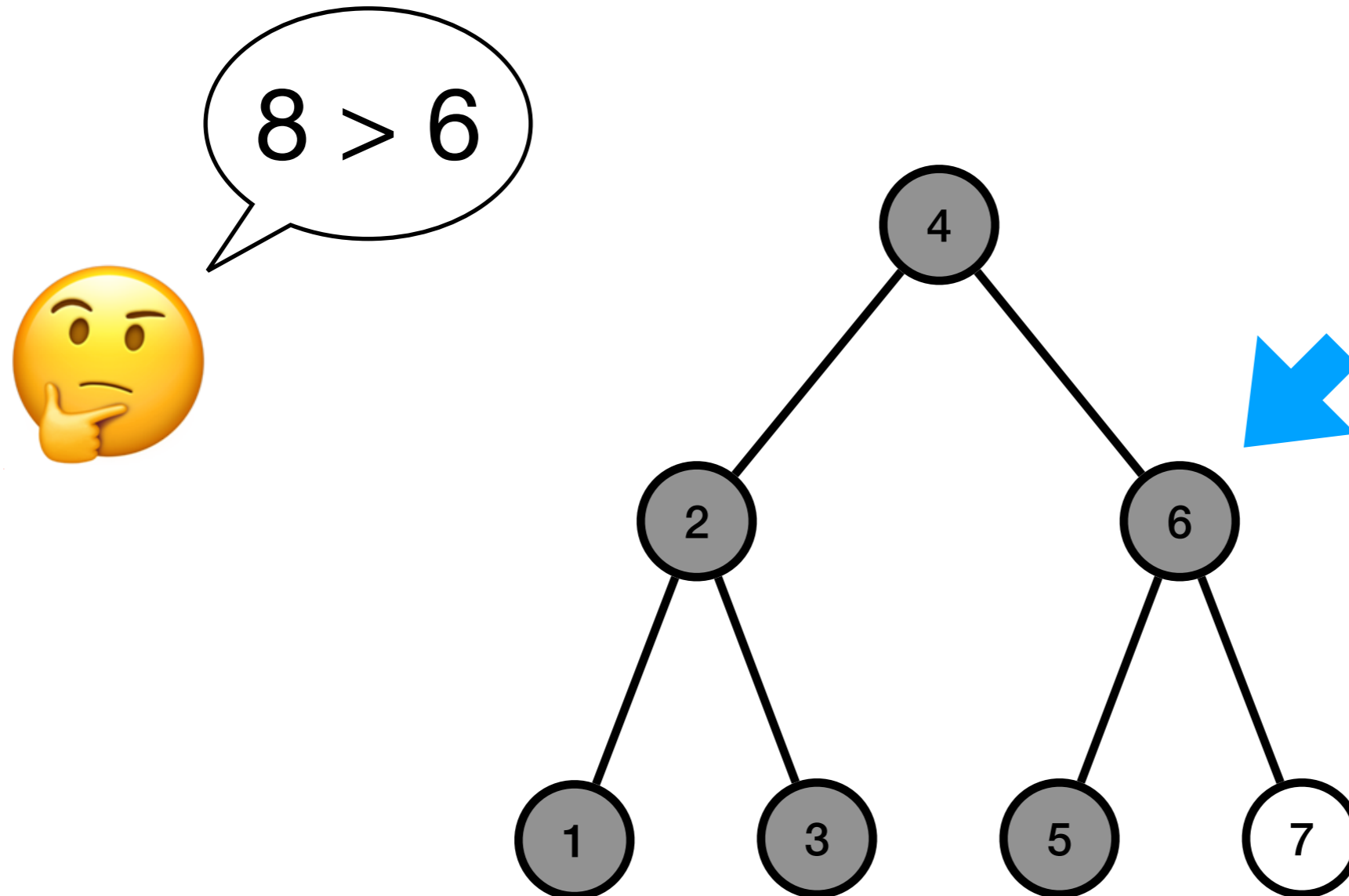




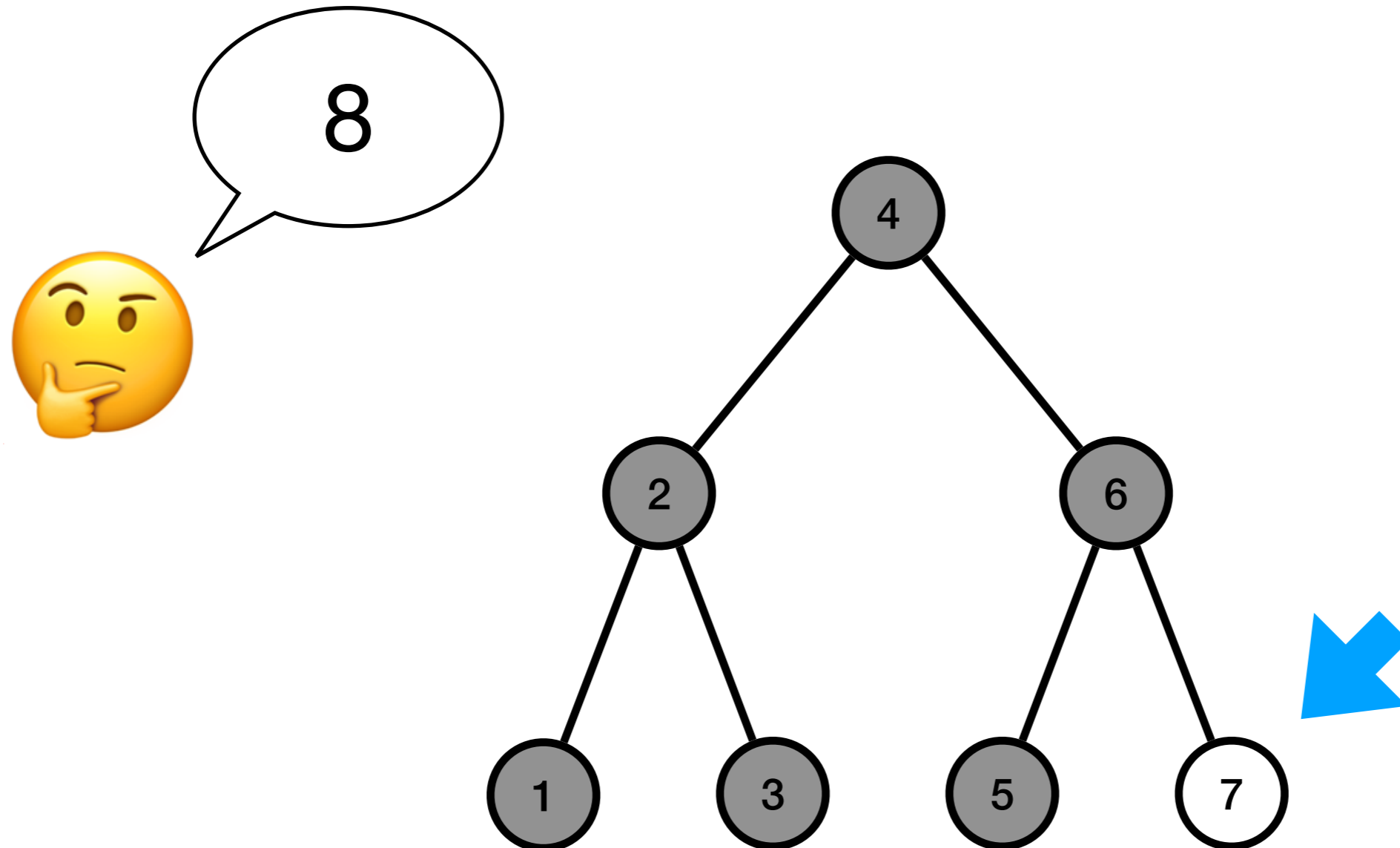
# Recherche dans un ABR



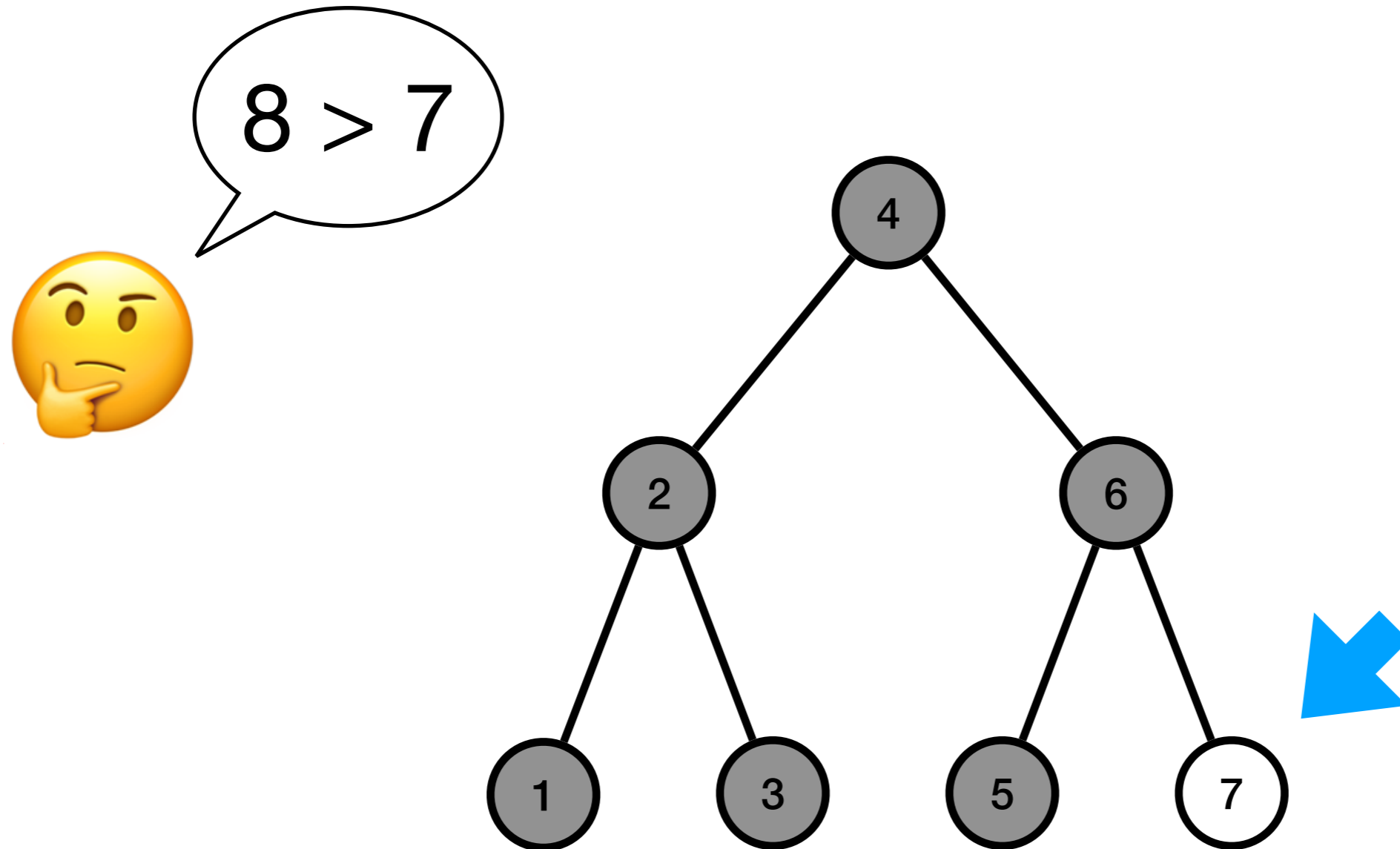
# Recherche dans un ABR



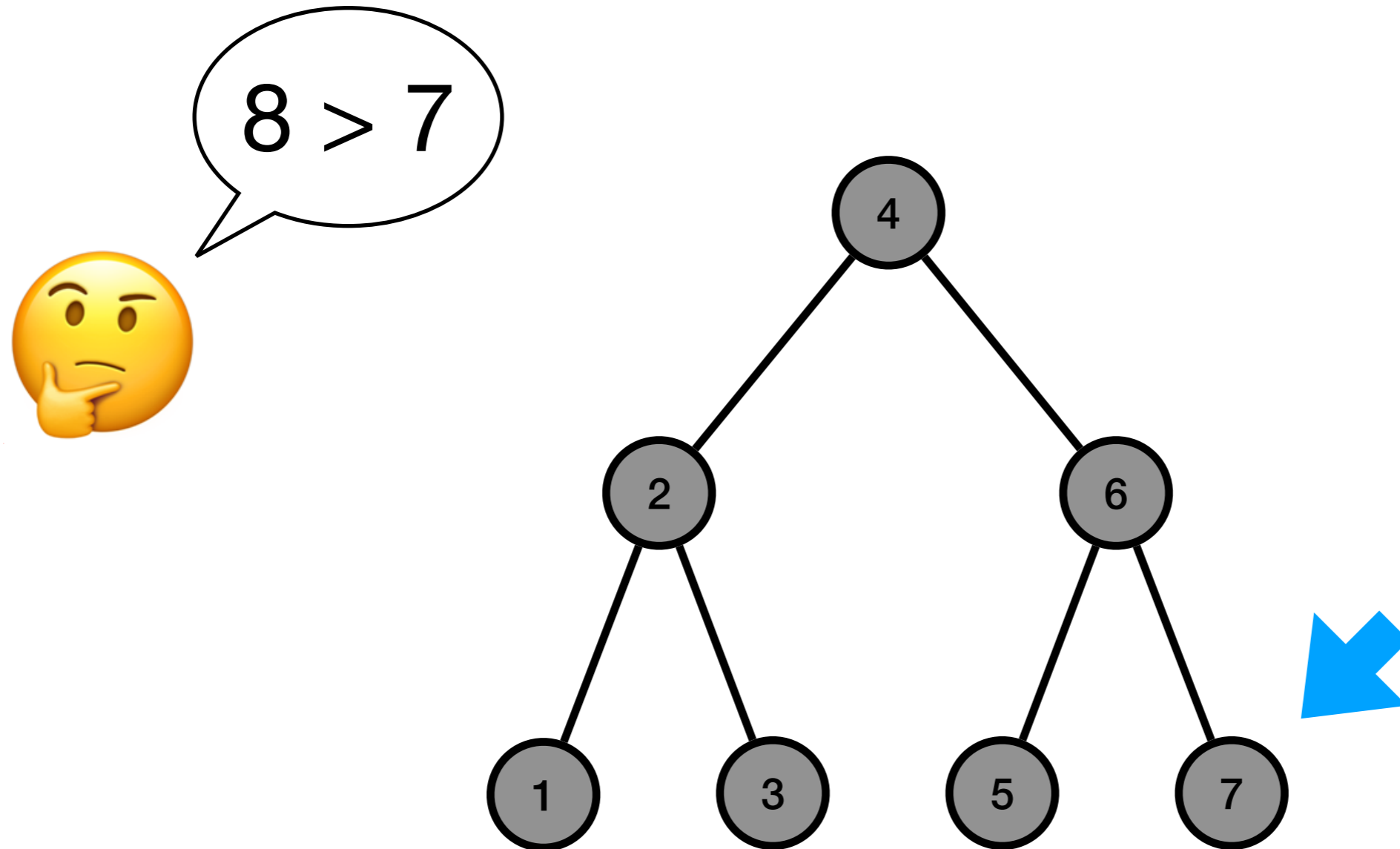
# Recherche dans un ABR



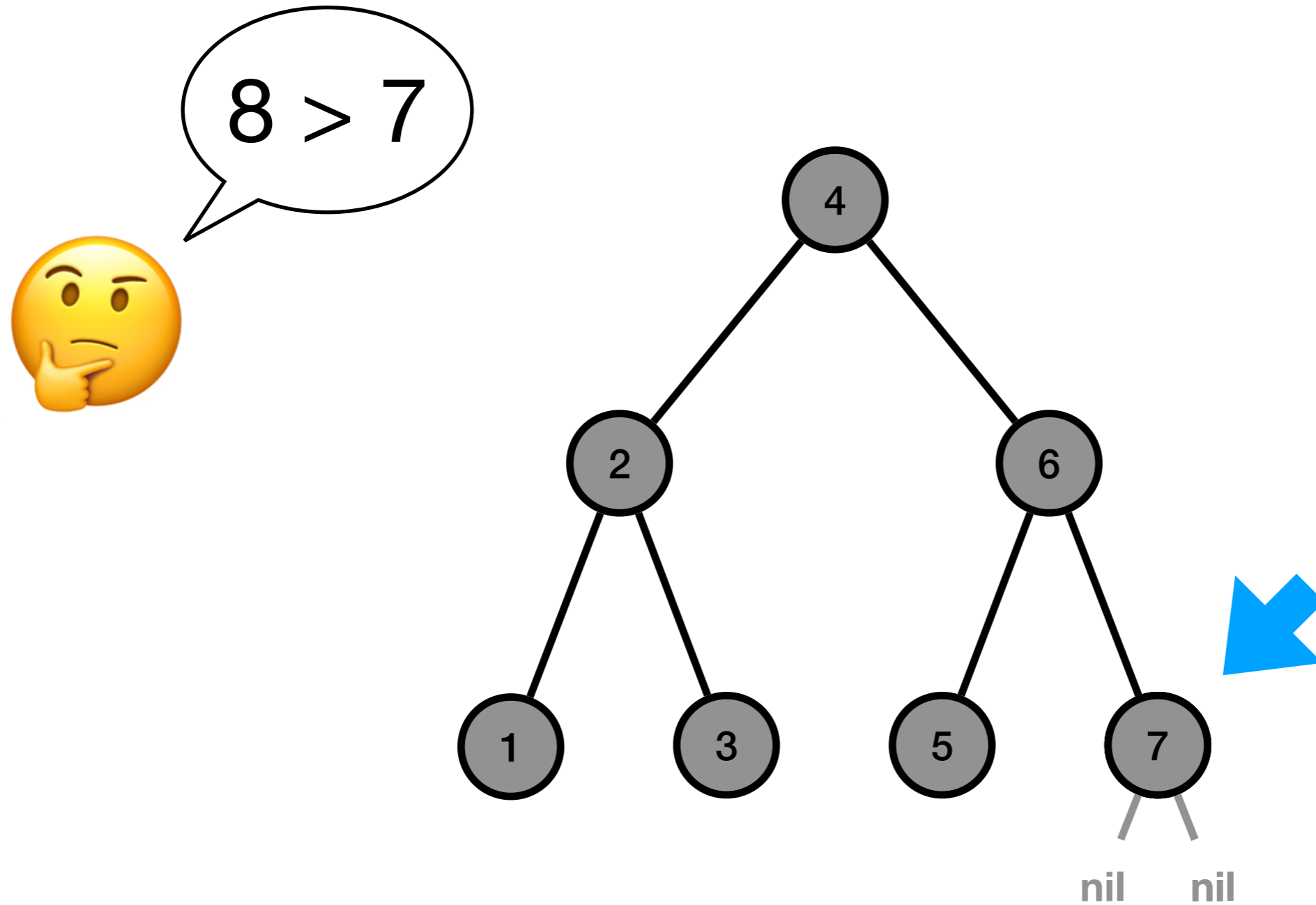
# Recherche dans un ABR



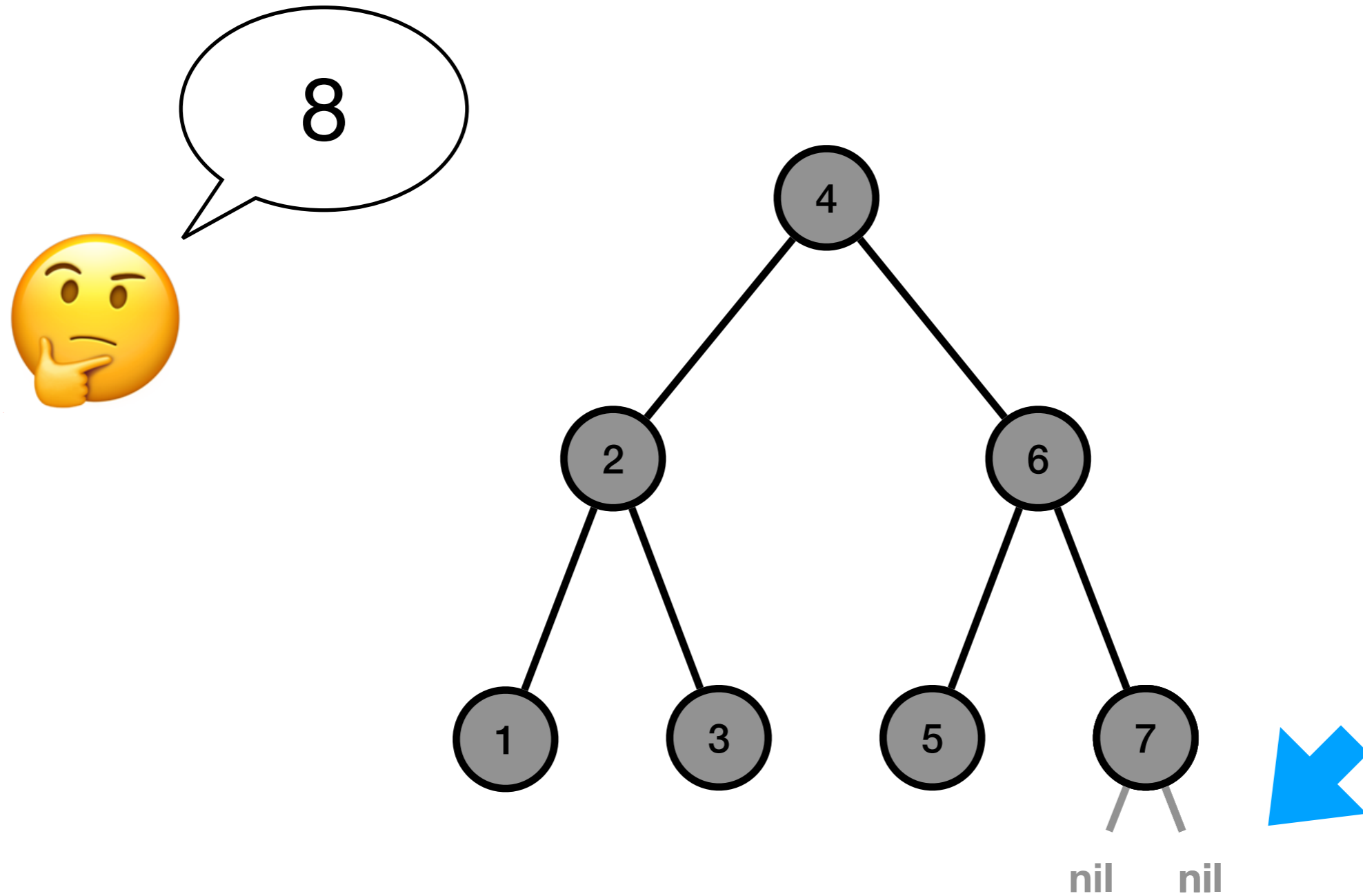
# Recherche dans un ABR



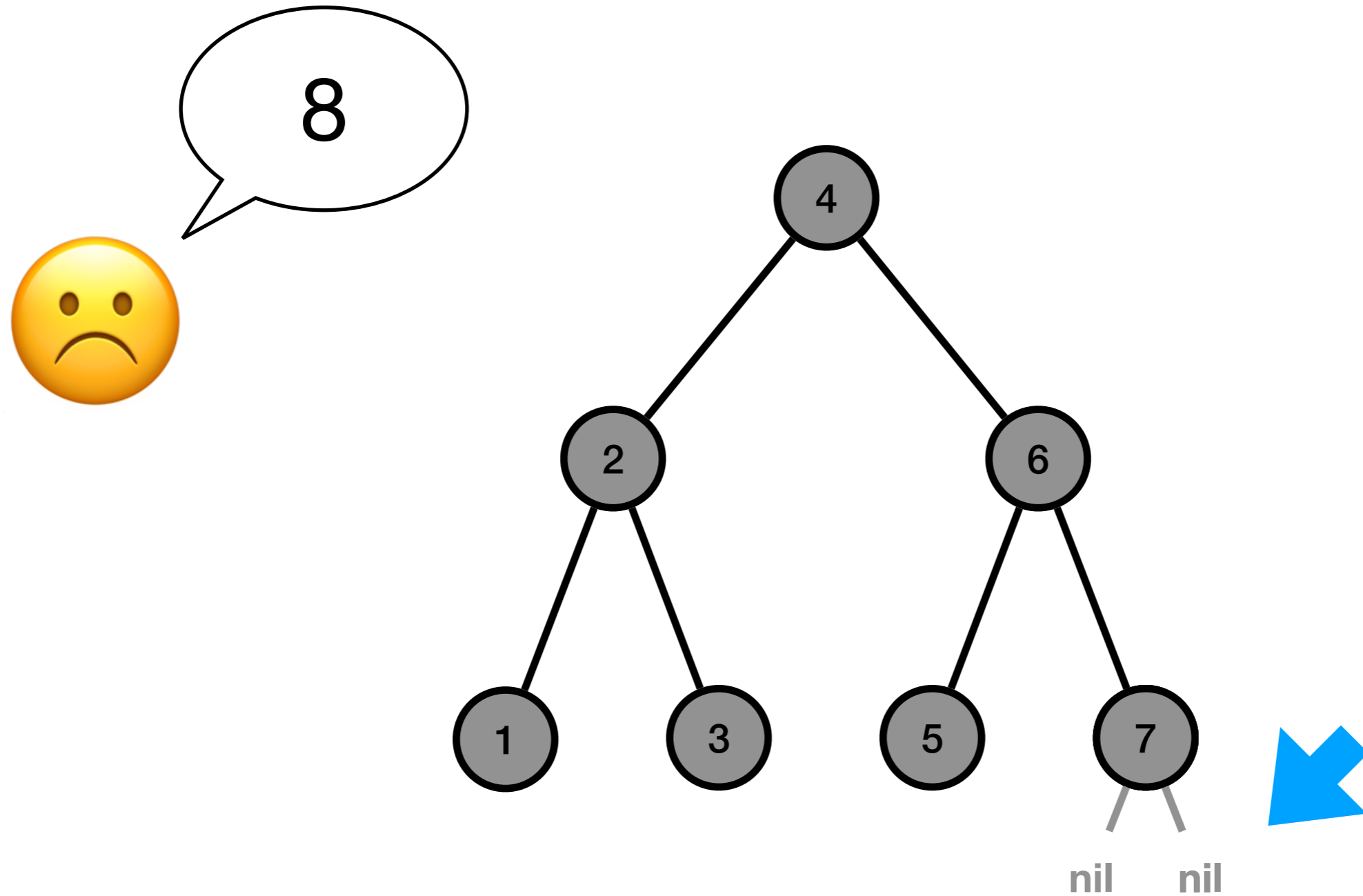
# Recherche dans un ABR



# Recherche dans un ABR



# Recherche dans un ABR

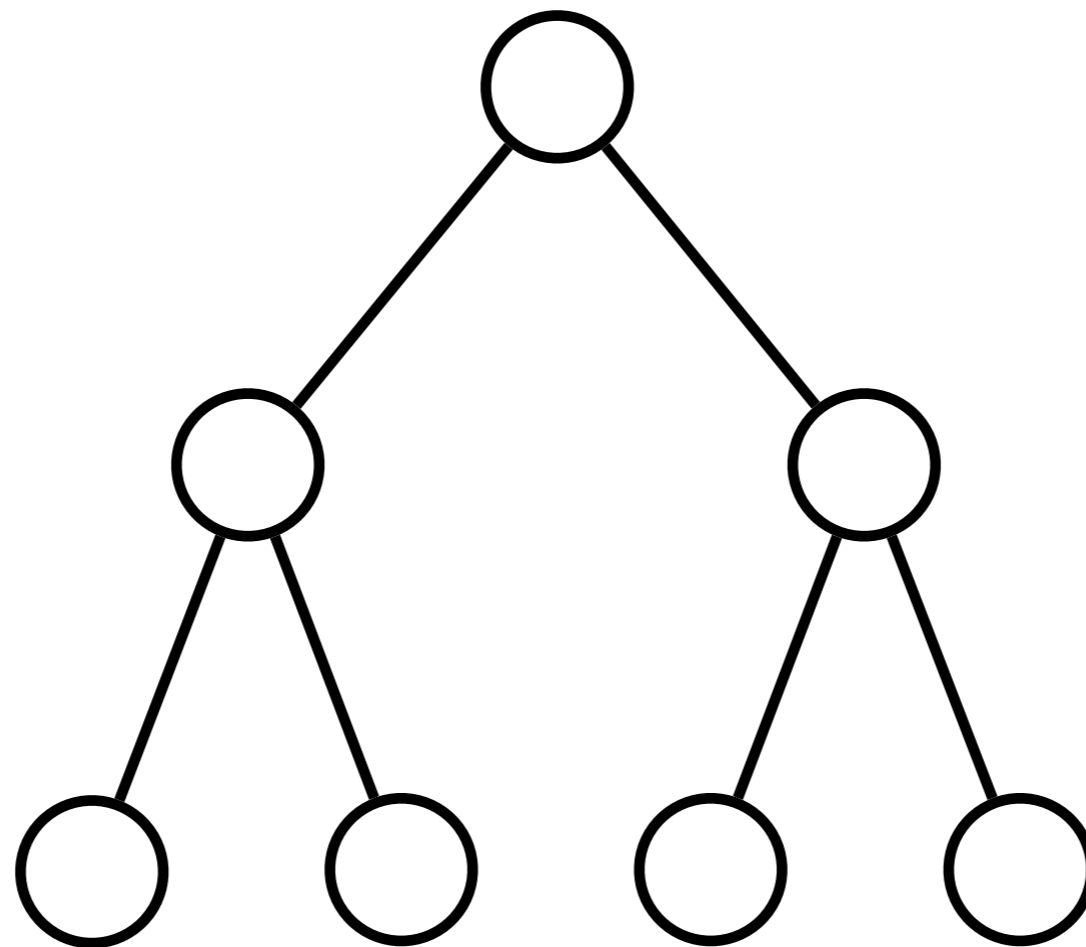




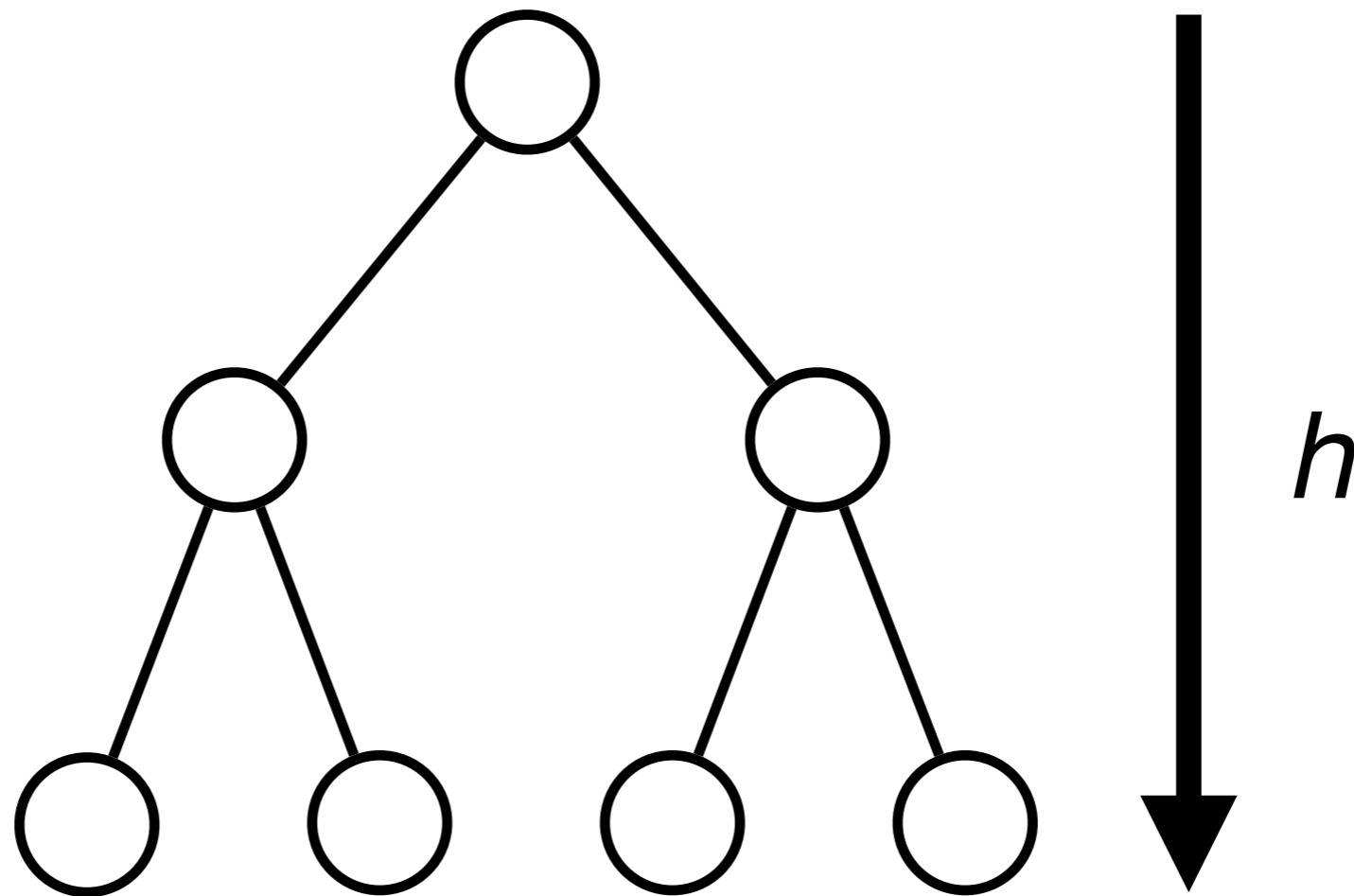
# Recherche dans un ABR

```
def rechercher_abr(nœud, x):  
    if est_vide(nœud):  
        return False  
    elif x == valeur(nœud):  
        return True  
    elif x < valeur(nœud):  
        return rechercher_abr(enfant_gauche(nœud), x)  
    else:  
        return rechercher_abr(enfant_droit(nœud), x)
```

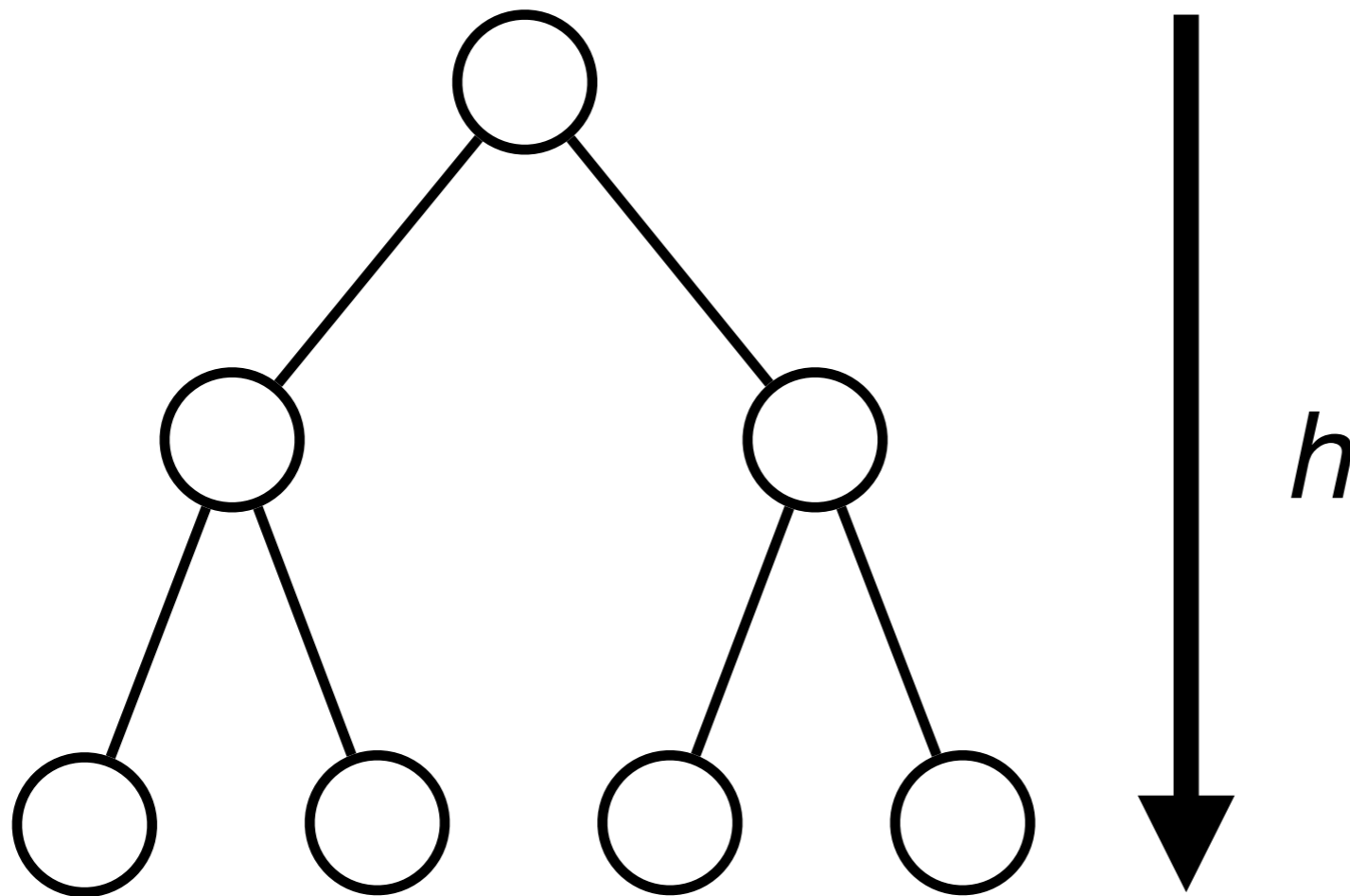
# Temps de recherche



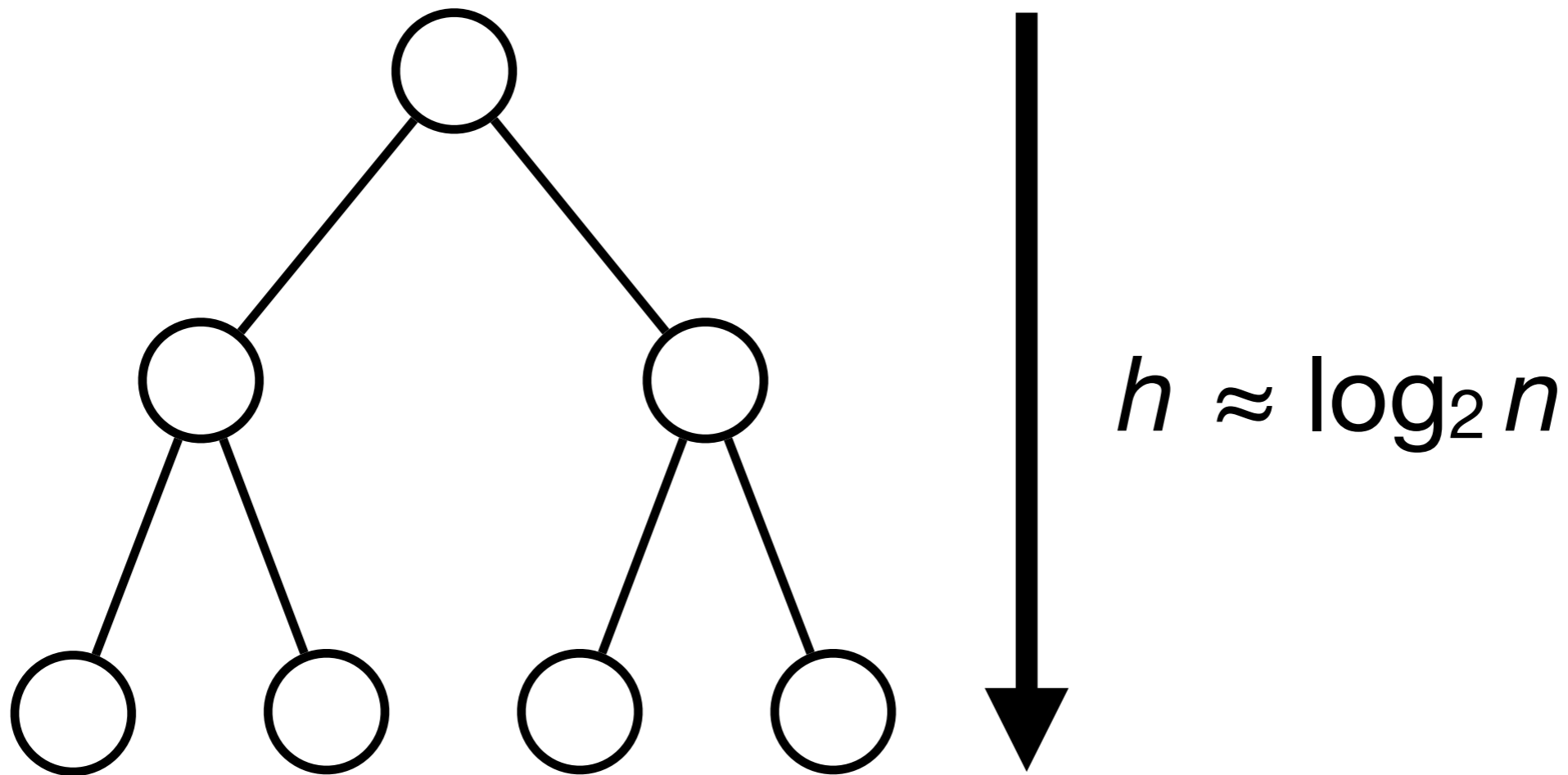
# Temps de recherche



# Pour un ABR équilibré



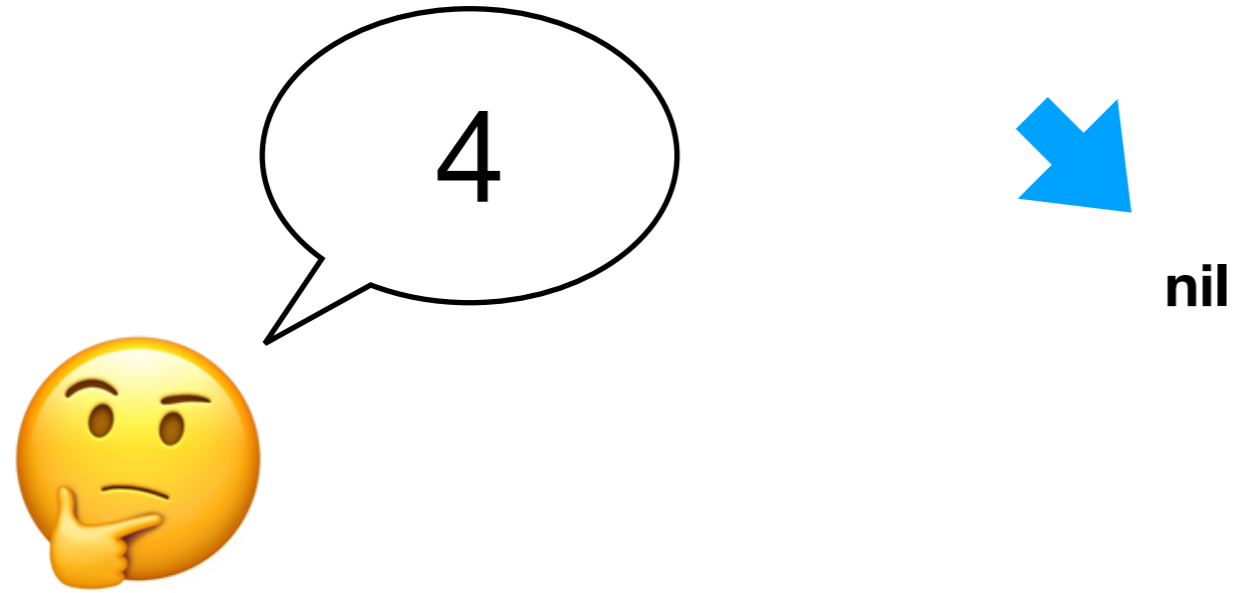
# Pour un ABR équilibré



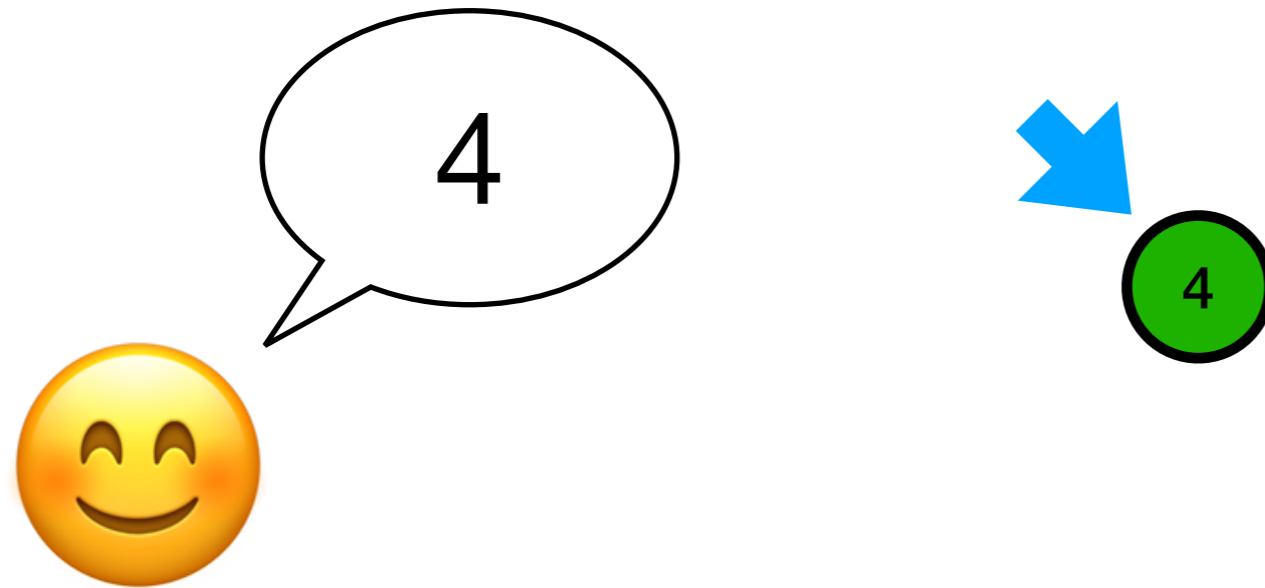
# Insertion dans un ABR

nil

# Insertion dans un ABR

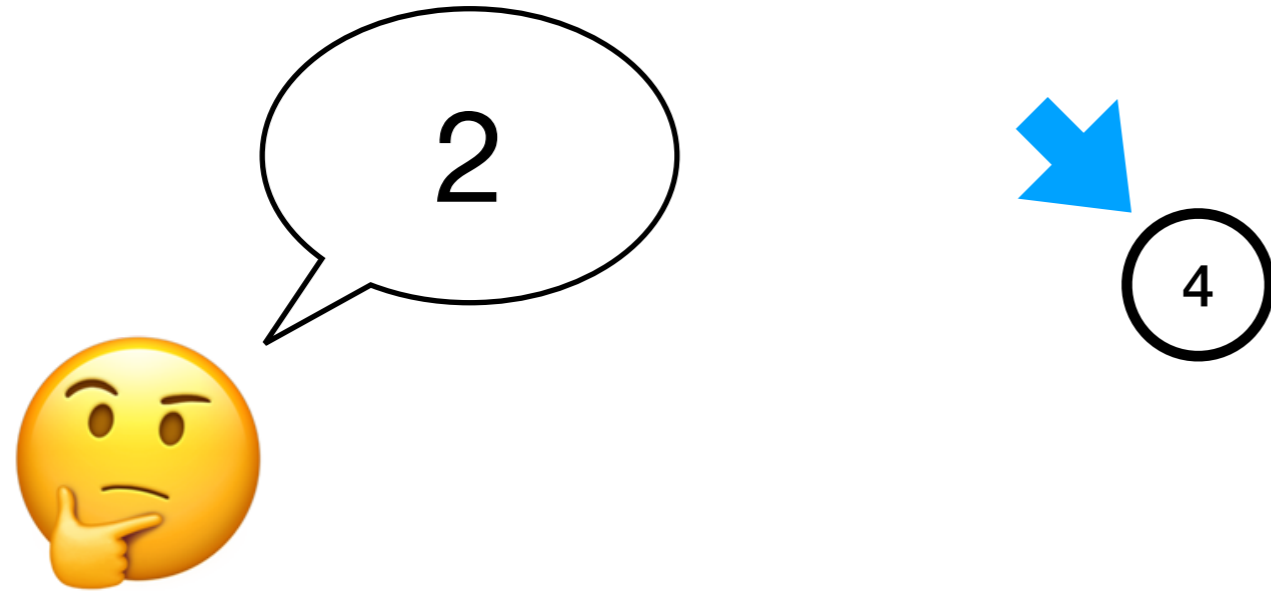


# Insertion dans un ABR

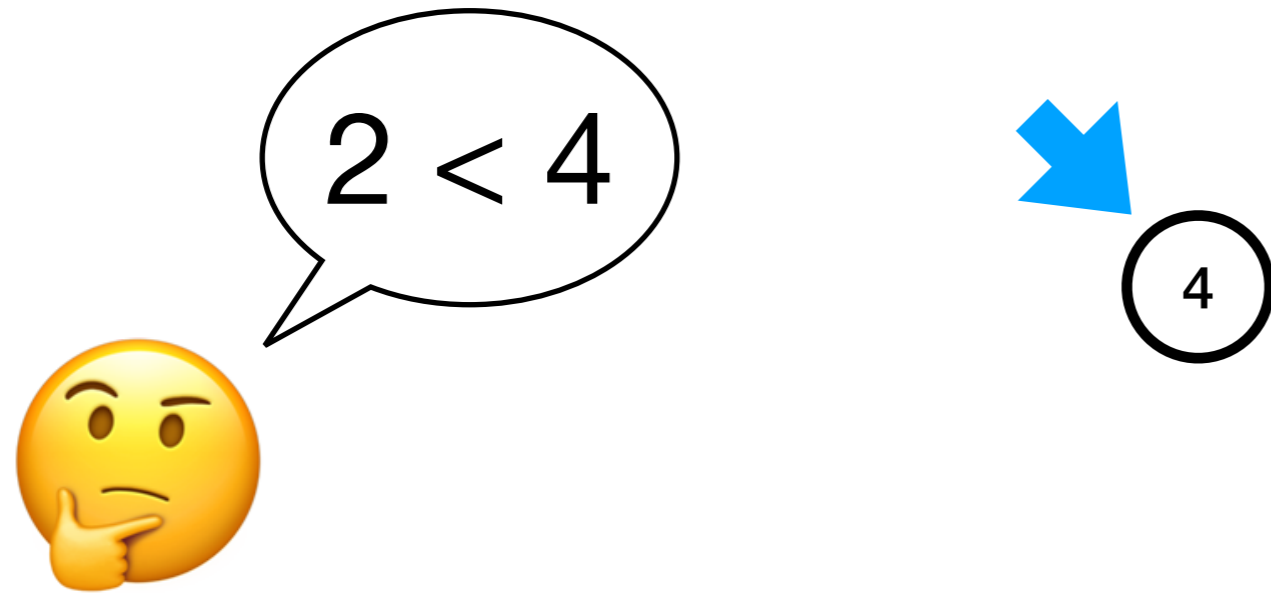




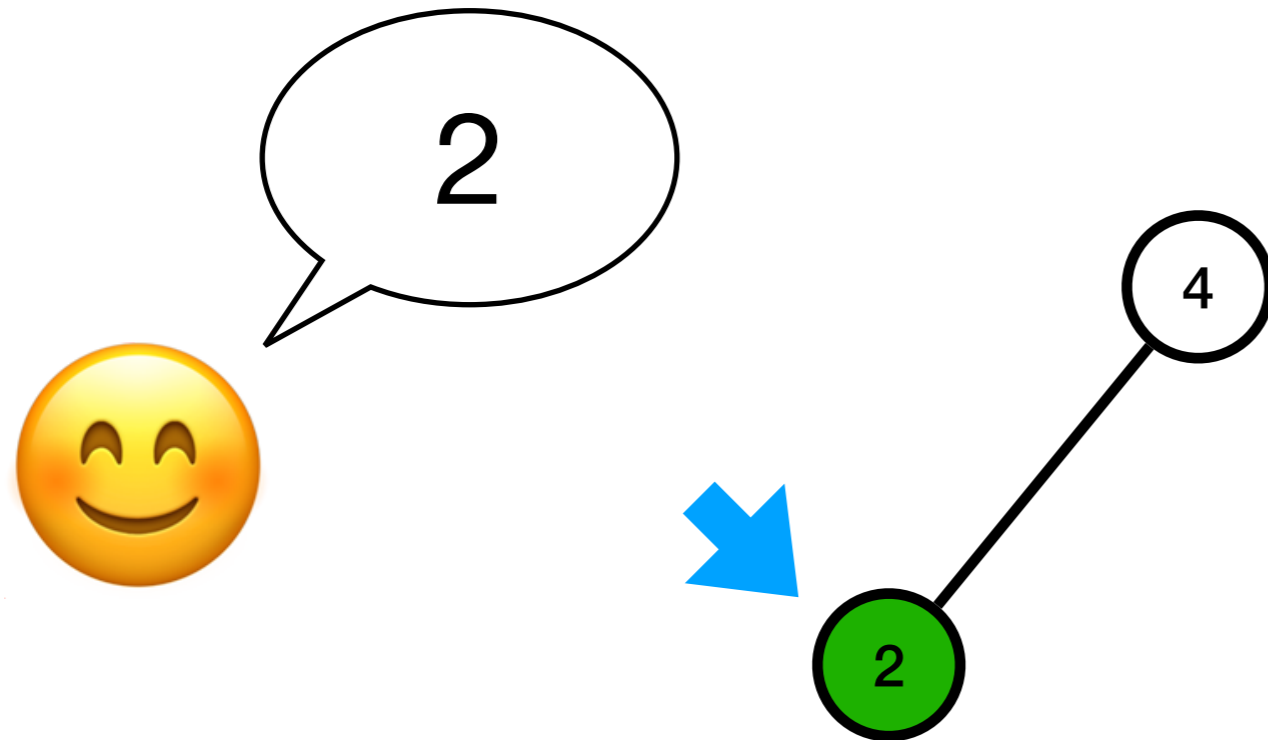
# Insertion dans un ABR



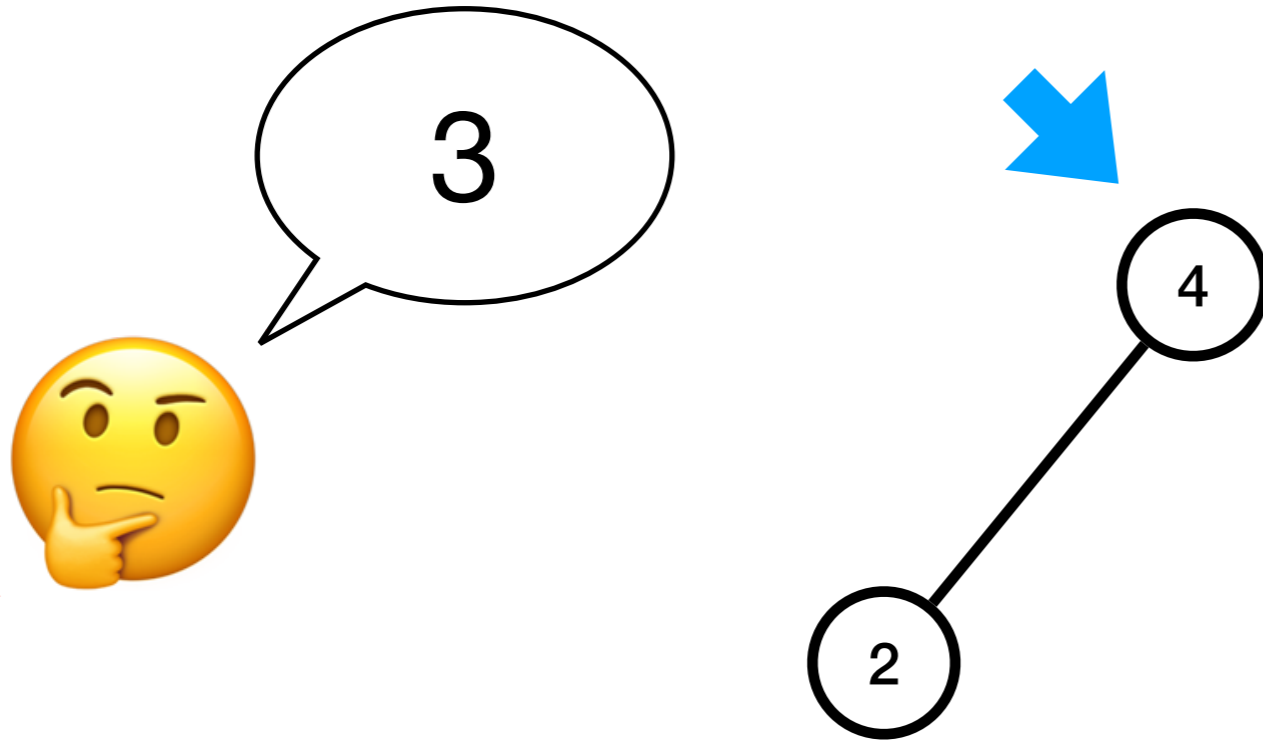
# Insertion dans un ABR



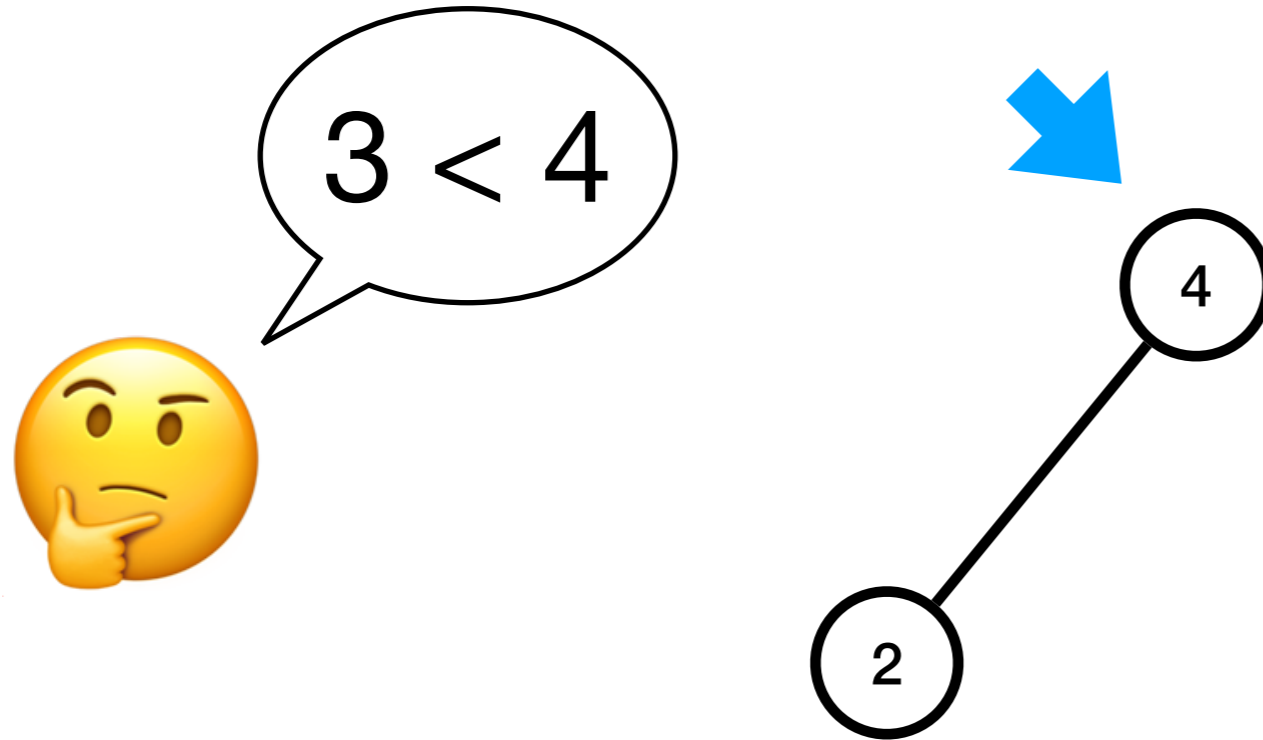
# Insertion dans un ABR



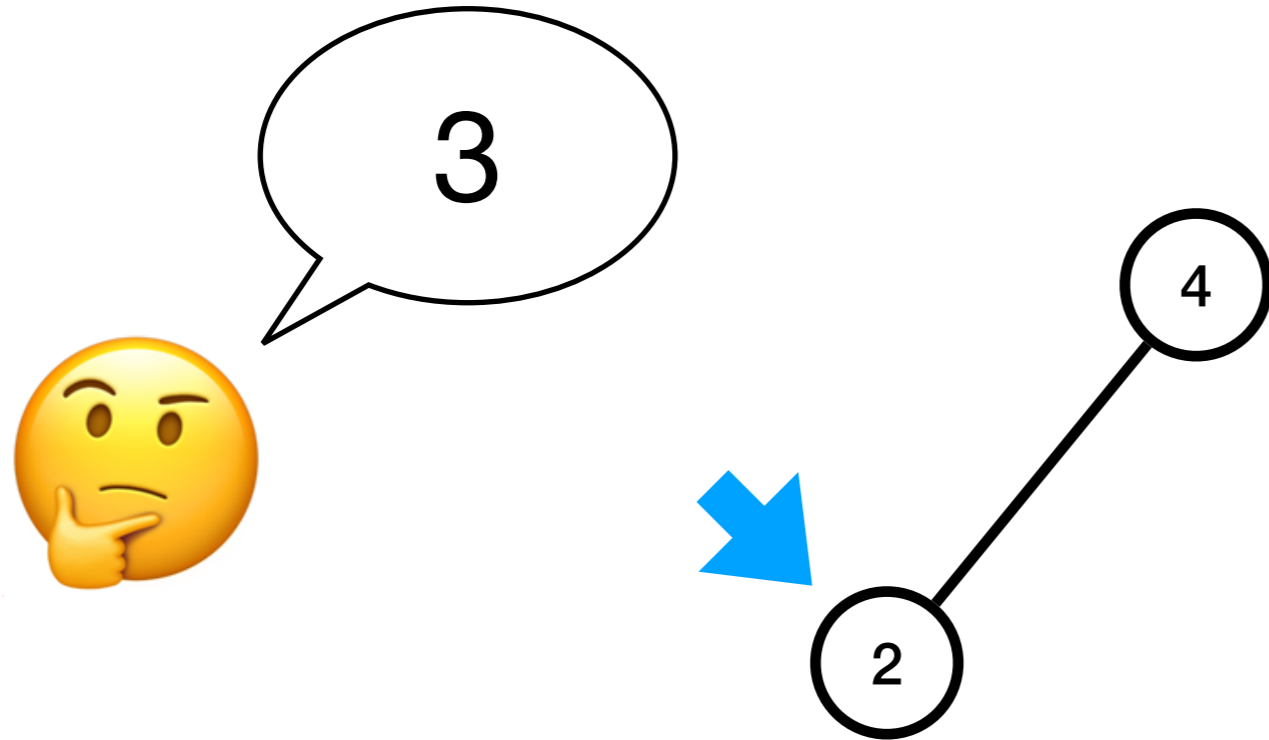
# Insertion dans un ABR



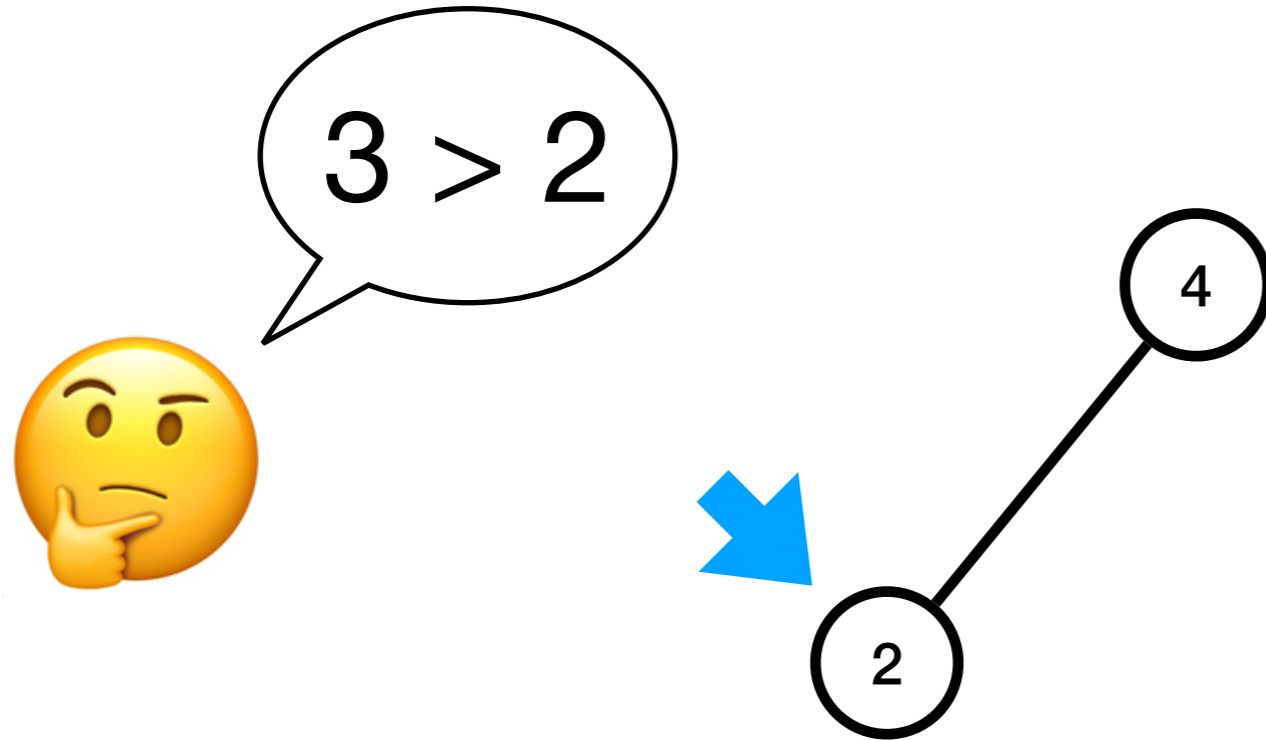
# Insertion dans un ABR



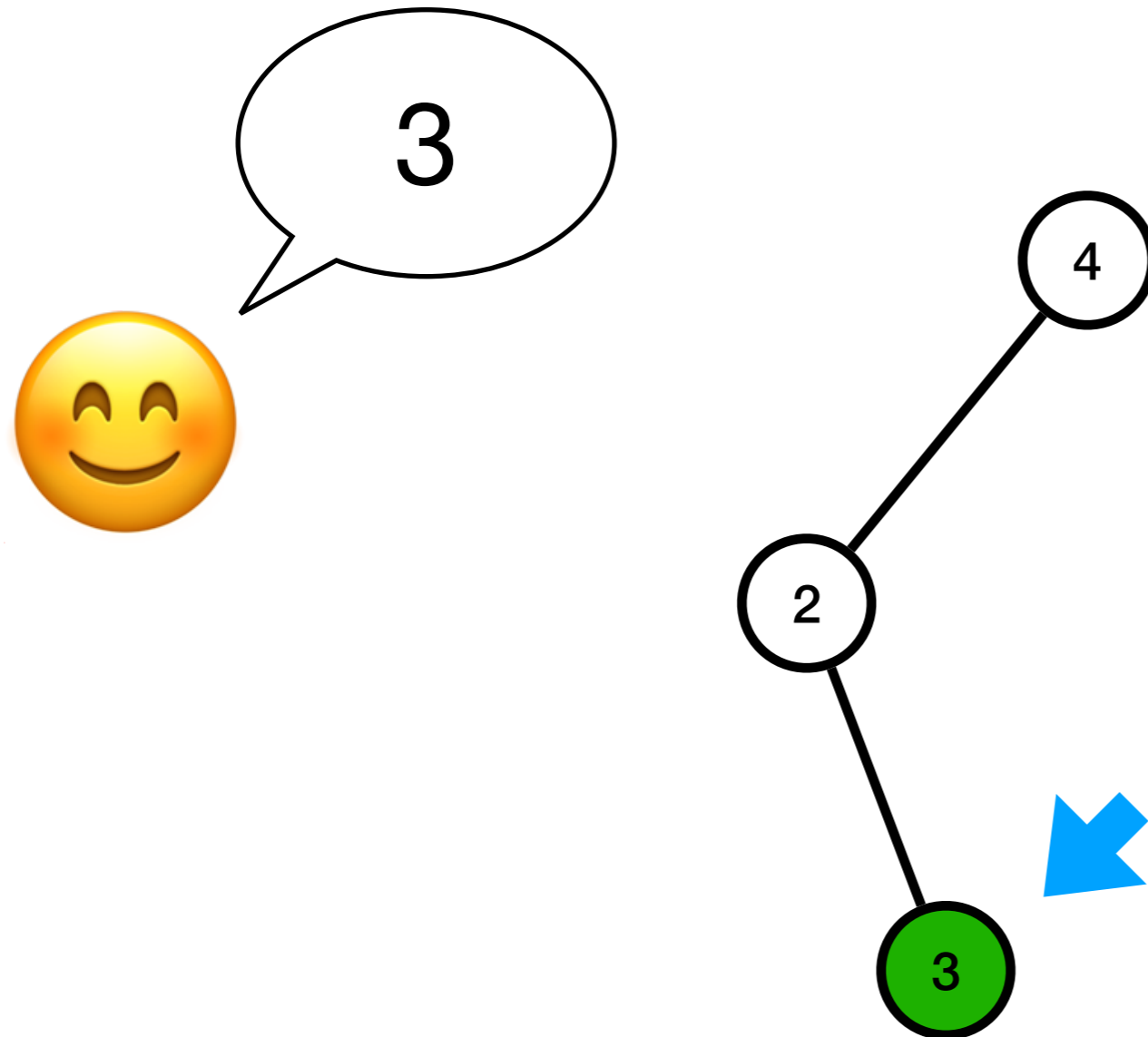
# Insertion dans un ABR



# Insertion dans un ABR

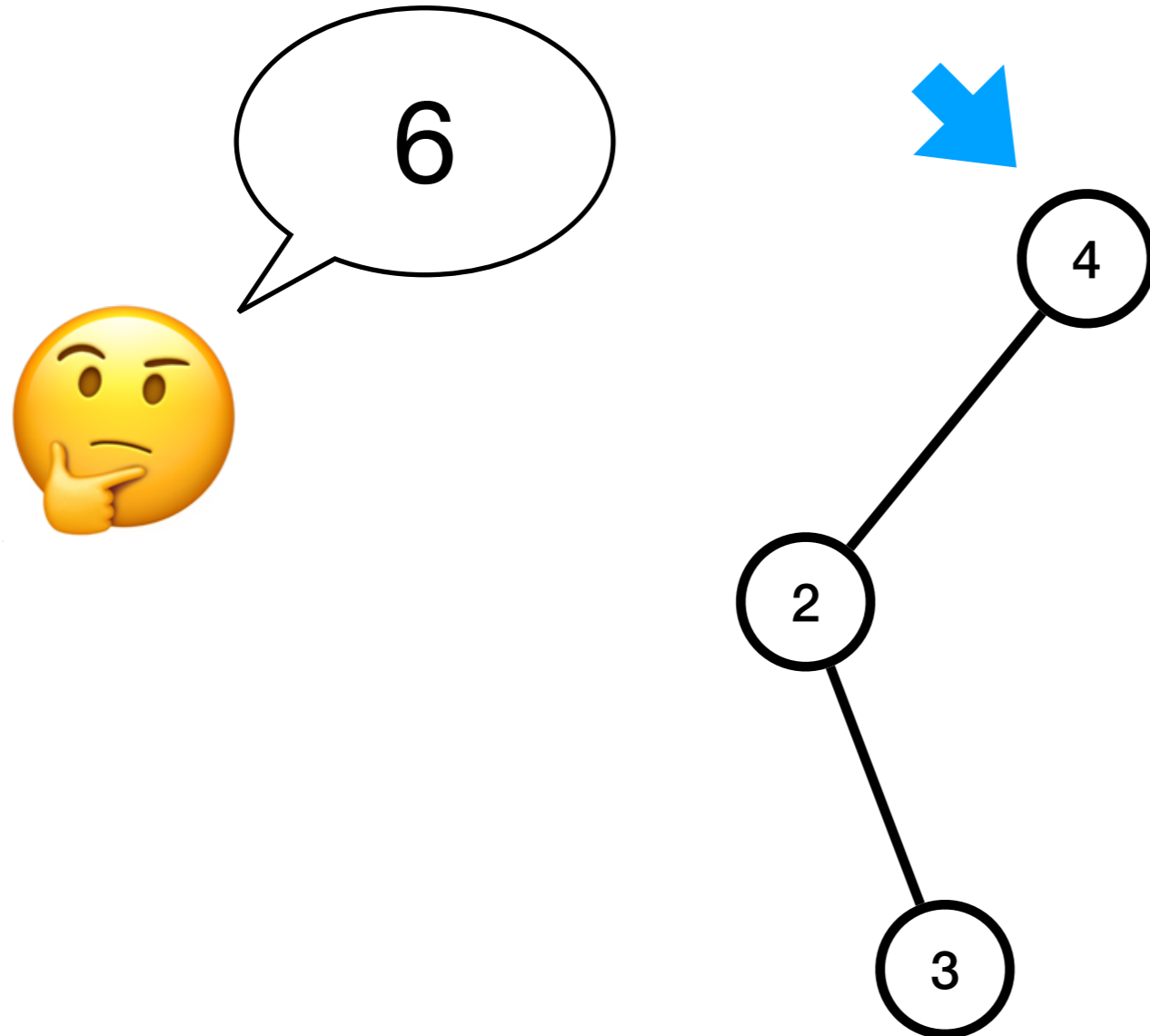


# Insertion dans un ABR

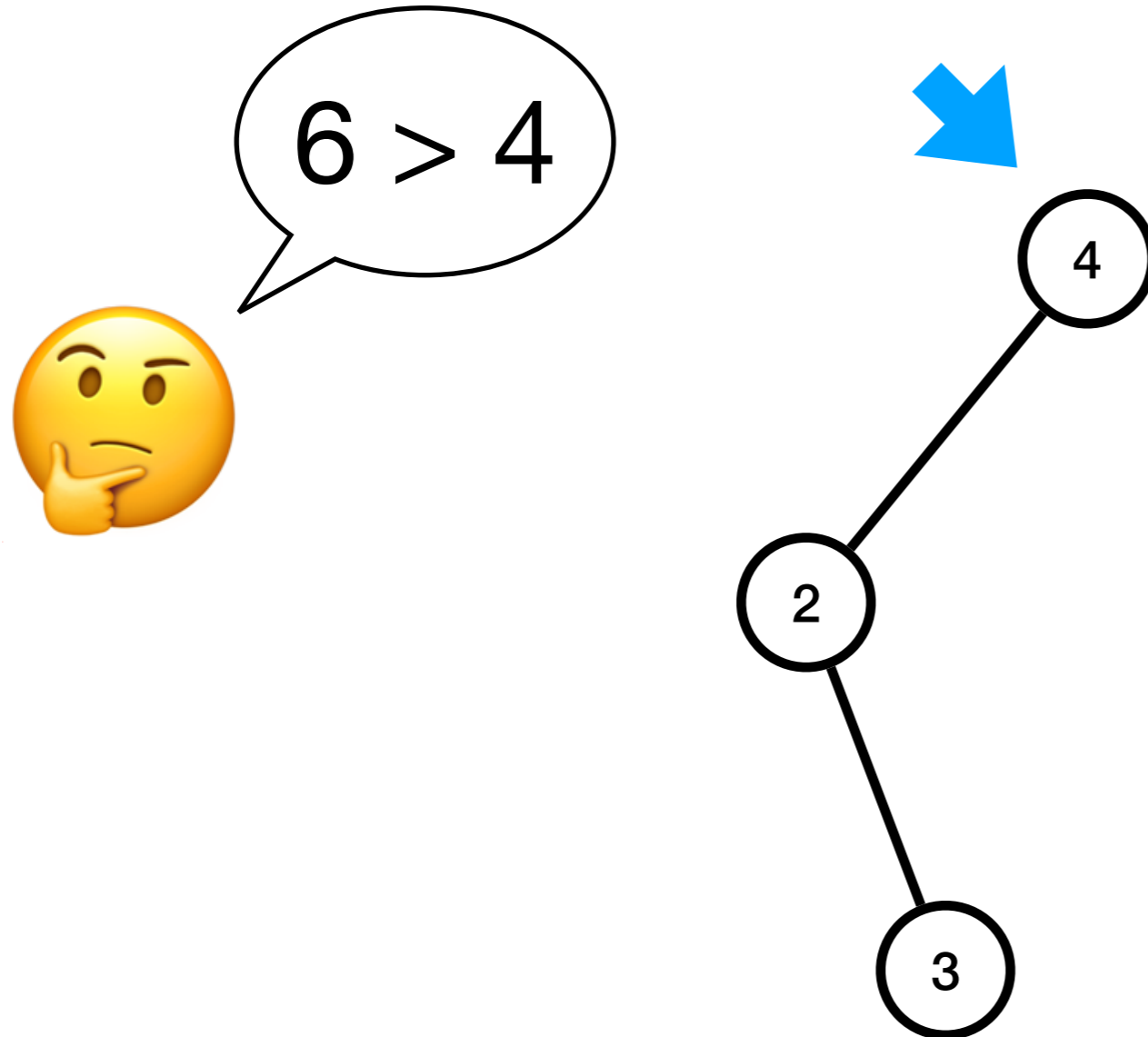




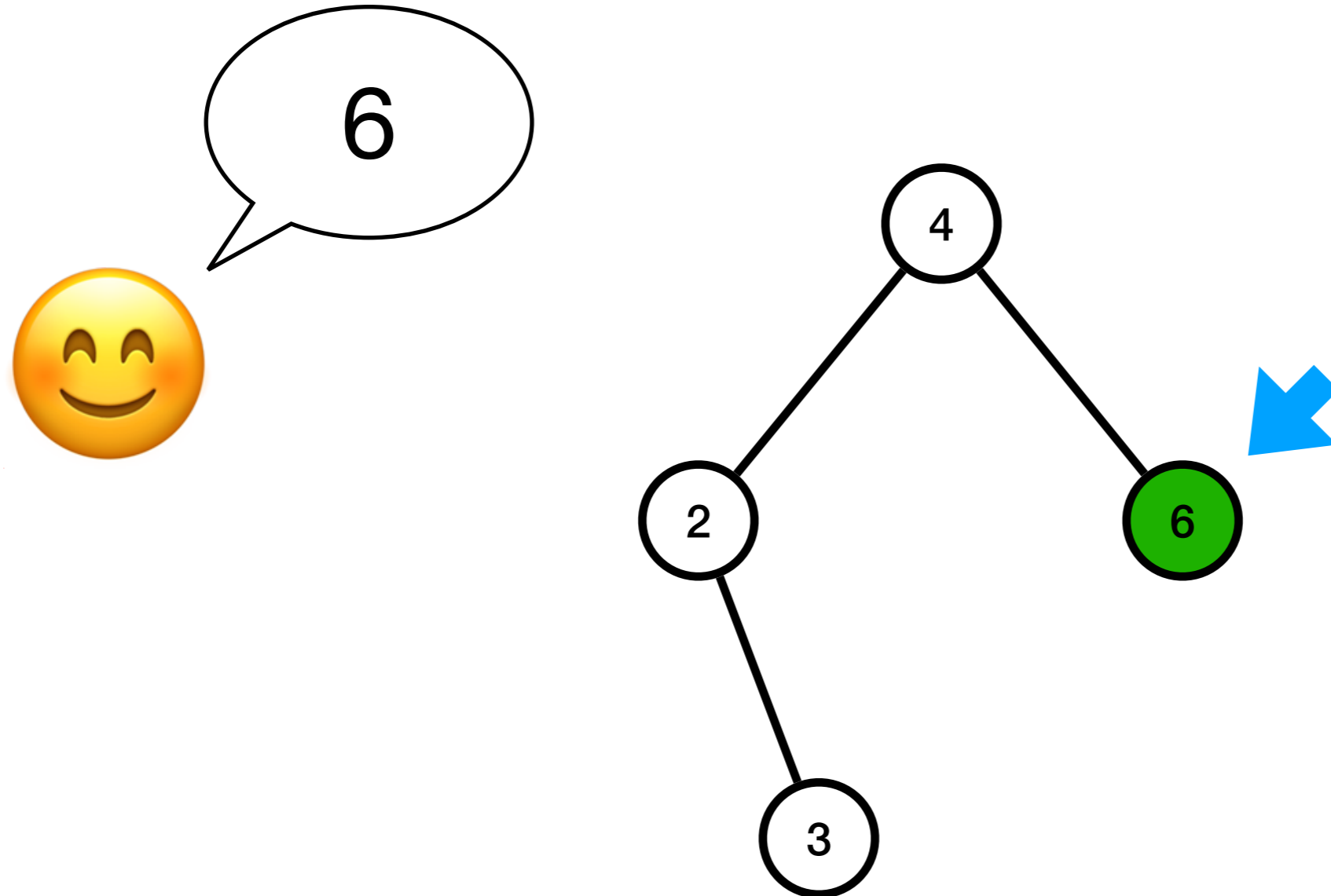
# Insertion dans un ABR



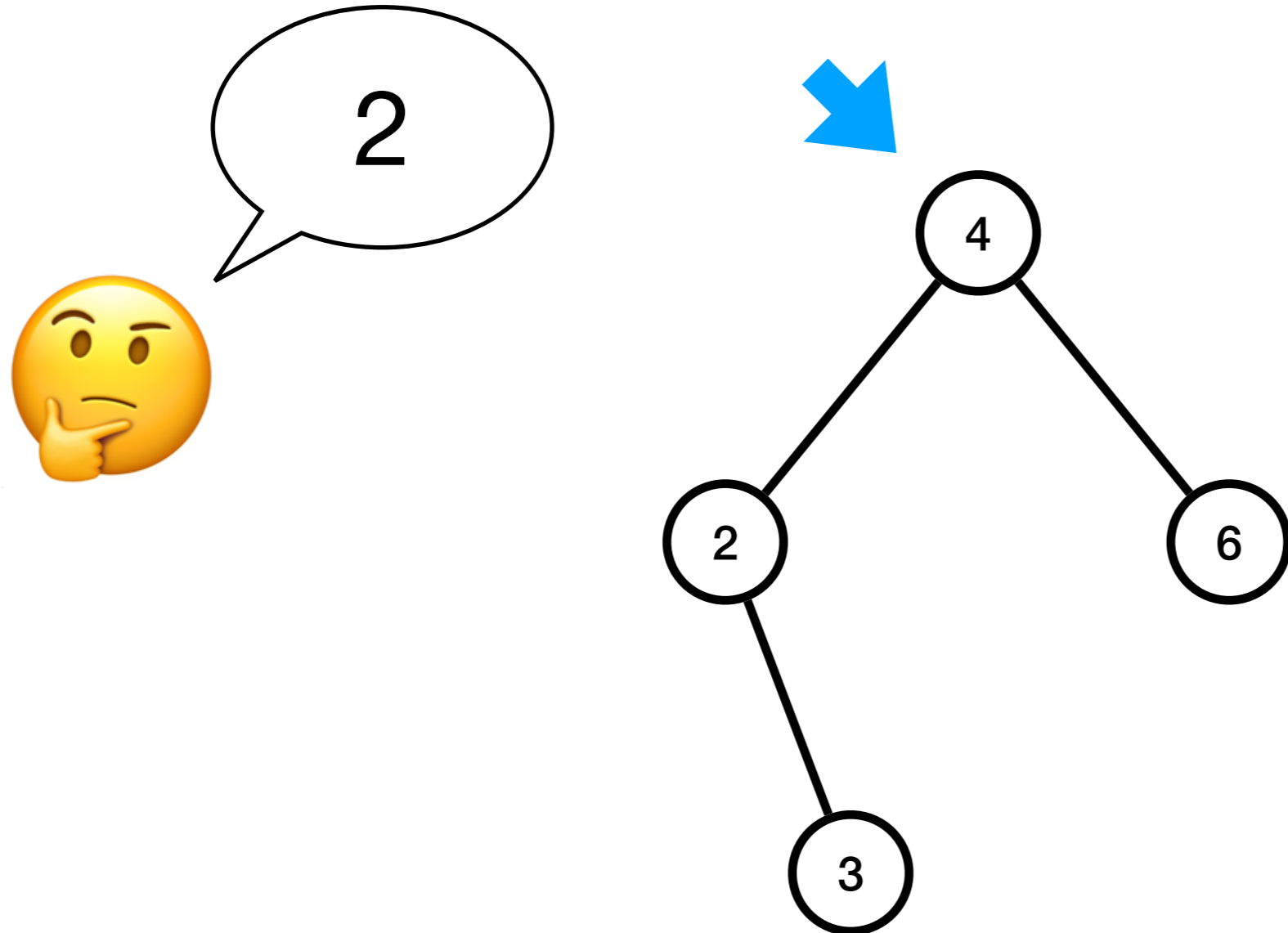
# Insertion dans un ABR



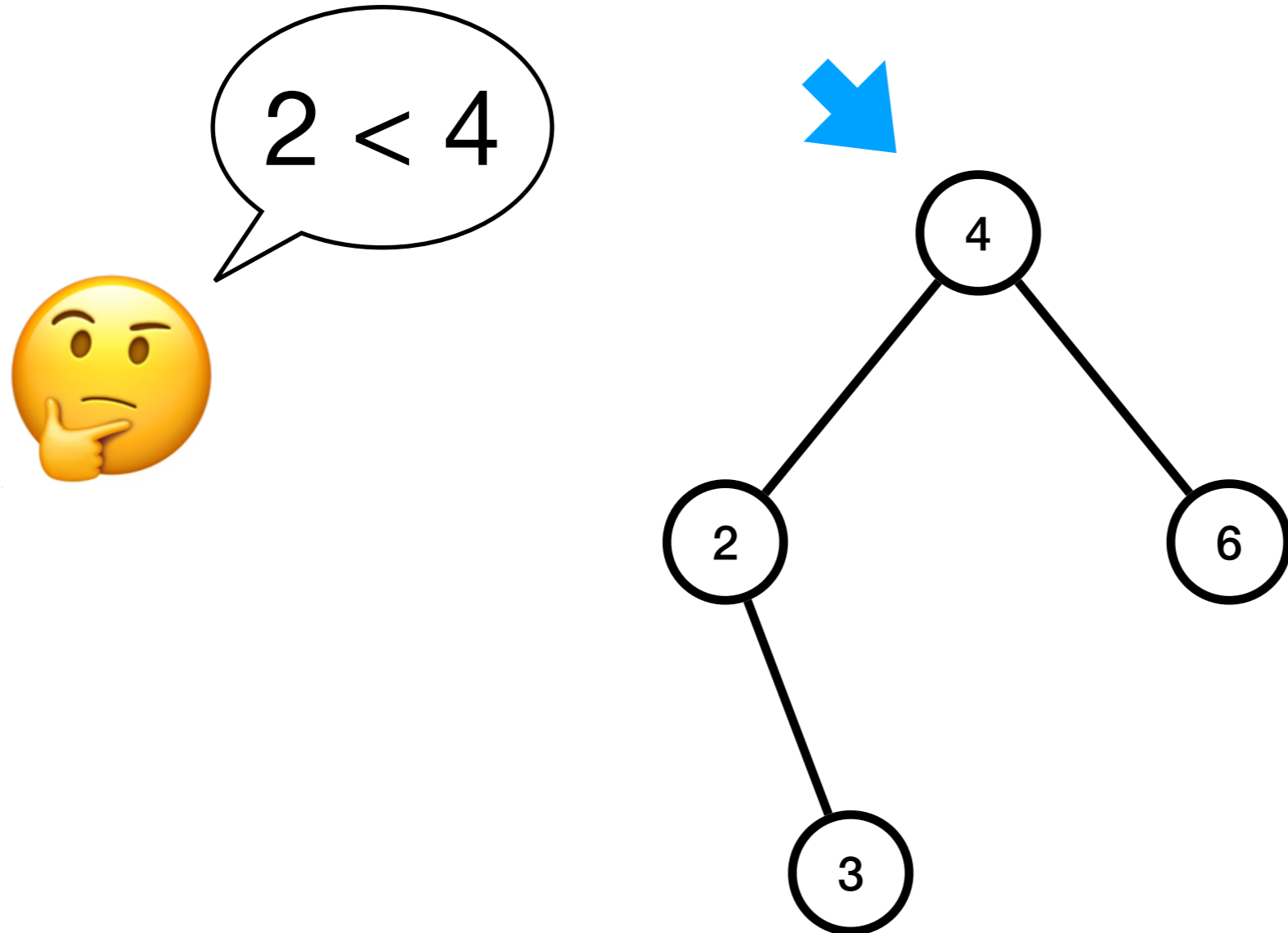
# Insertion dans un ABR



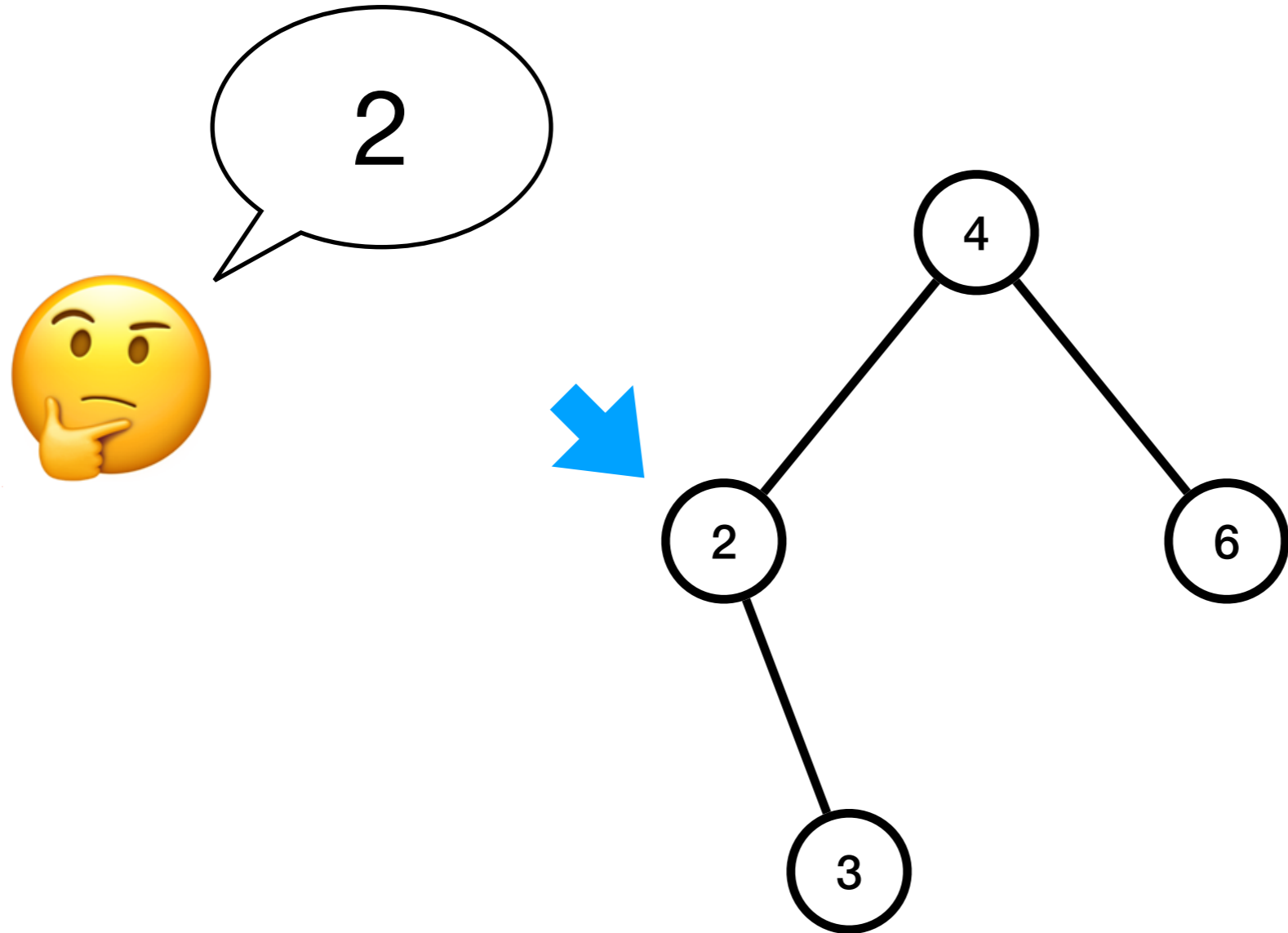
# Insertion dans un ABR



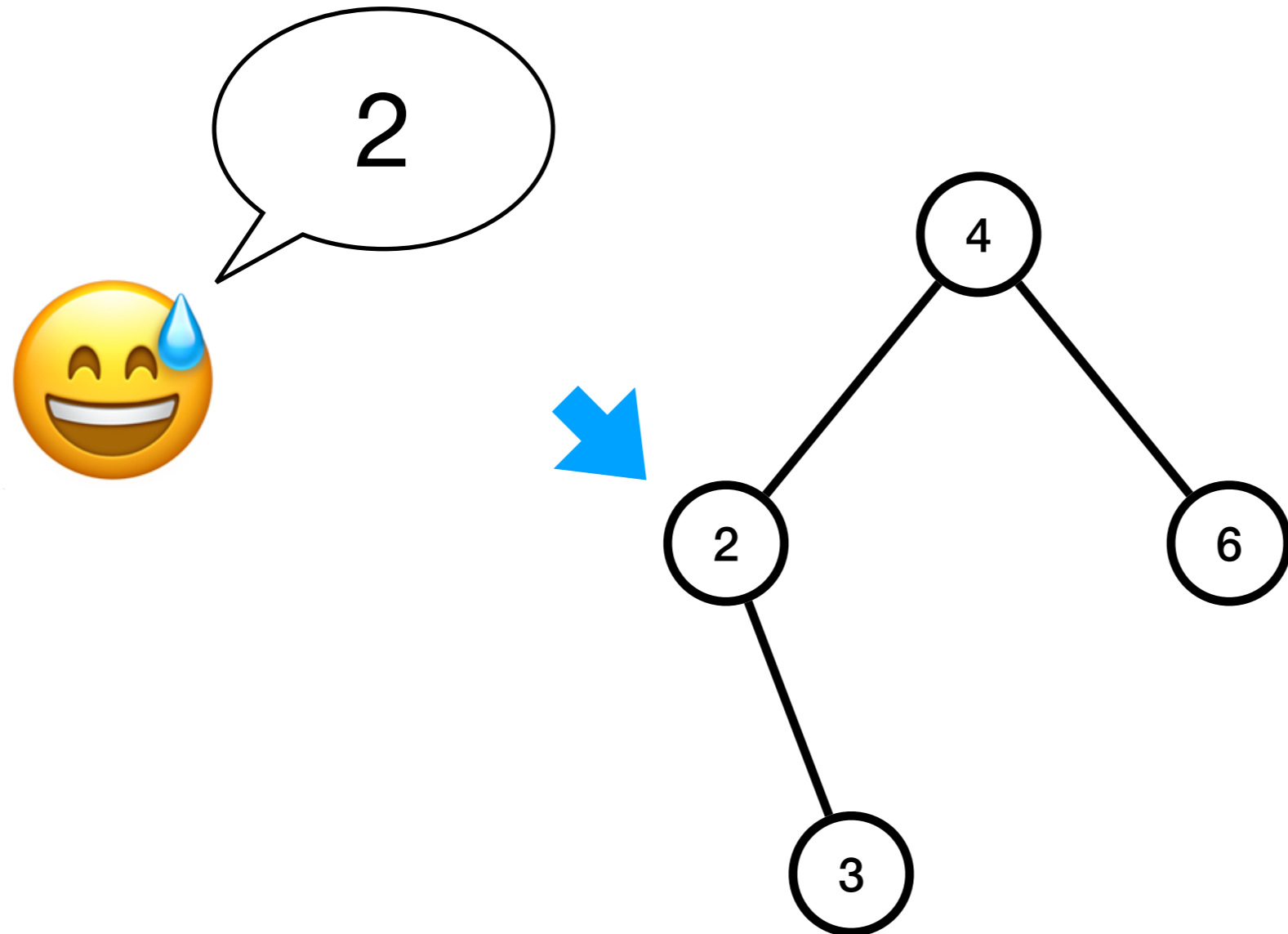
# Insertion dans un ABR



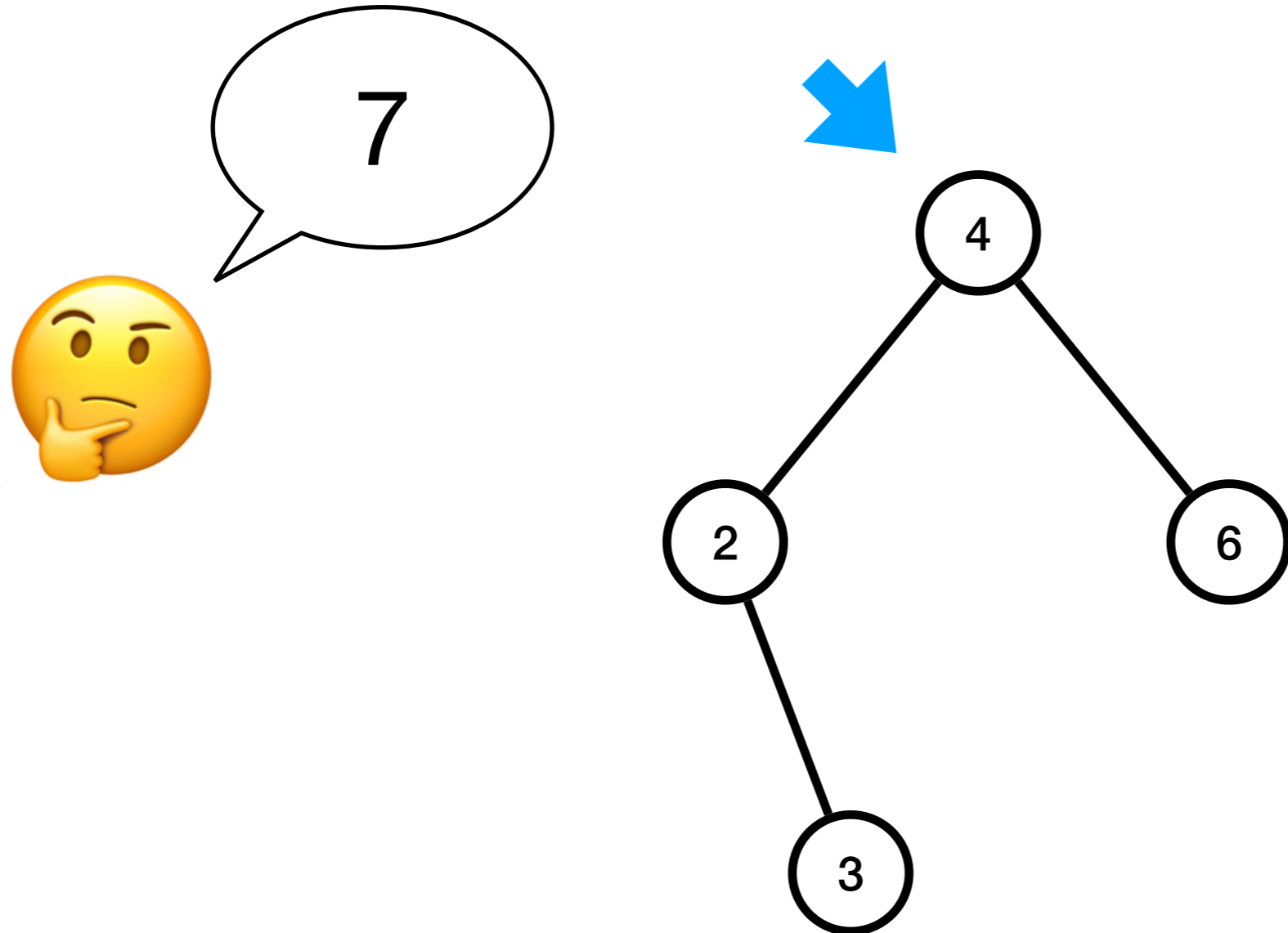
# Insertion dans un ABR



# Insertion dans un ABR

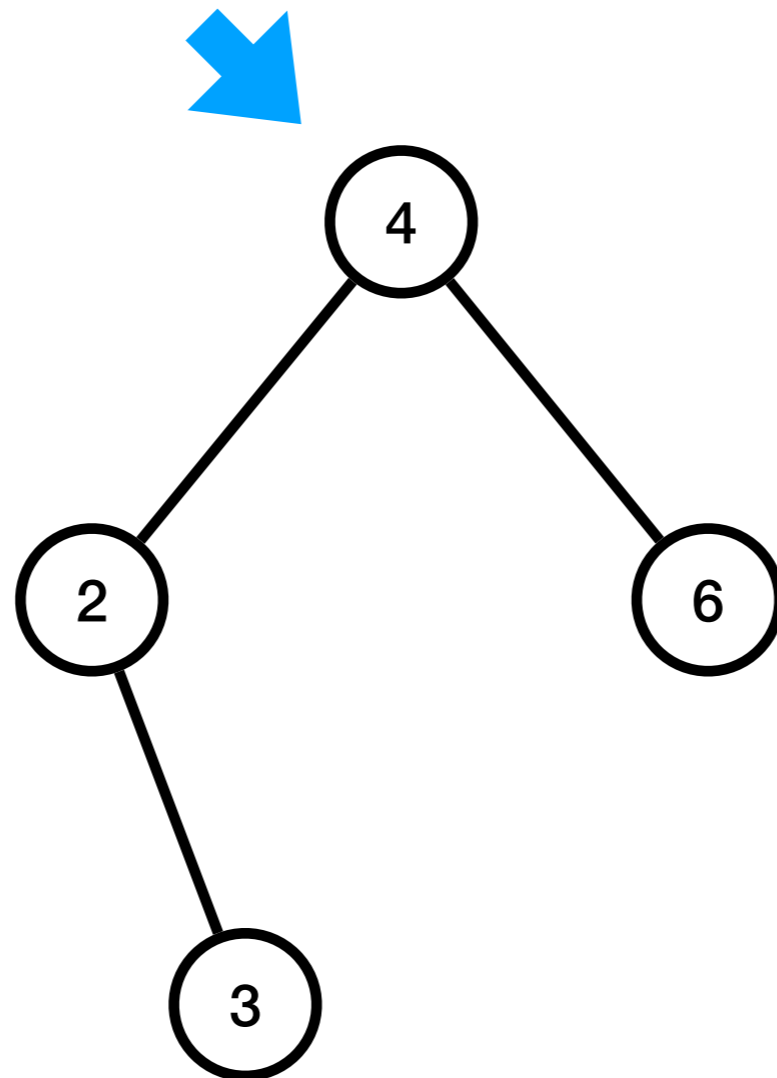
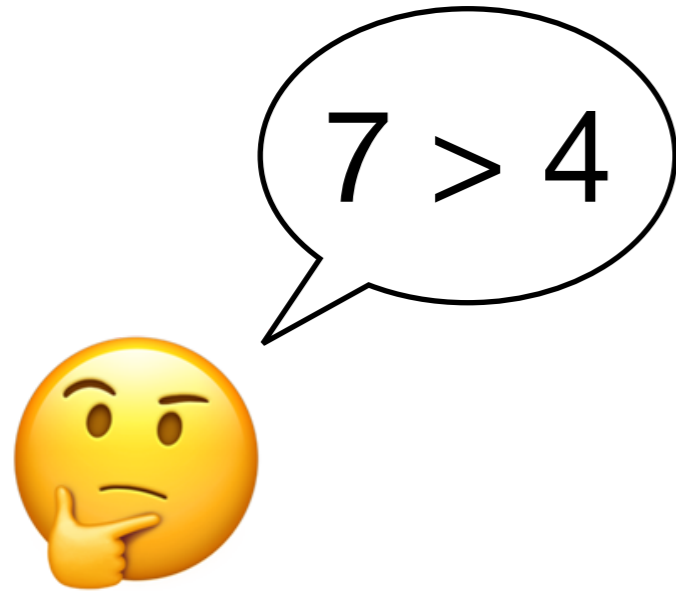


# Insertion dans un ABR

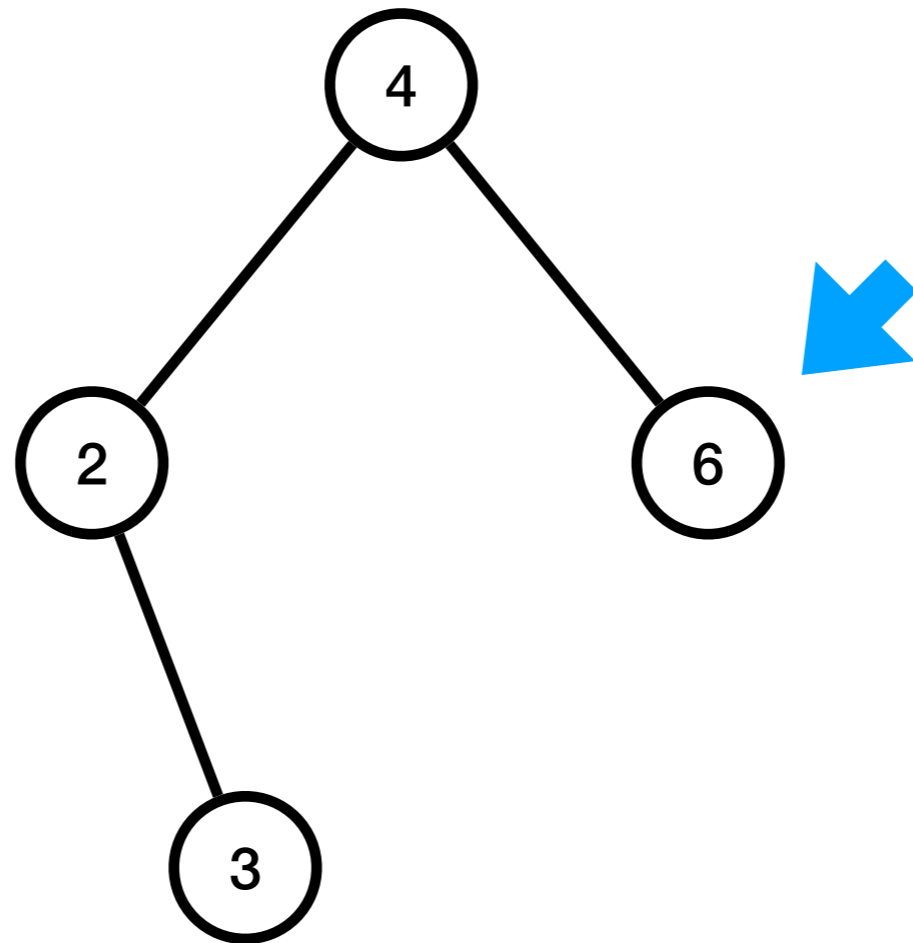
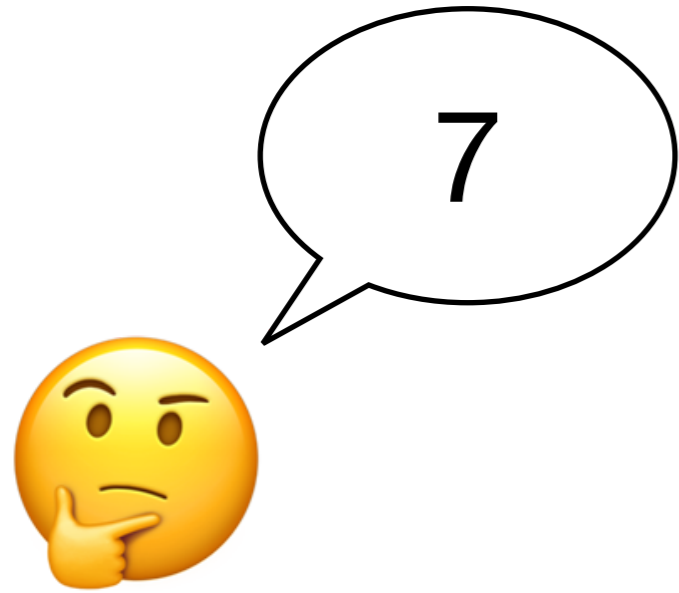




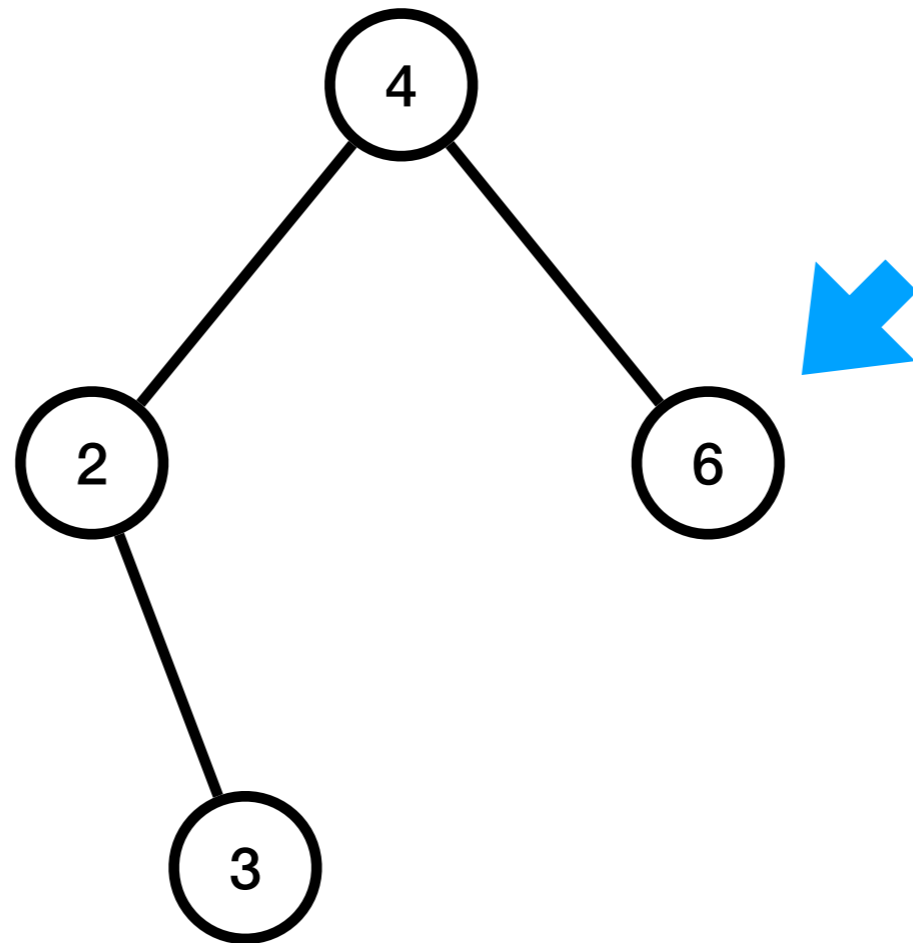
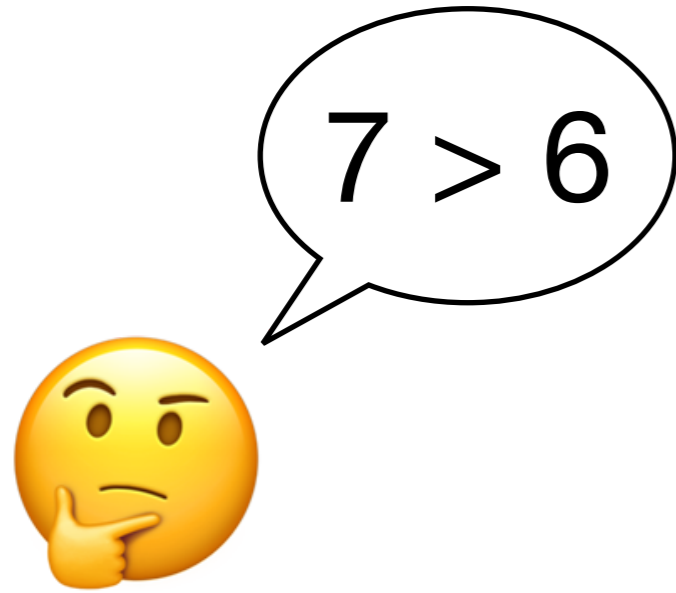
# Insertion dans un ABR



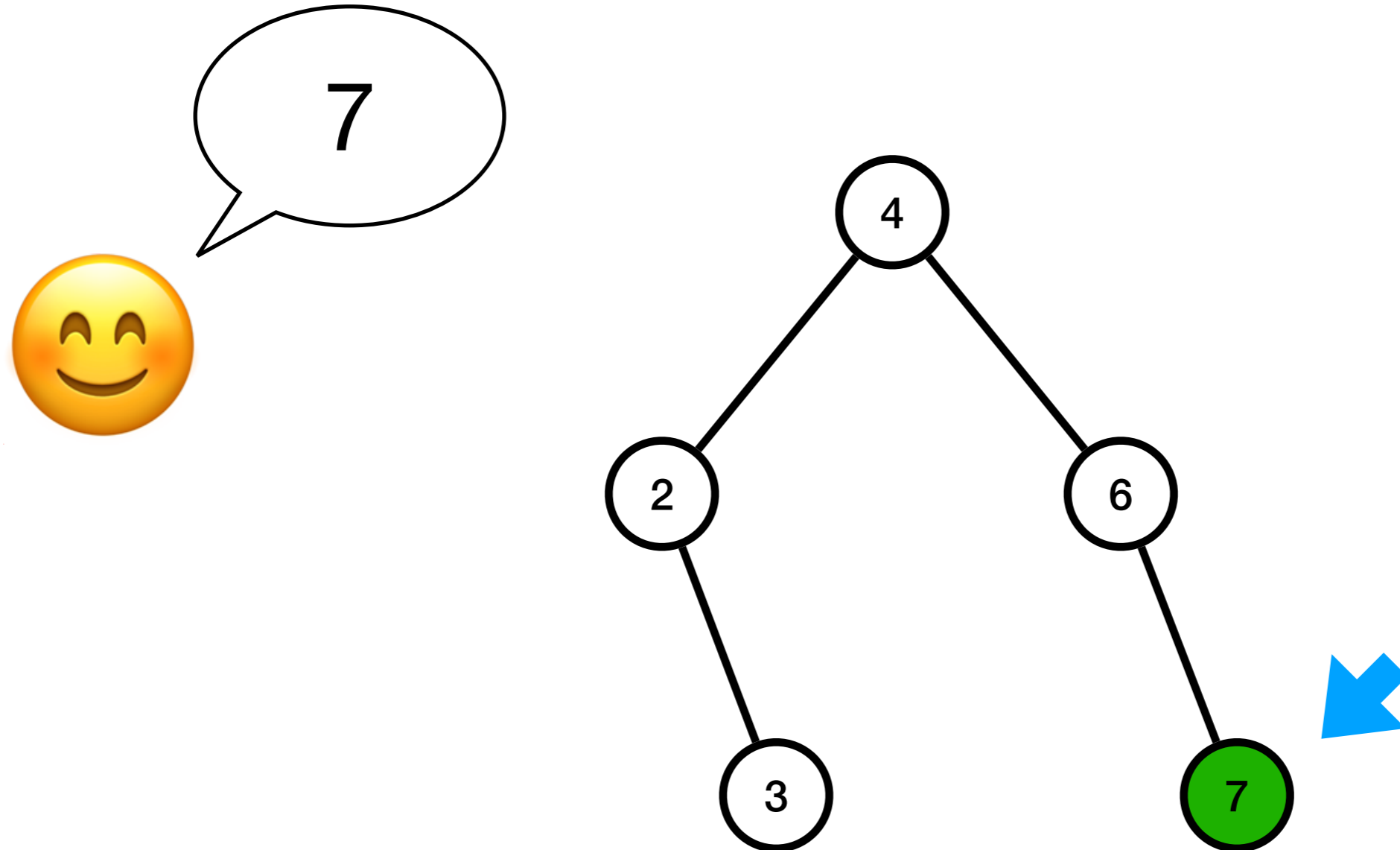
# Insertion dans un ABR



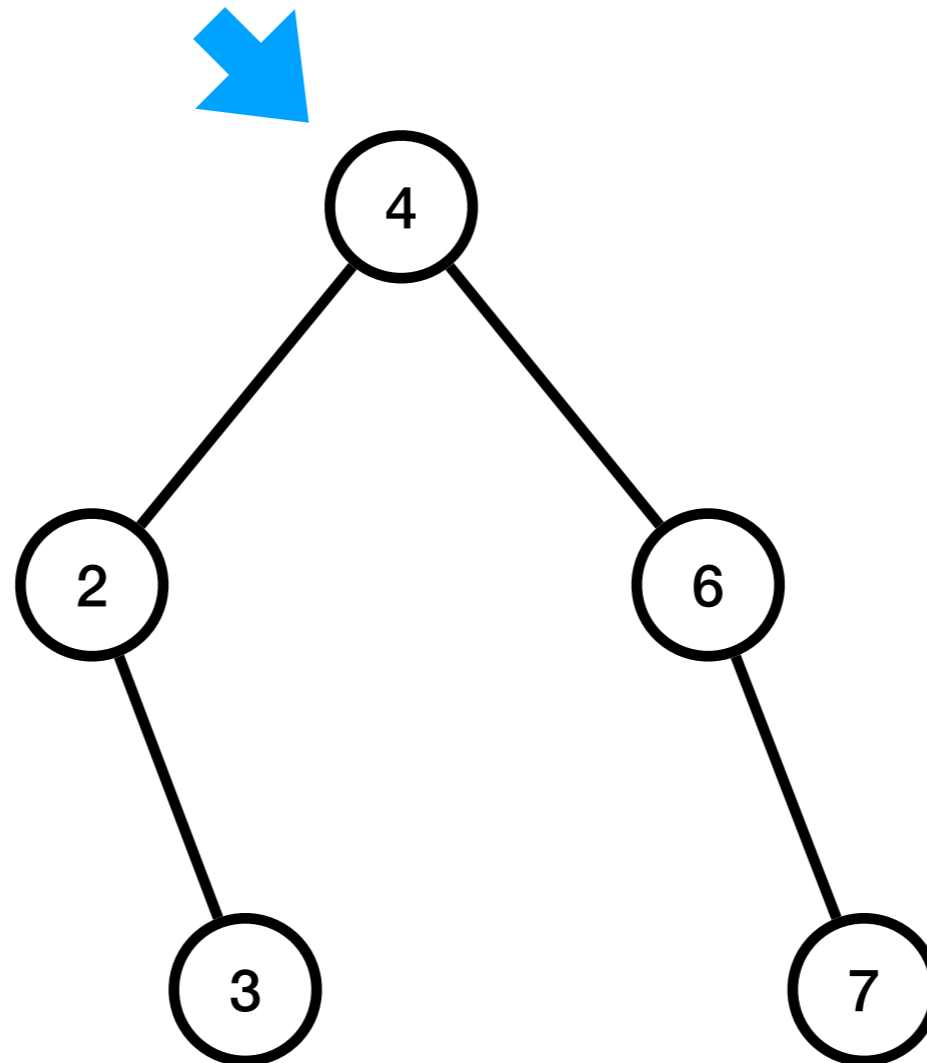
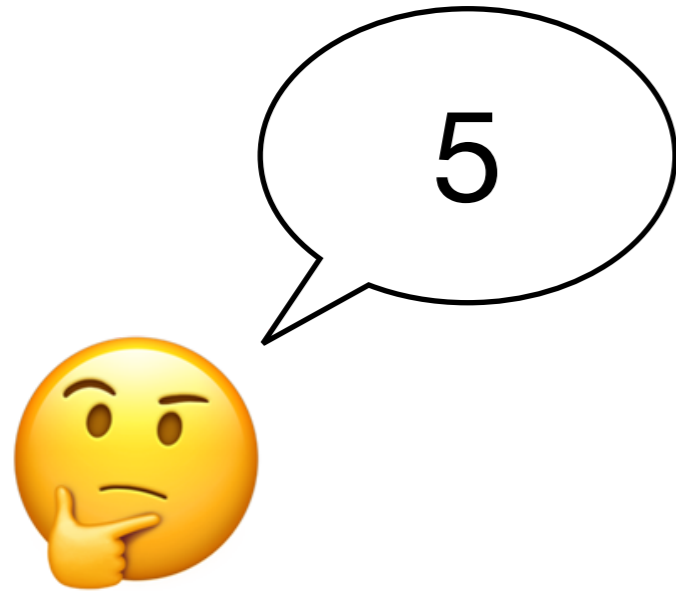
# Insertion dans un ABR



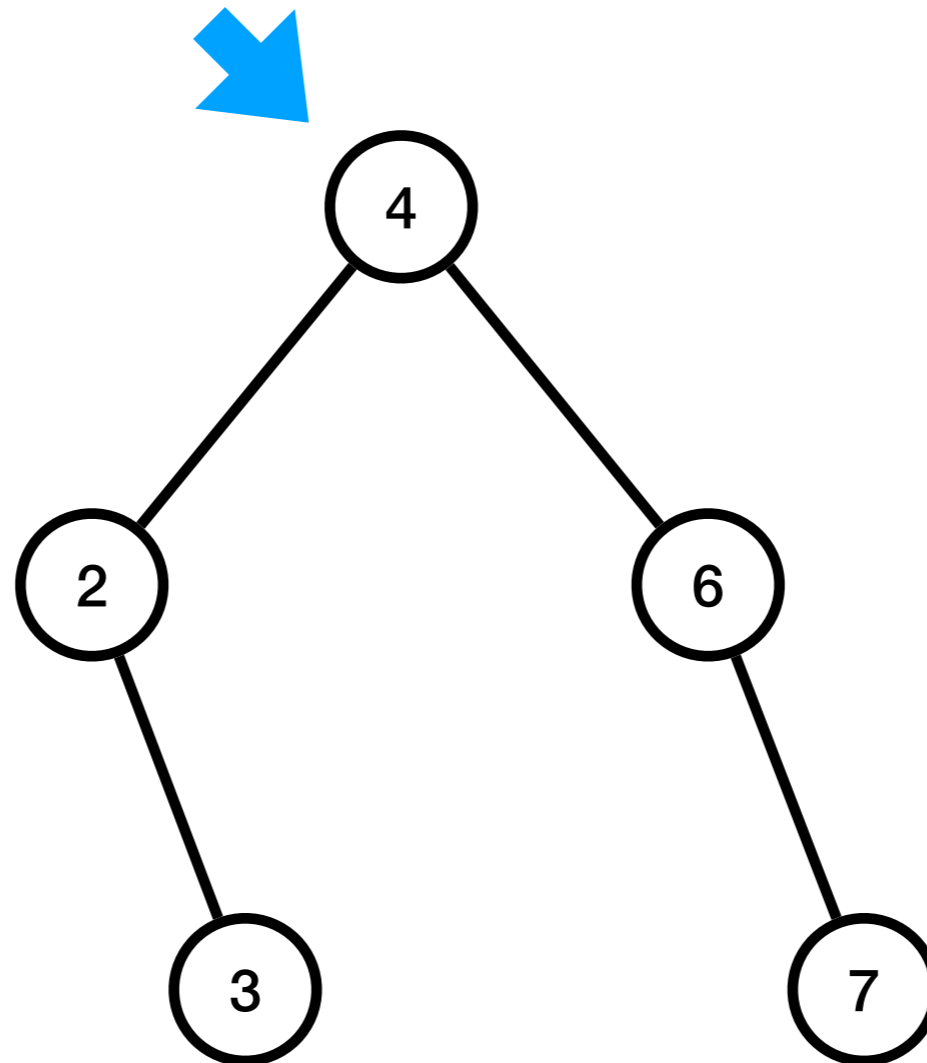
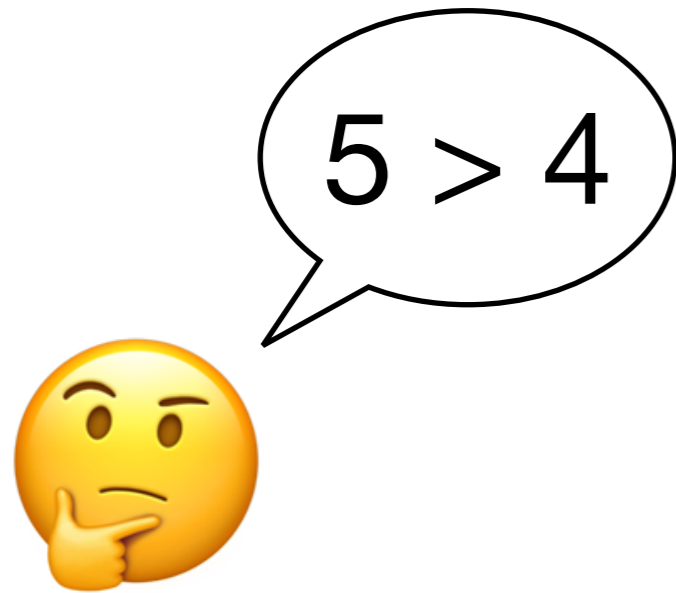
# Insertion dans un ABR



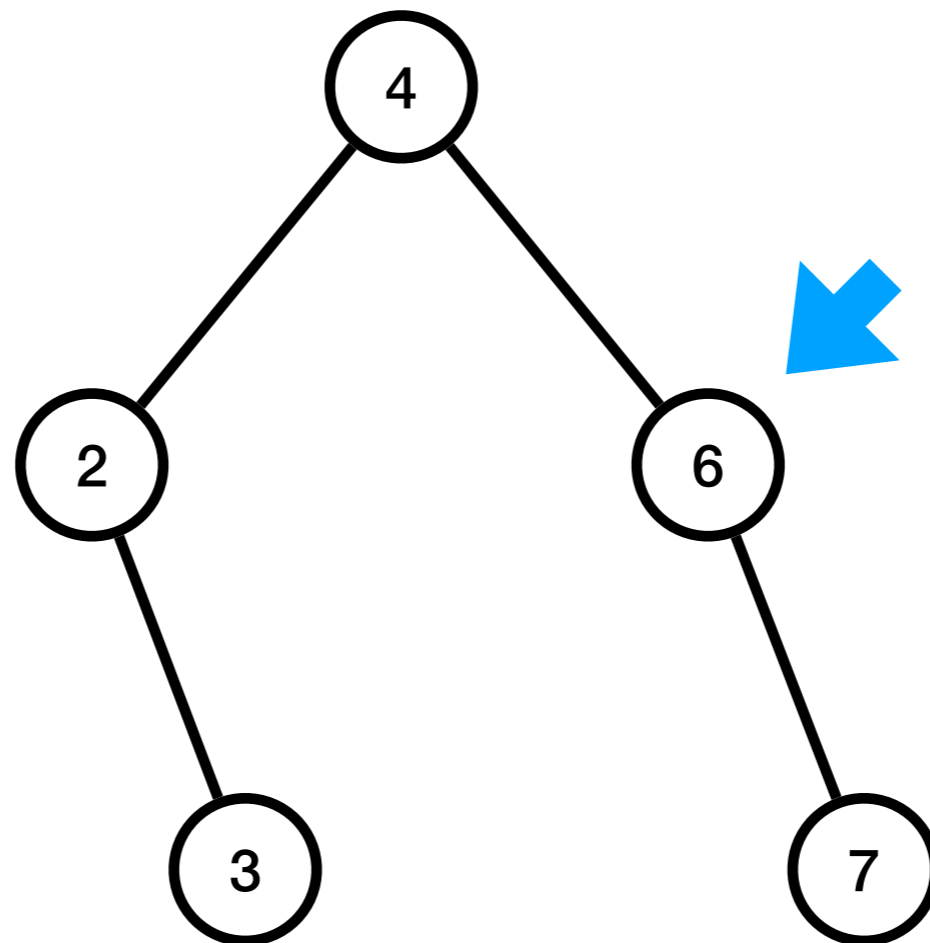
# Insertion dans un ABR



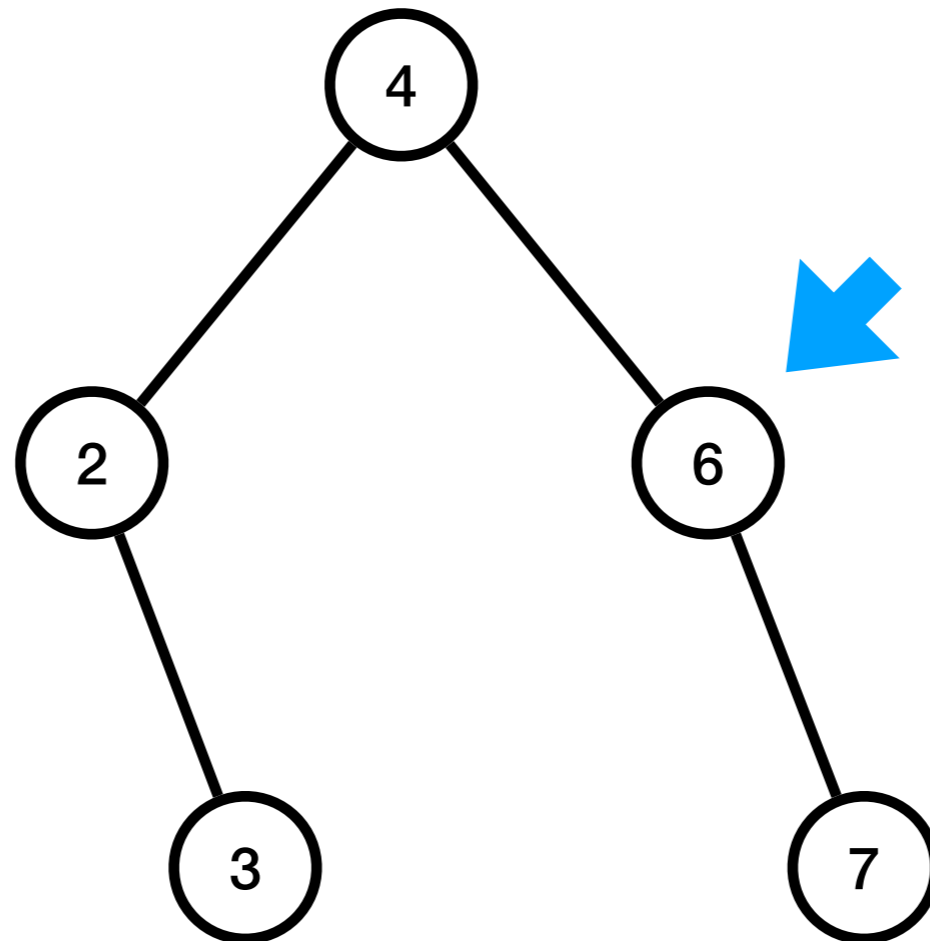
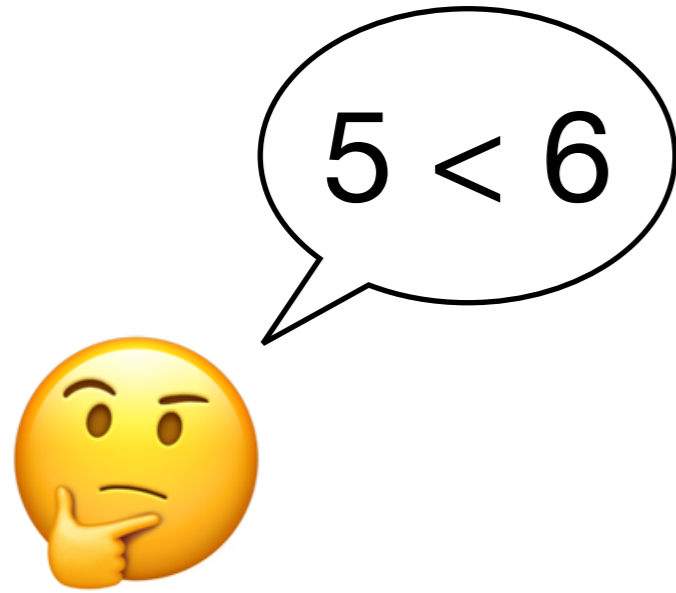
# Insertion dans un ABR



# Insertion dans un ABR

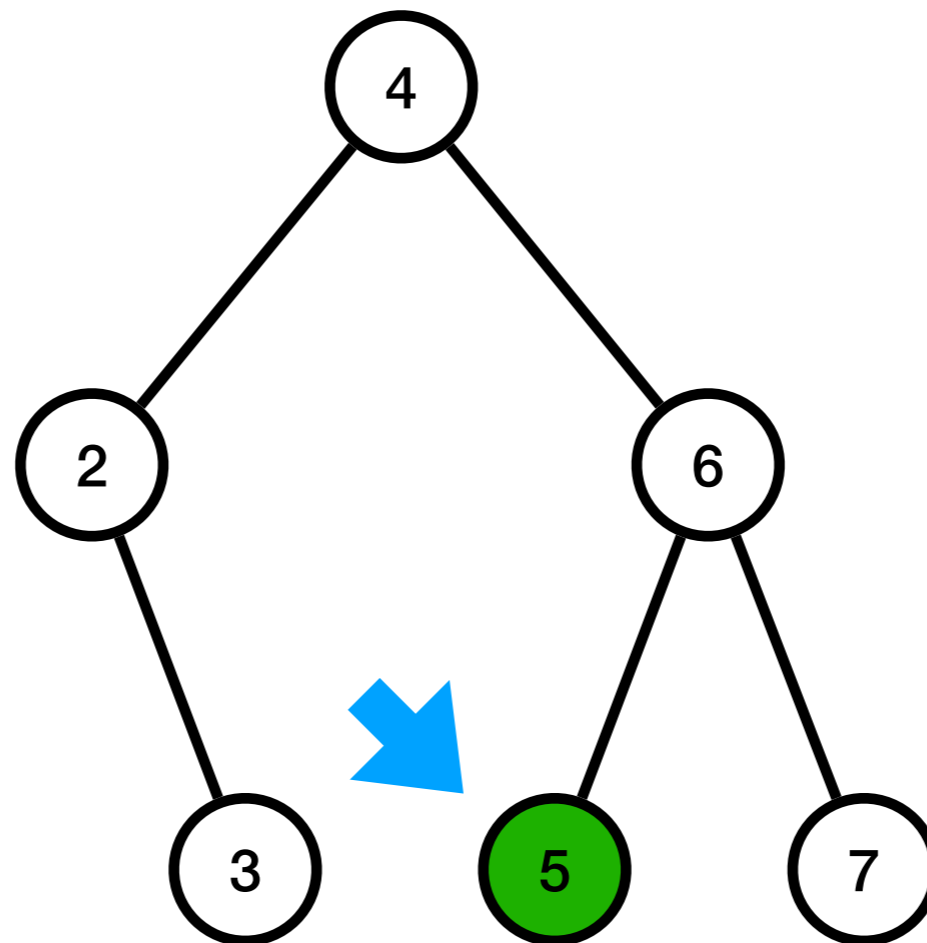
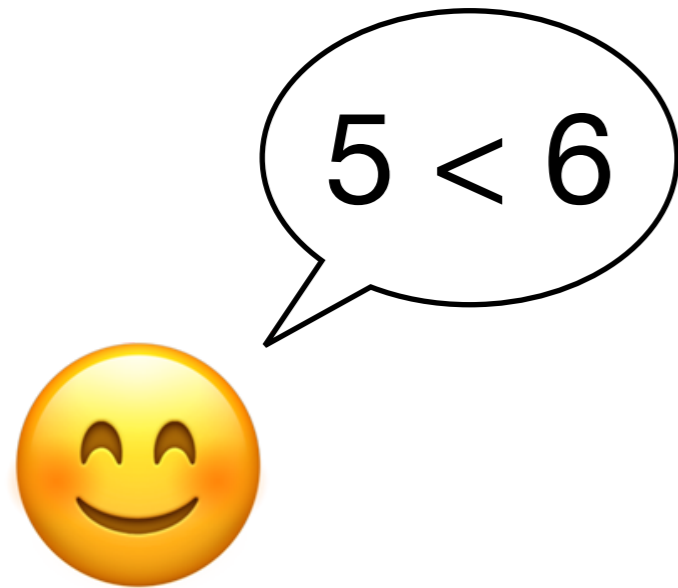


# Insertion dans un ABR

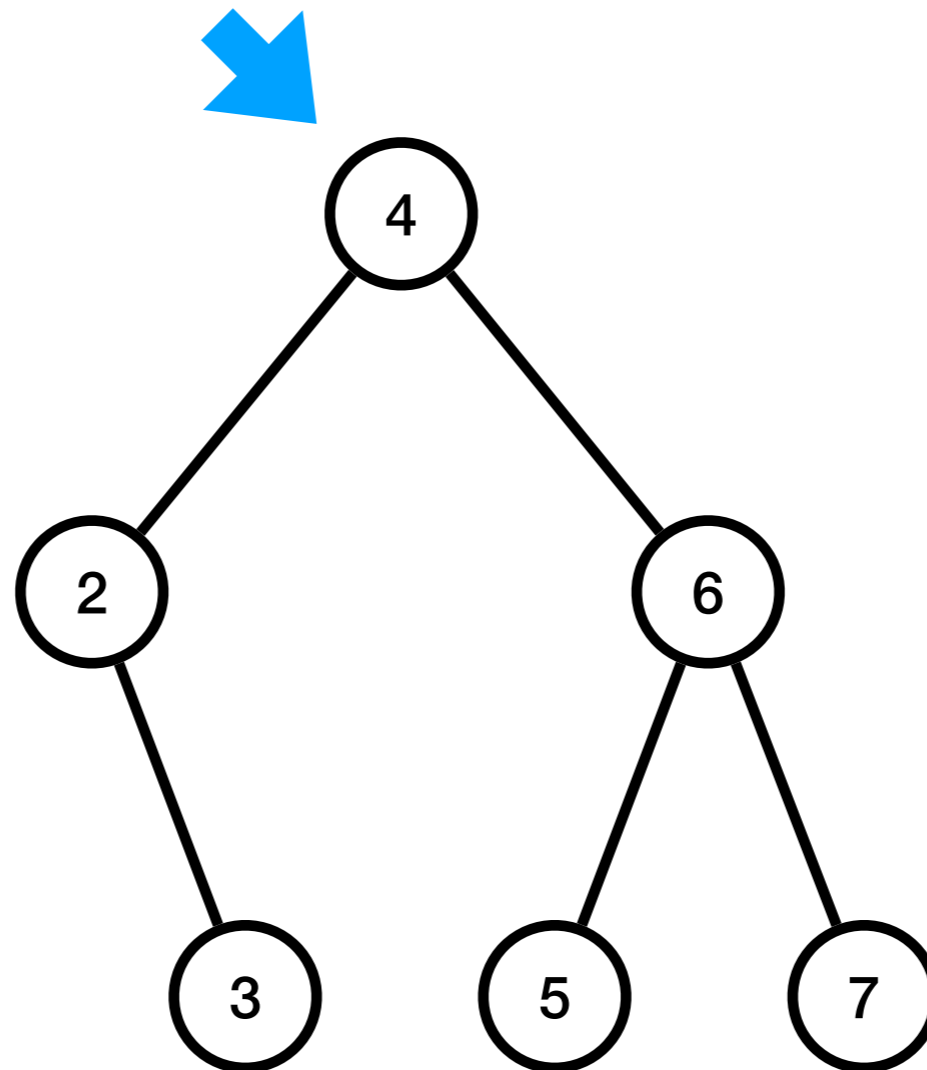
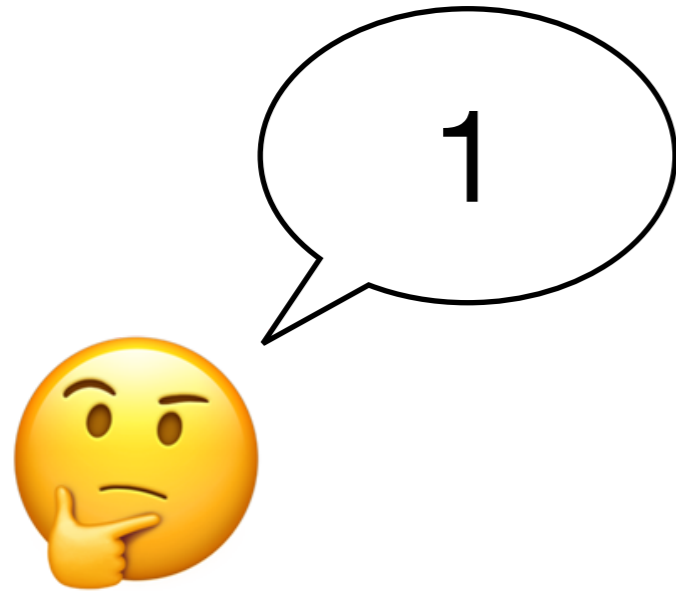




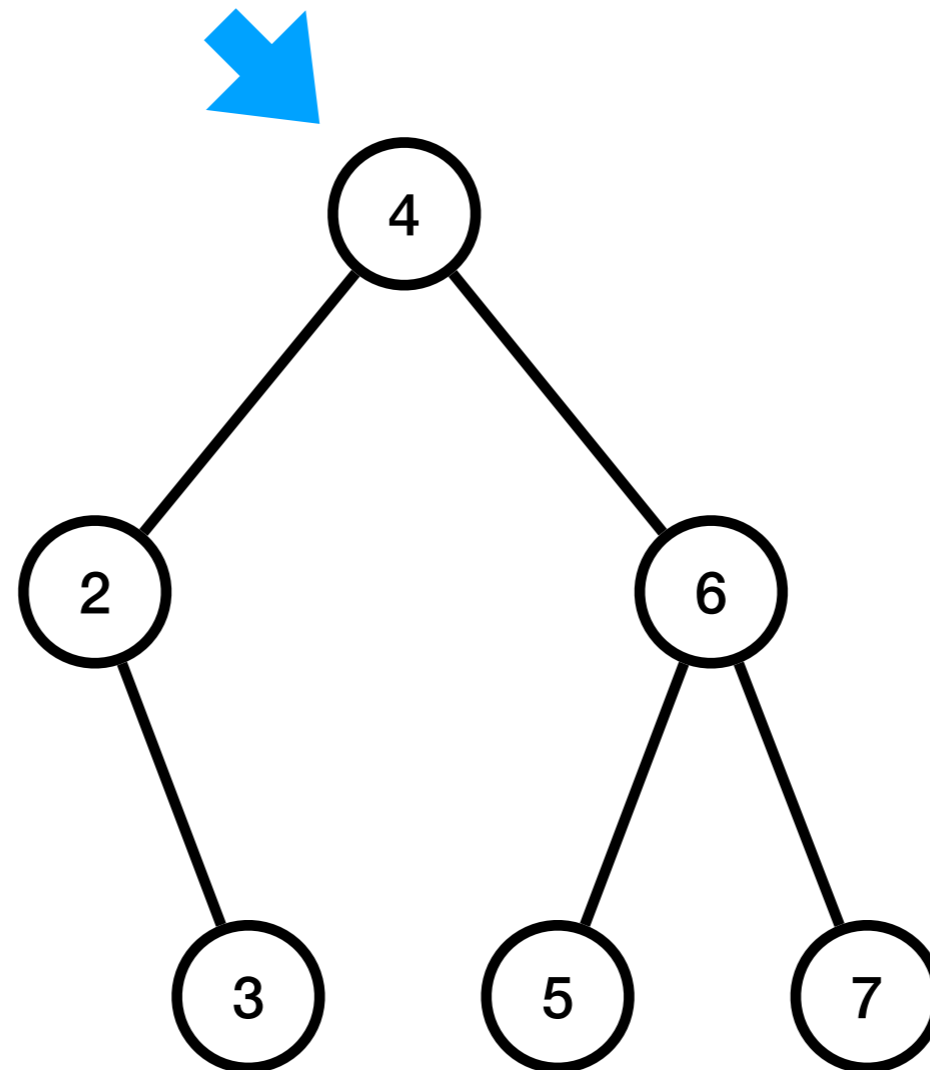
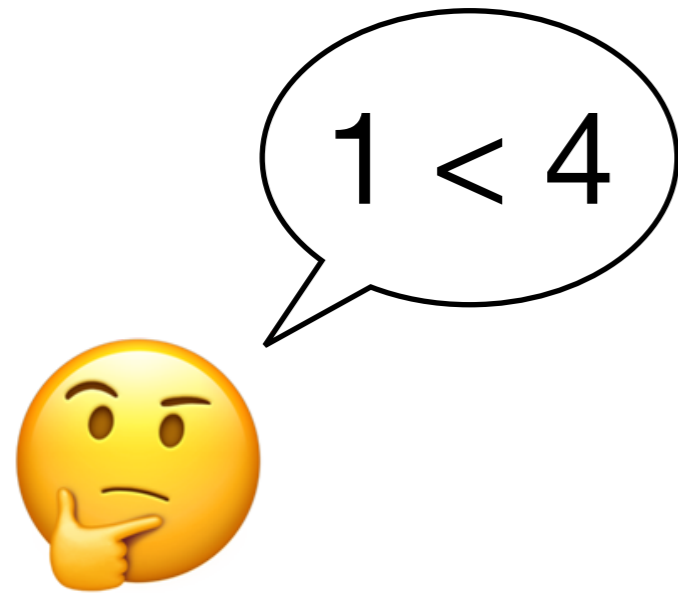
# Insertion dans un ABR



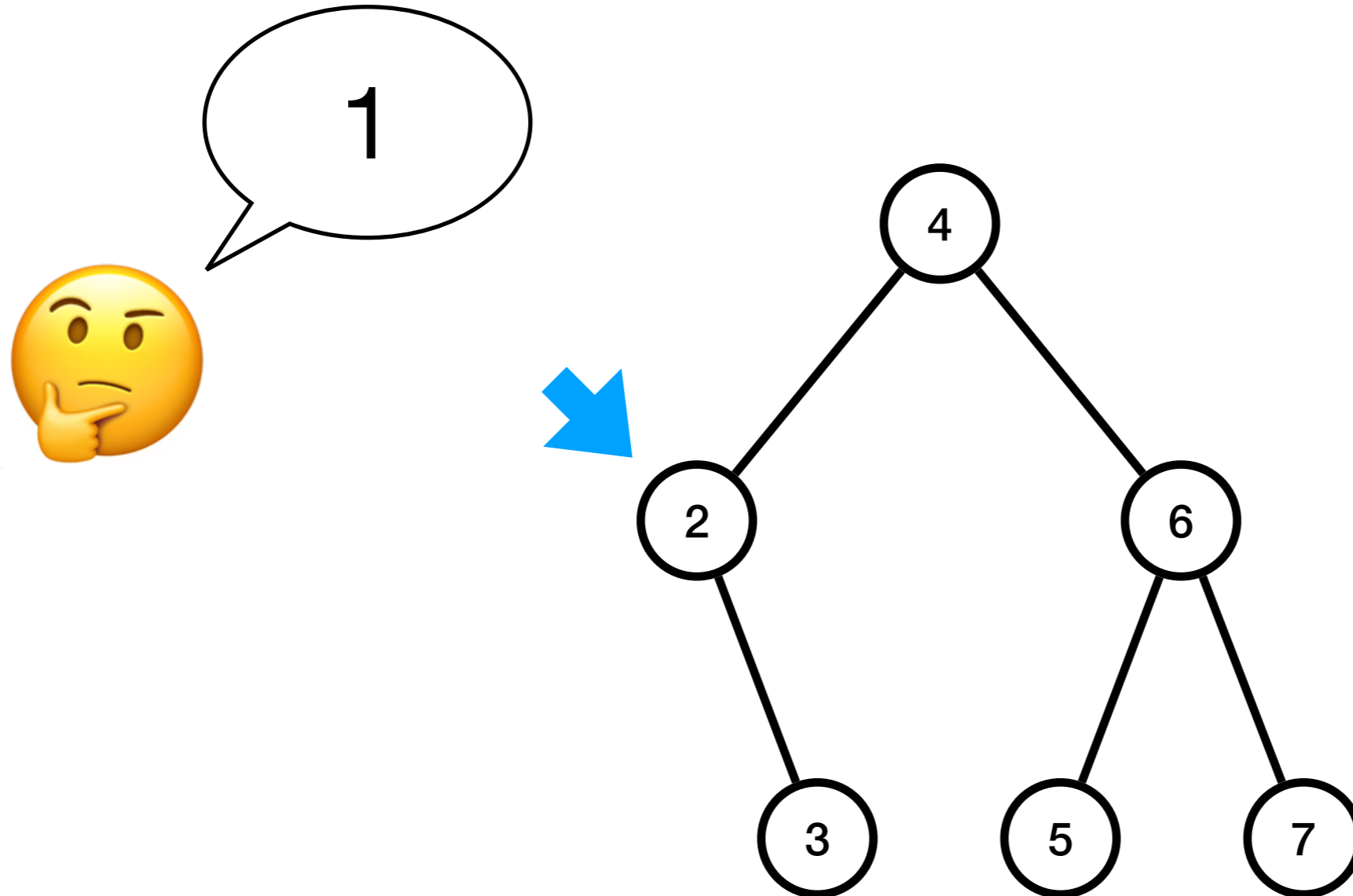
# Insertion dans un ABR



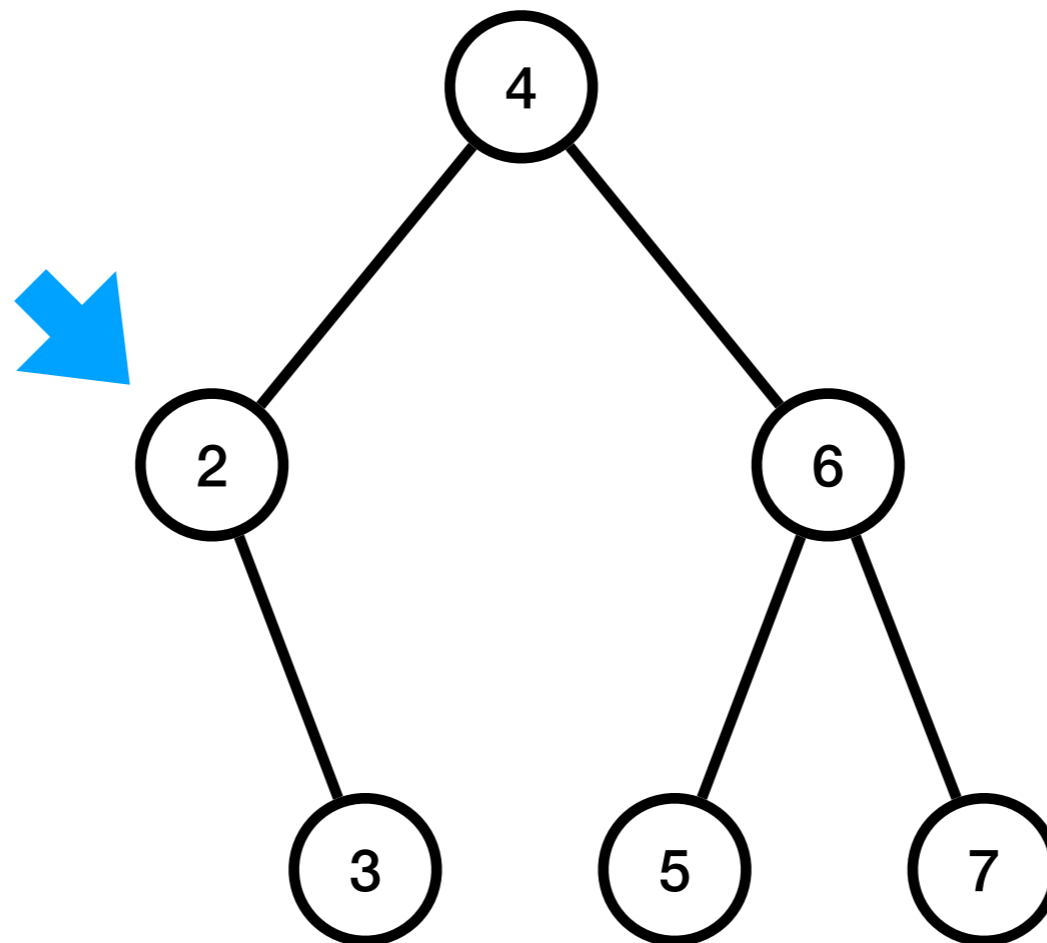
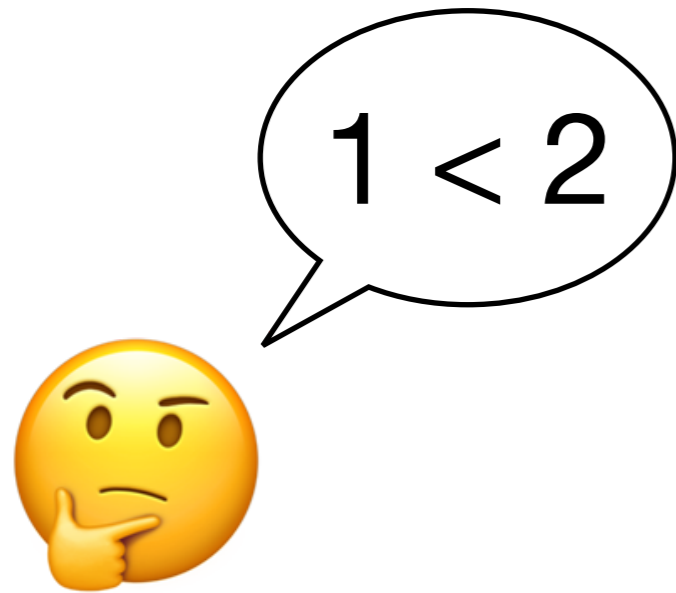
# Insertion dans un ABR



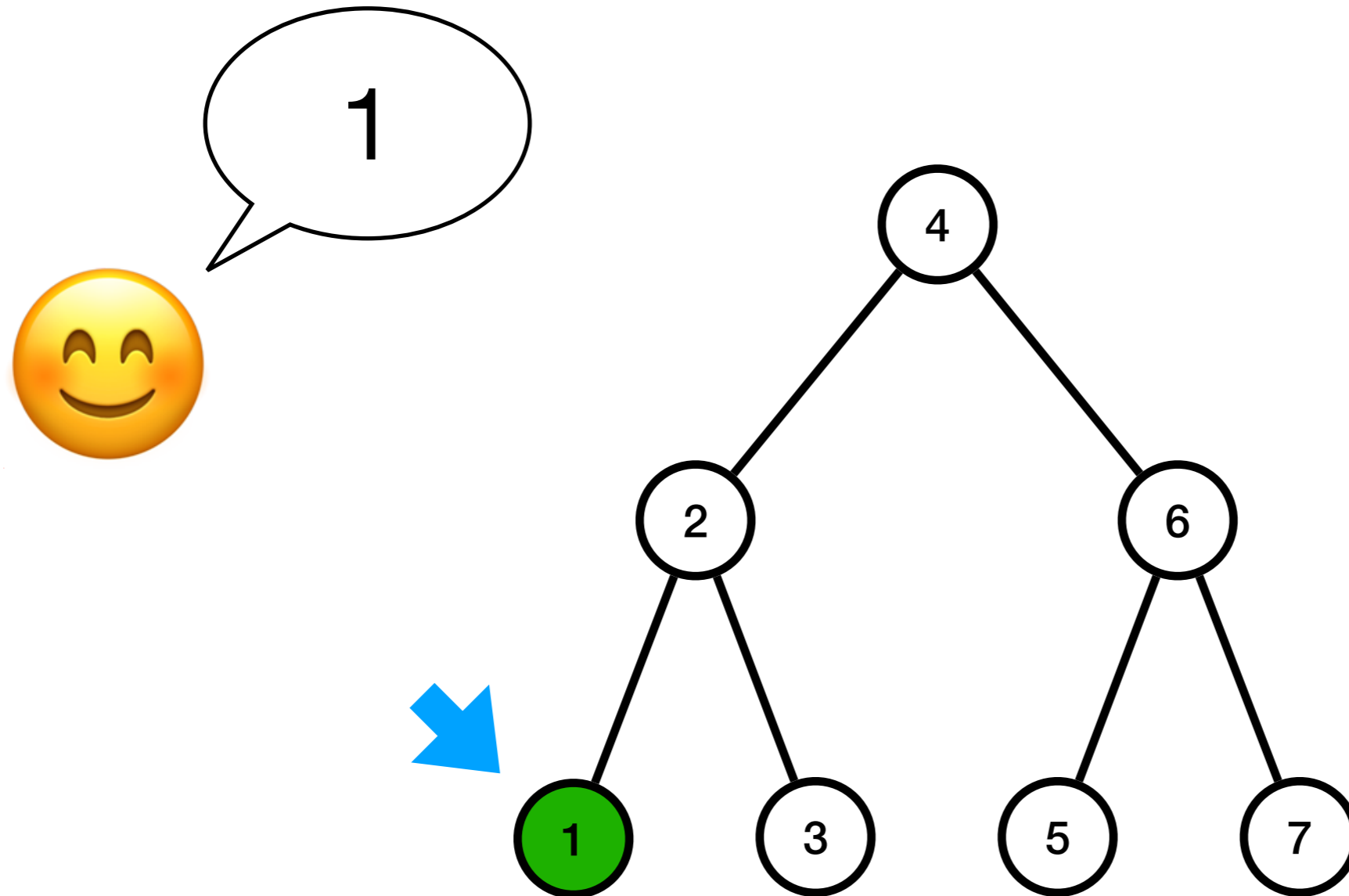
# Insertion dans un ABR



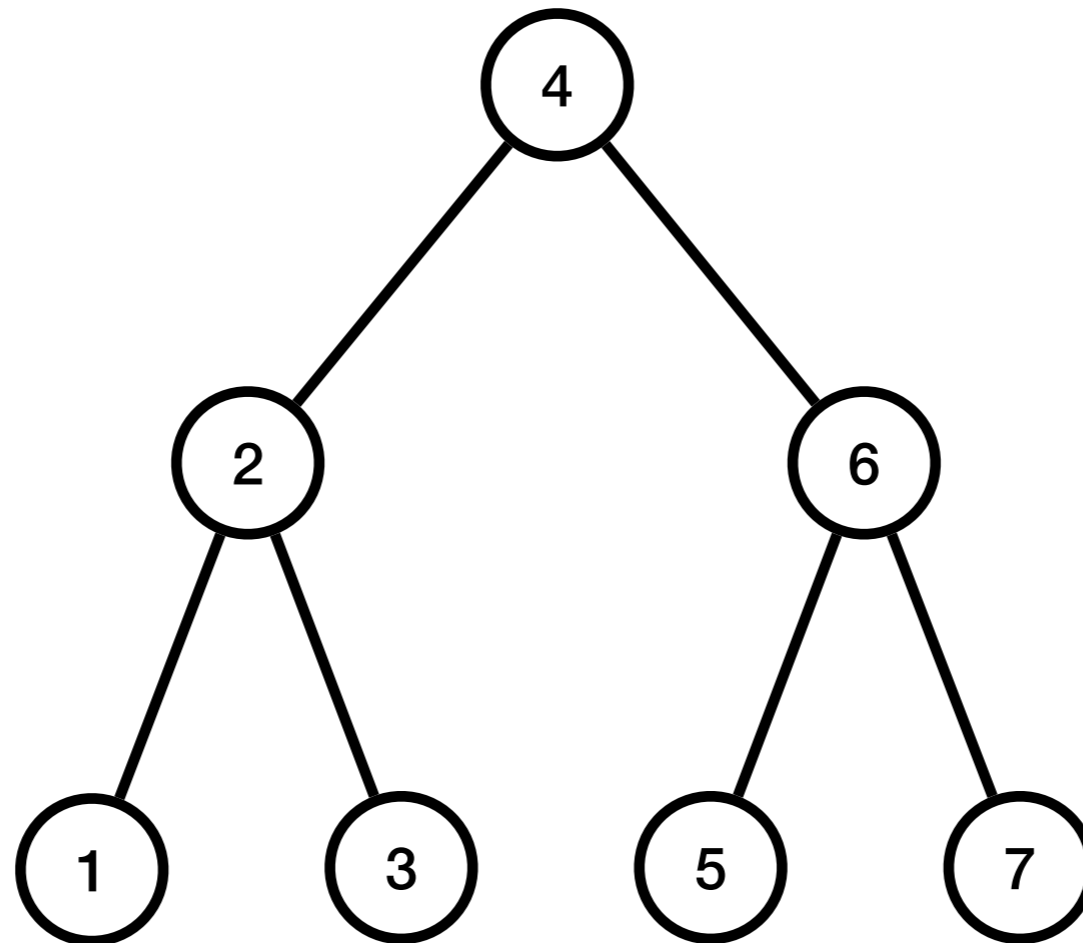
# Insertion dans un ABR



# Insertion dans un ABR



# Insertion dans un ABR



# Exercice 4 du TD5



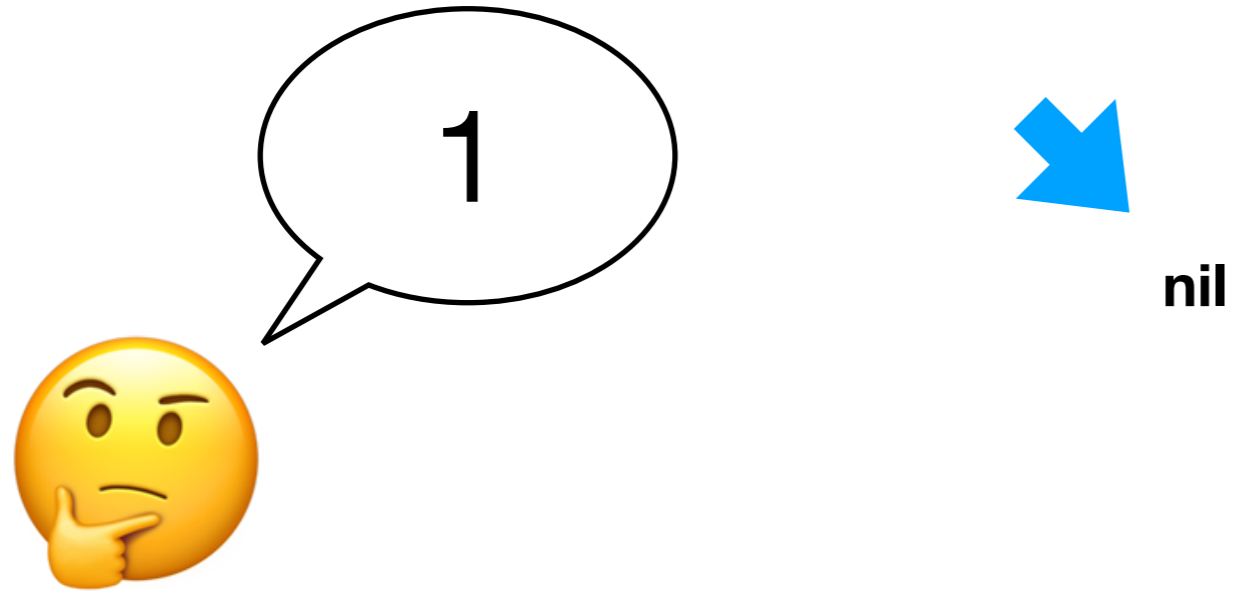
# Insertion dans un ABR

```
def insérer_abr(nœud, x)  
    ...
```

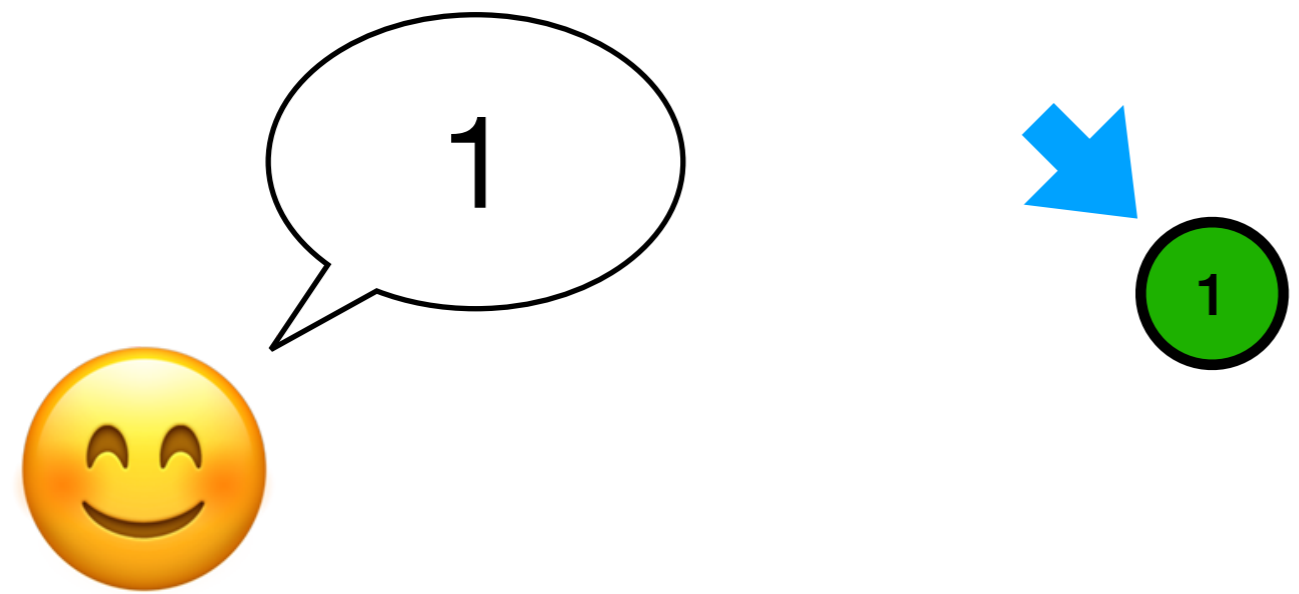
# Insertion dans un ABR

nil

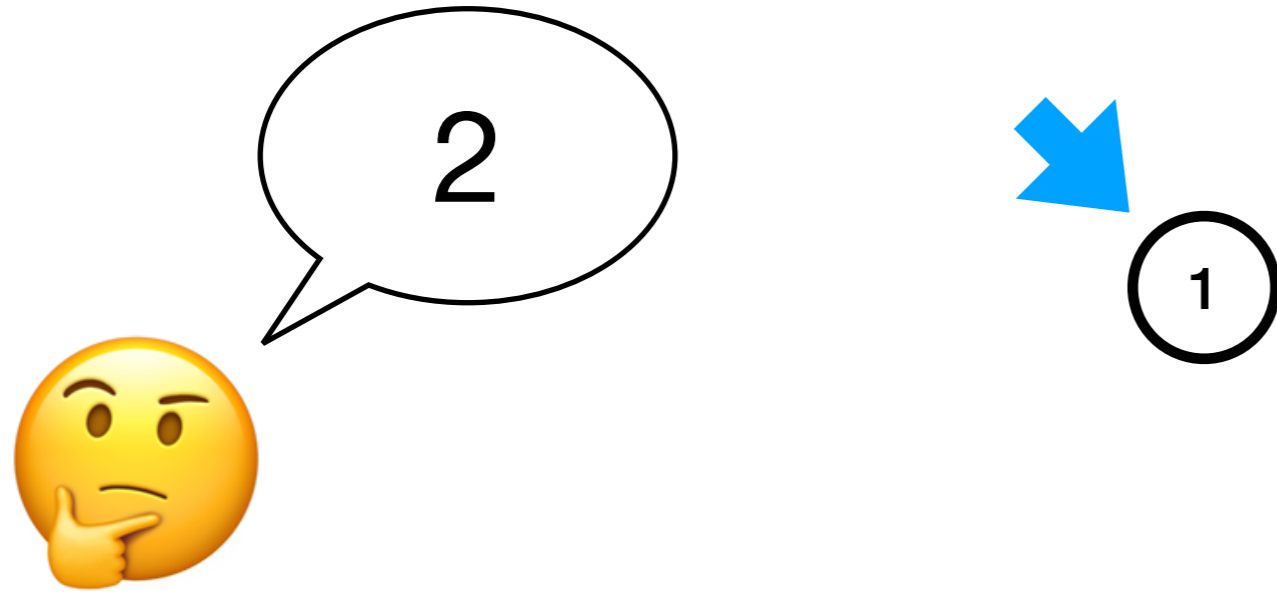
# Insertion dans un ABR



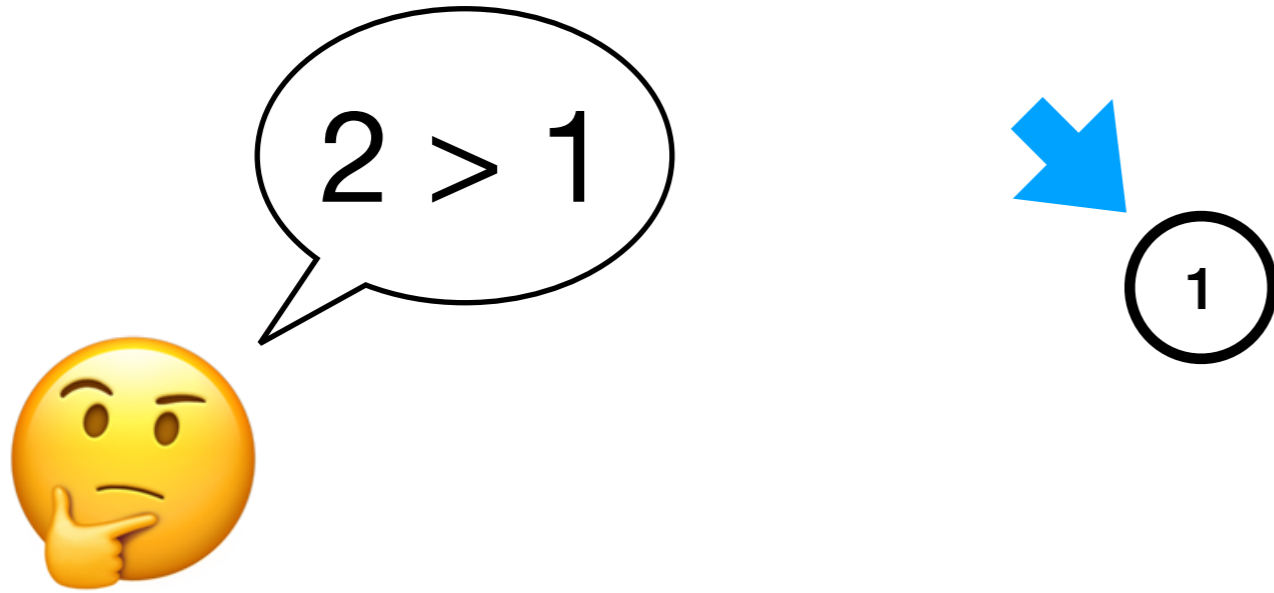
# Insertion dans un ABR



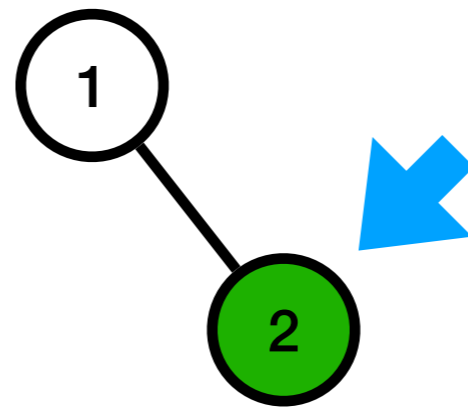
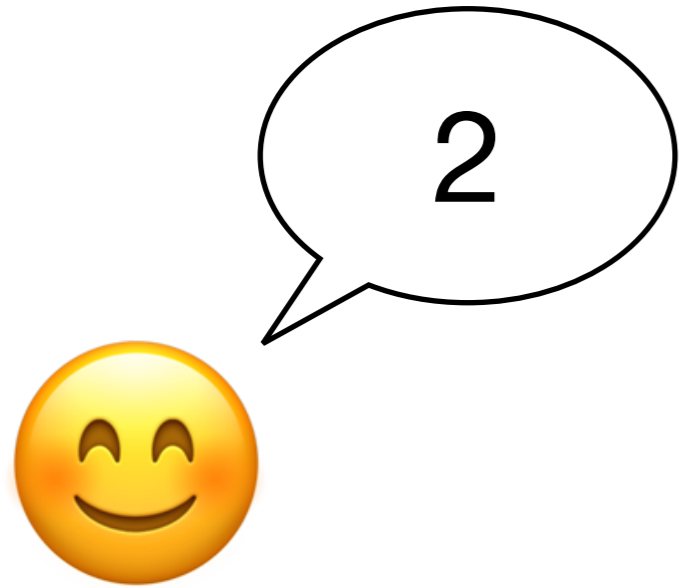
# Insertion dans un ABR



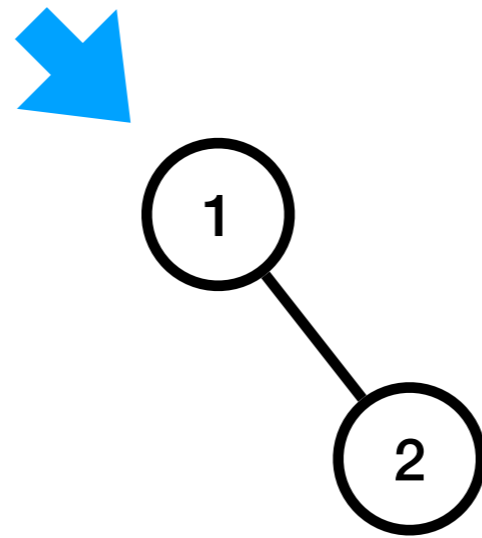
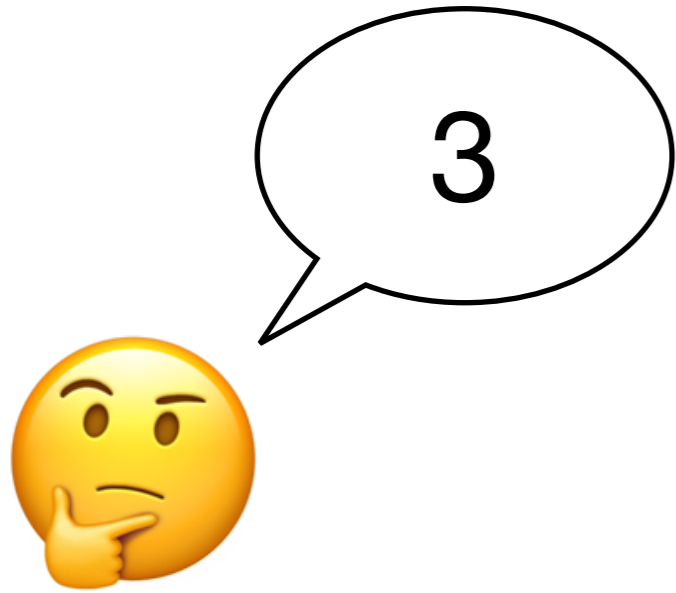
# Insertion dans un ABR



# Insertion dans un ABR

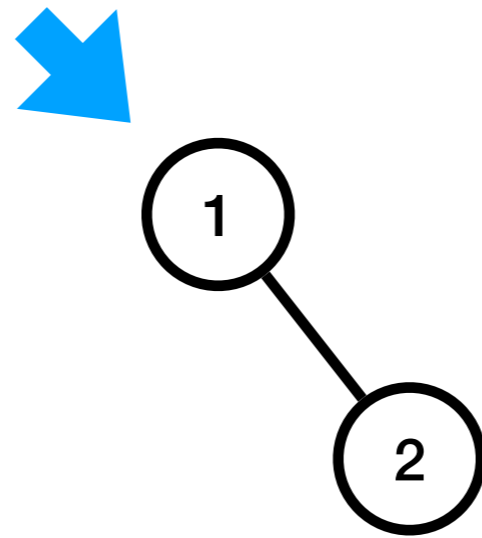
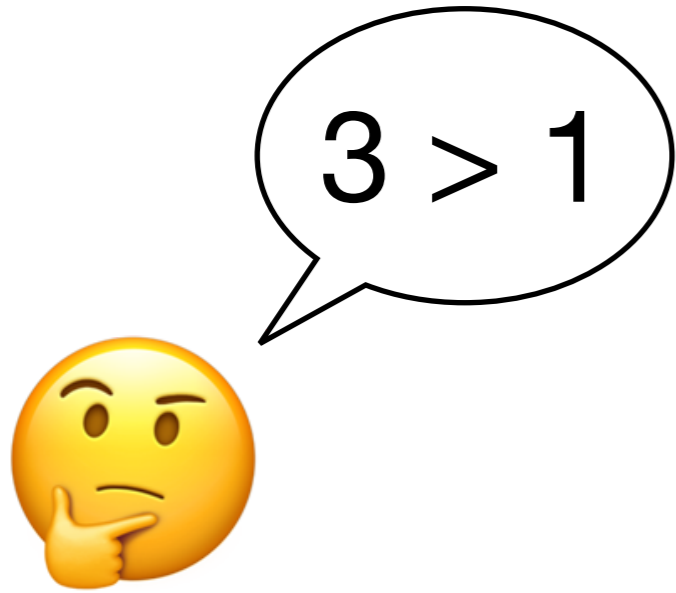


# Insertion dans un ABR

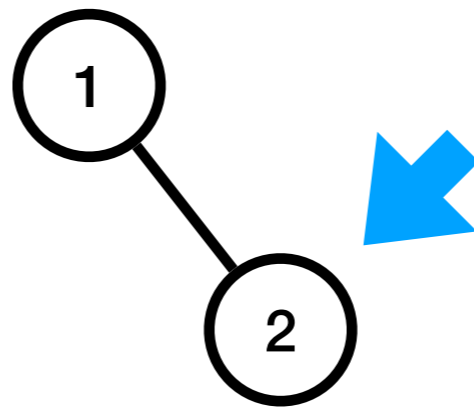
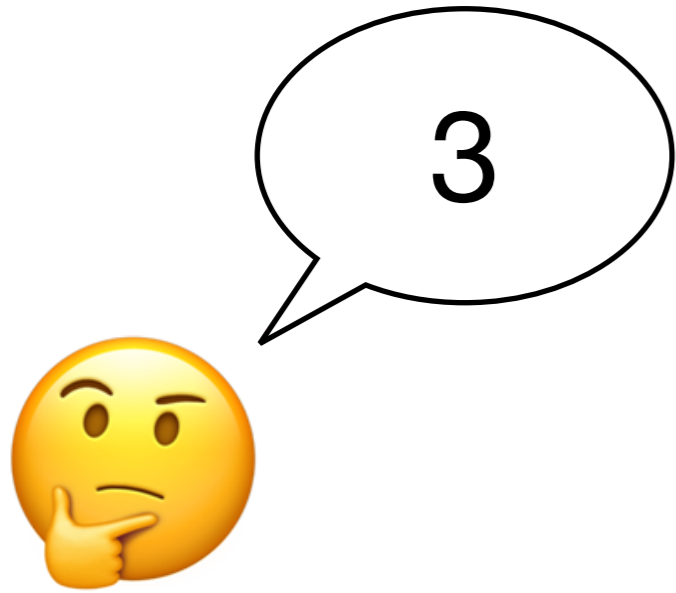




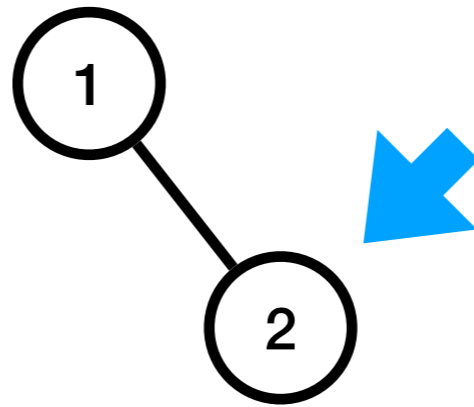
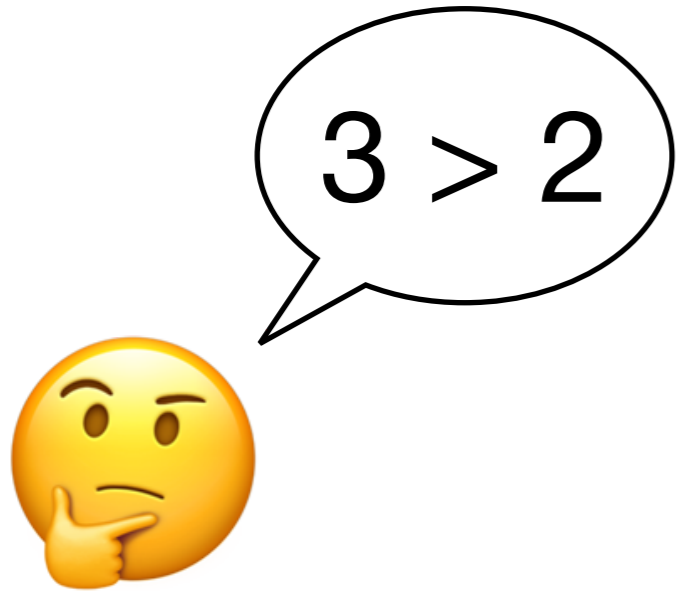
# Insertion dans un ABR



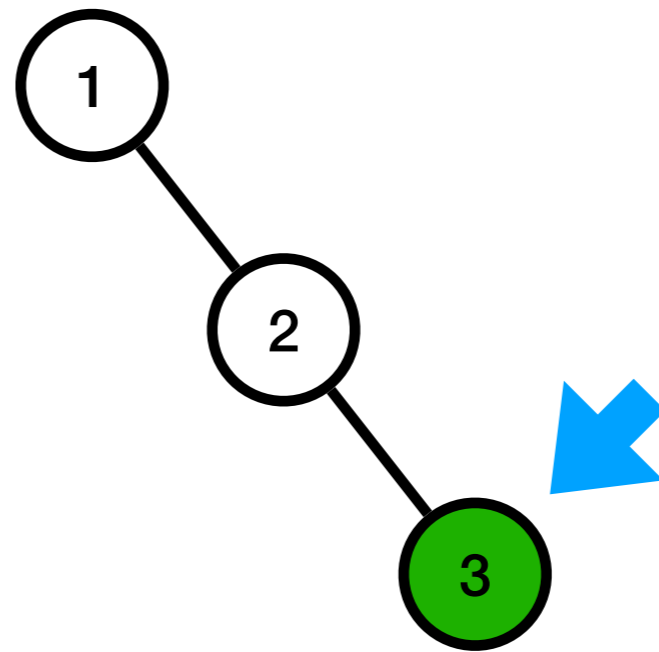
# Insertion dans un ABR



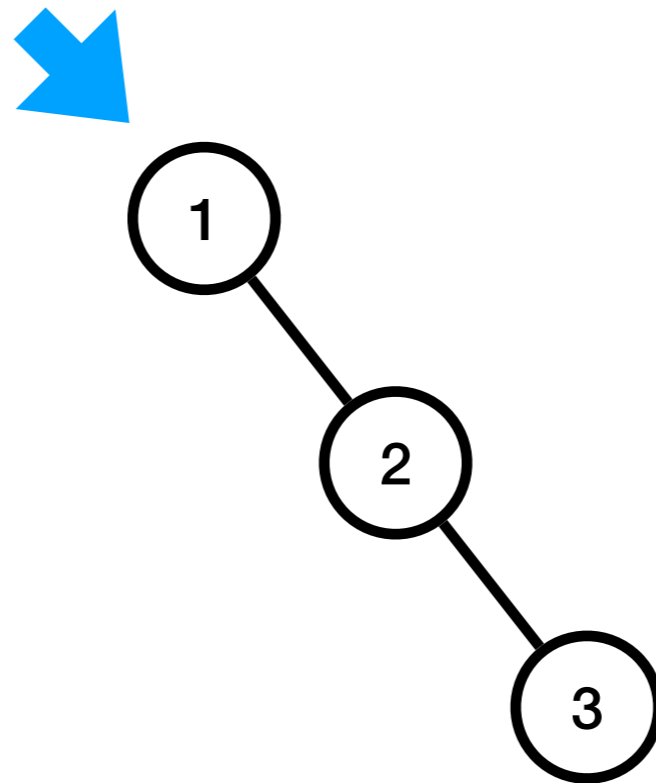
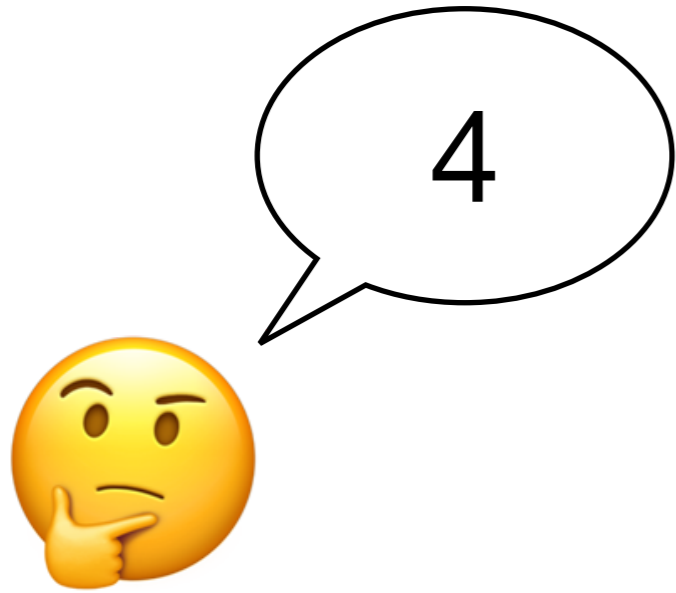
# Insertion dans un ABR



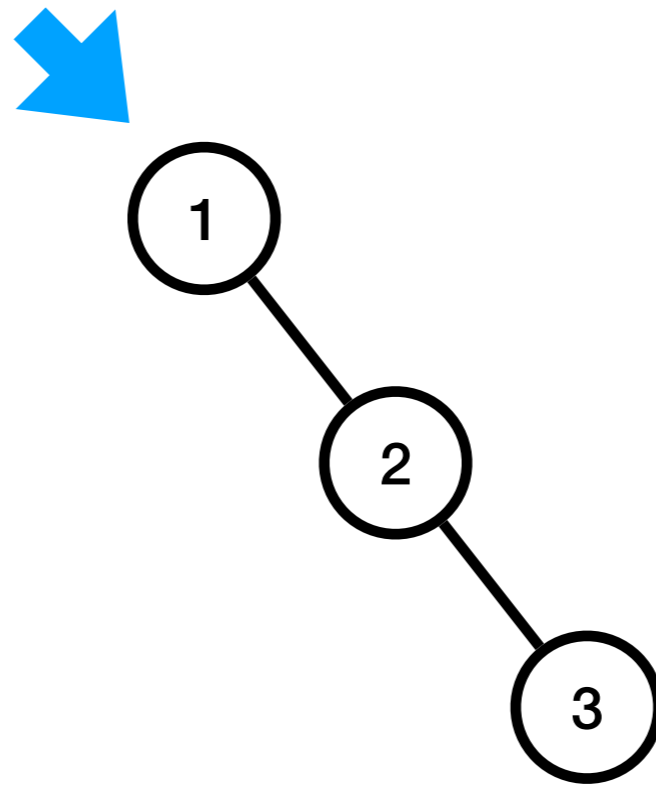
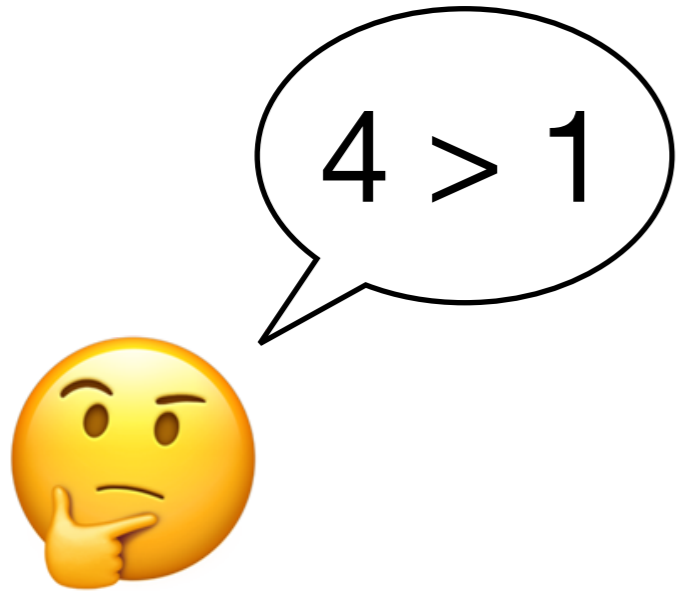
# Insertion dans un ABR



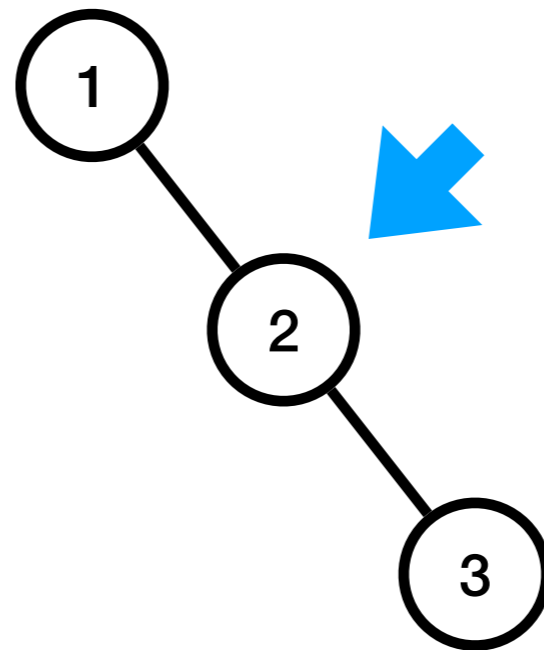
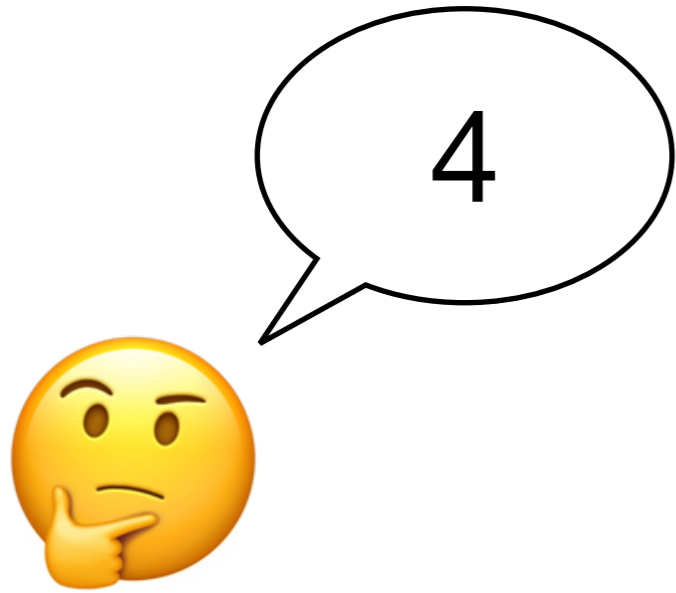
# Insertion dans un ABR



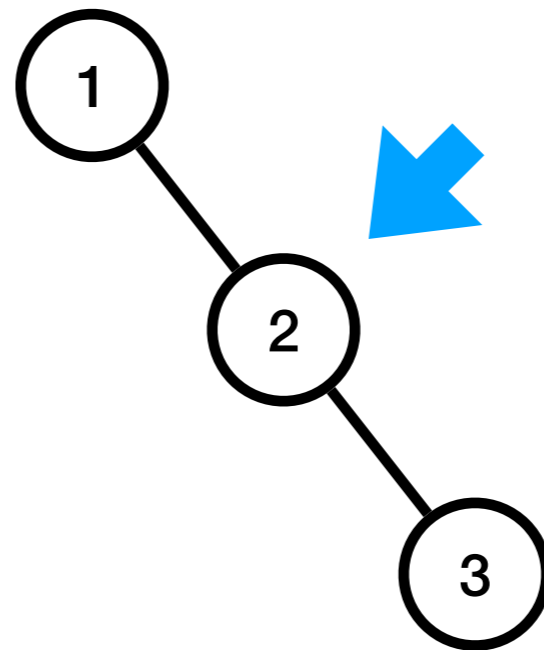
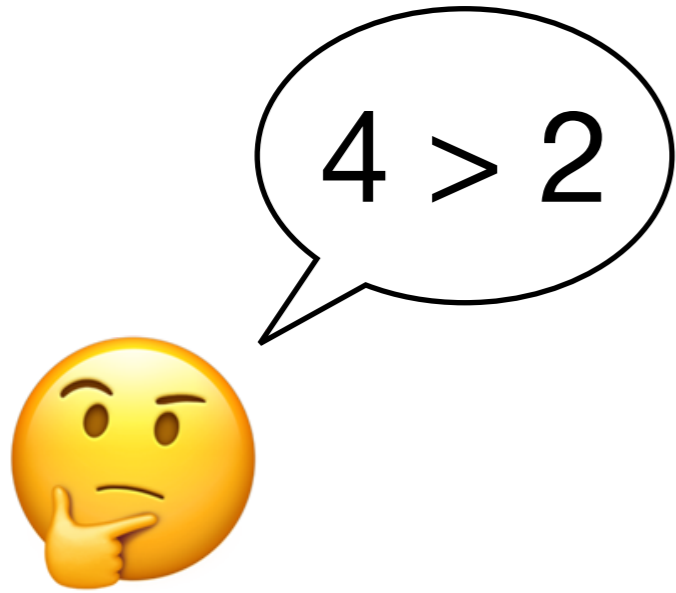
# Insertion dans un ABR



# Insertion dans un ABR

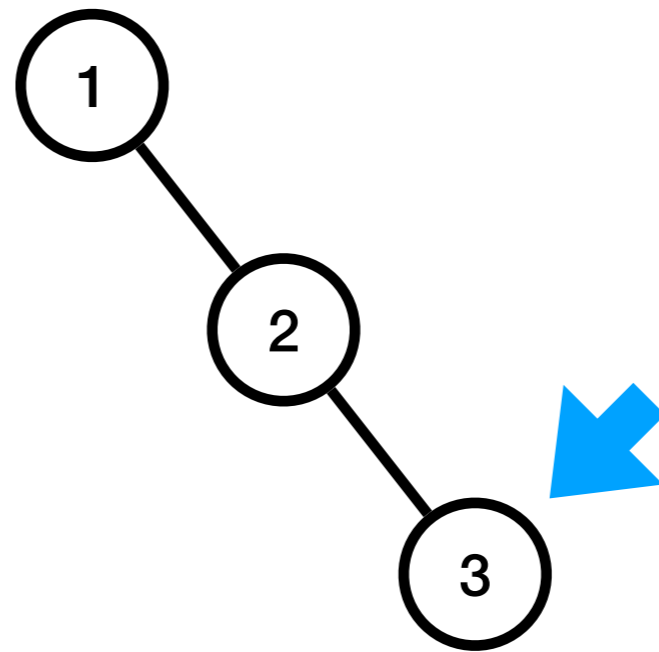
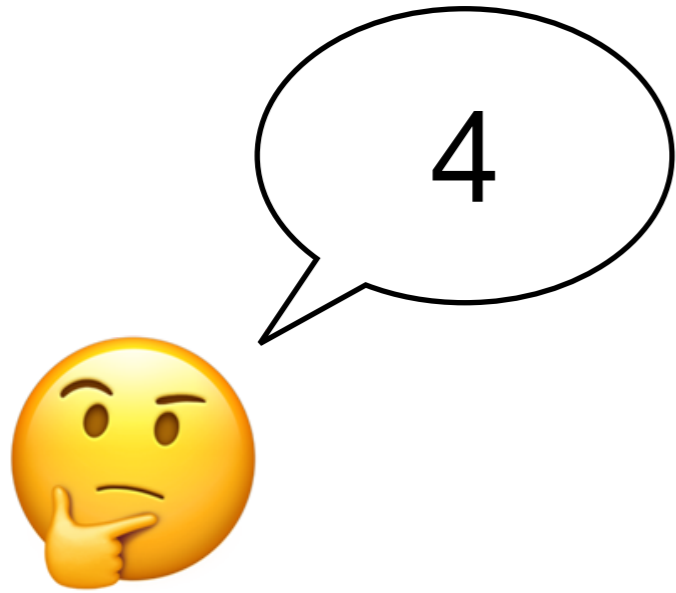


# Insertion dans un ABR

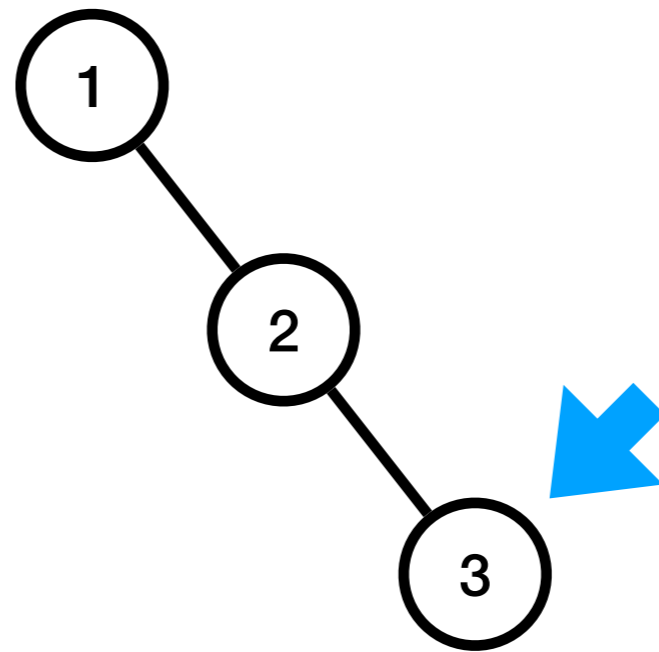
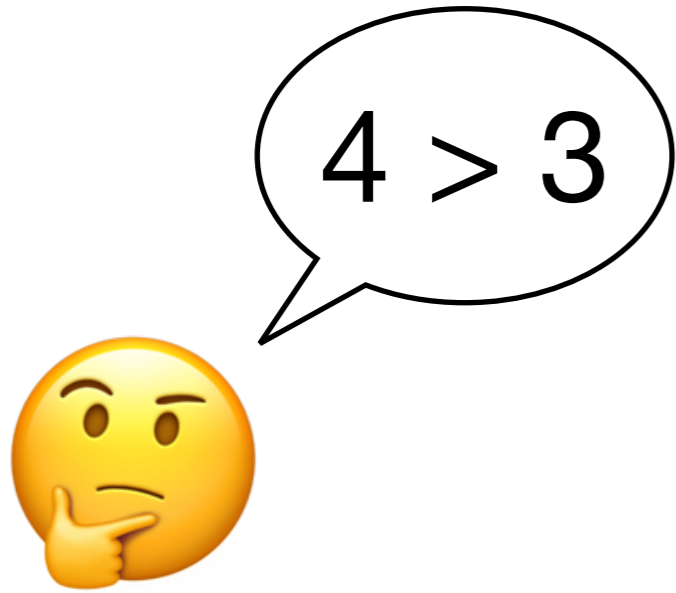




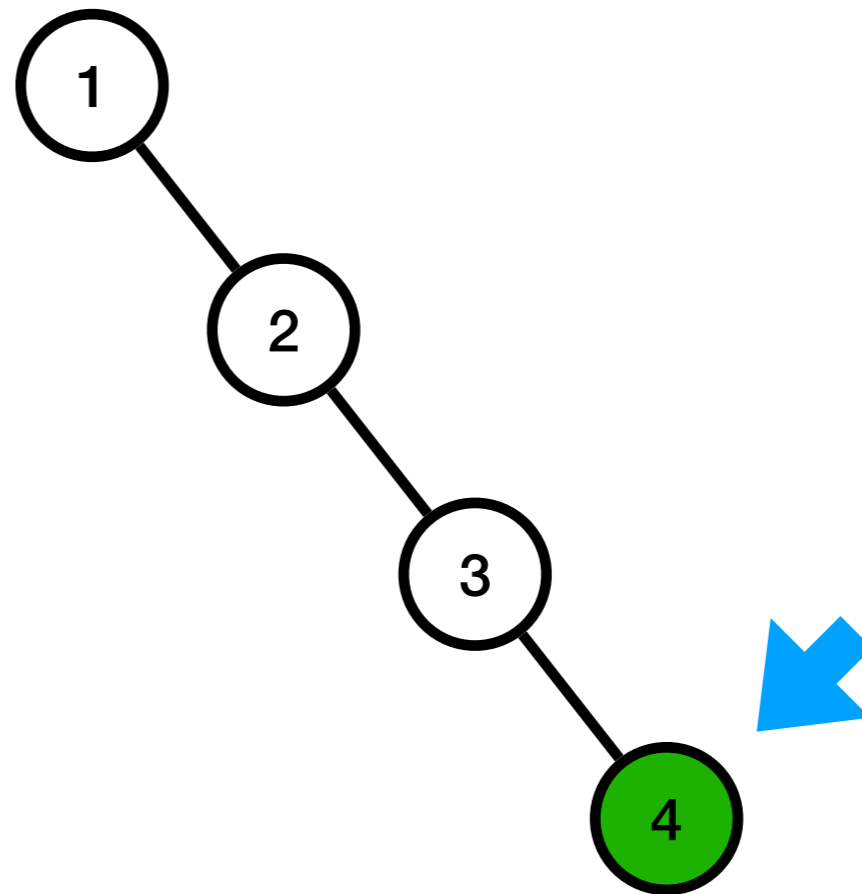
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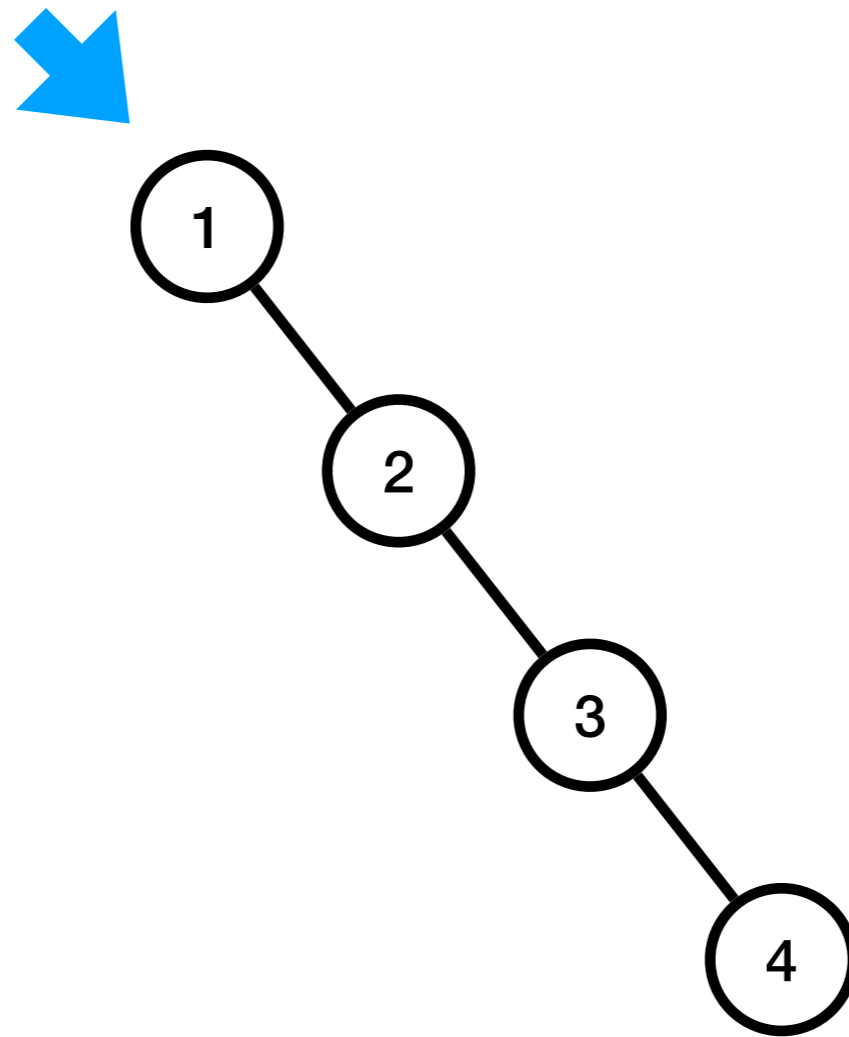
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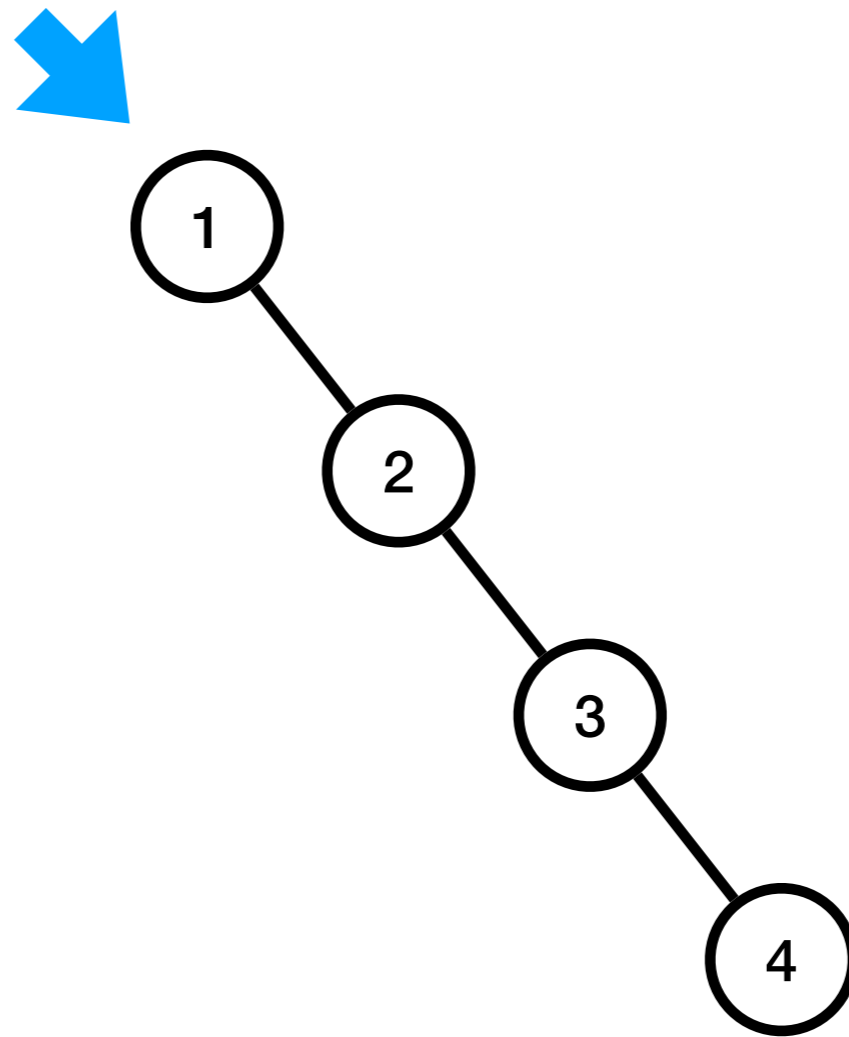
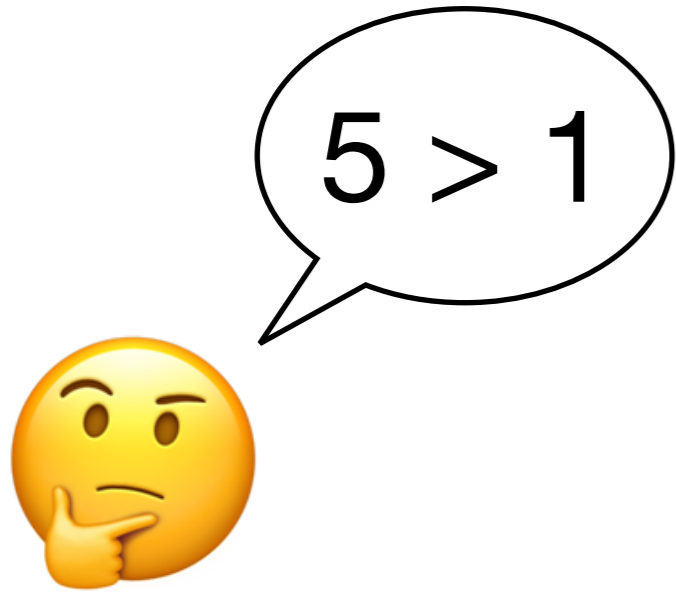
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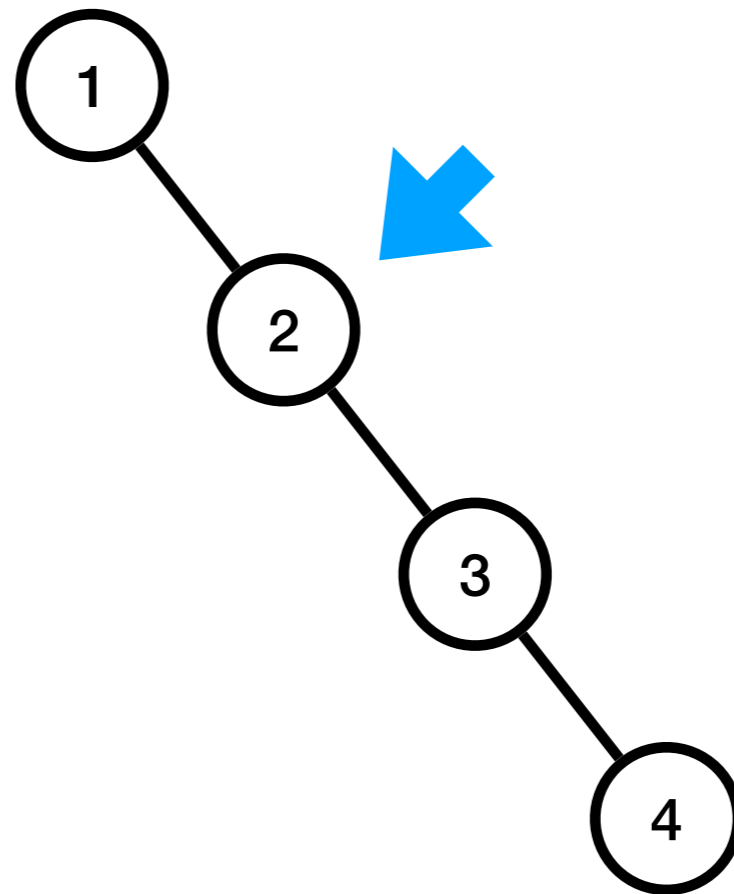
# Insertion dans un ABR



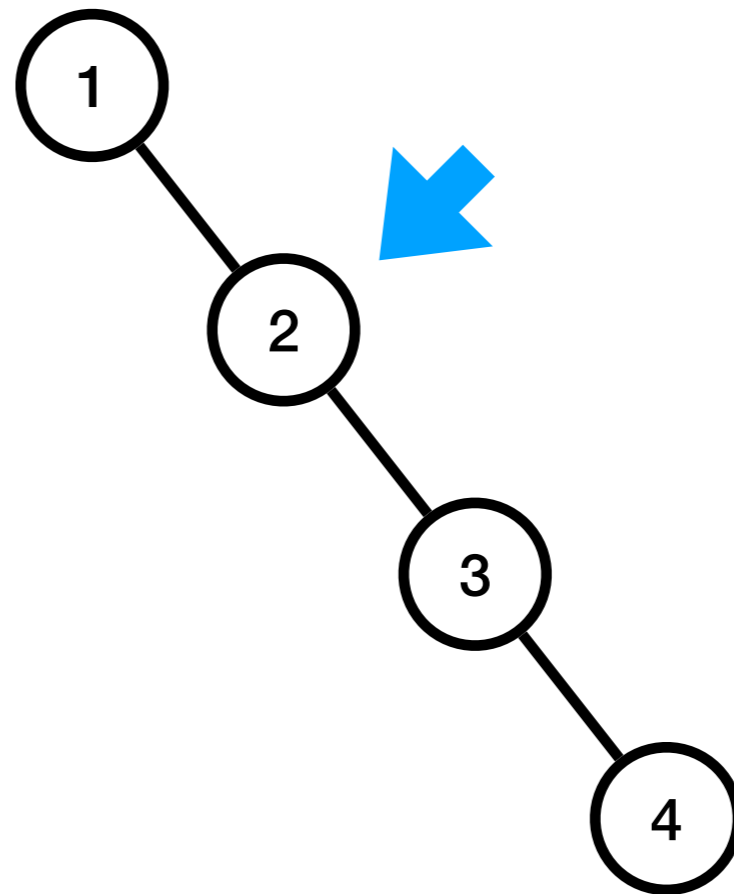
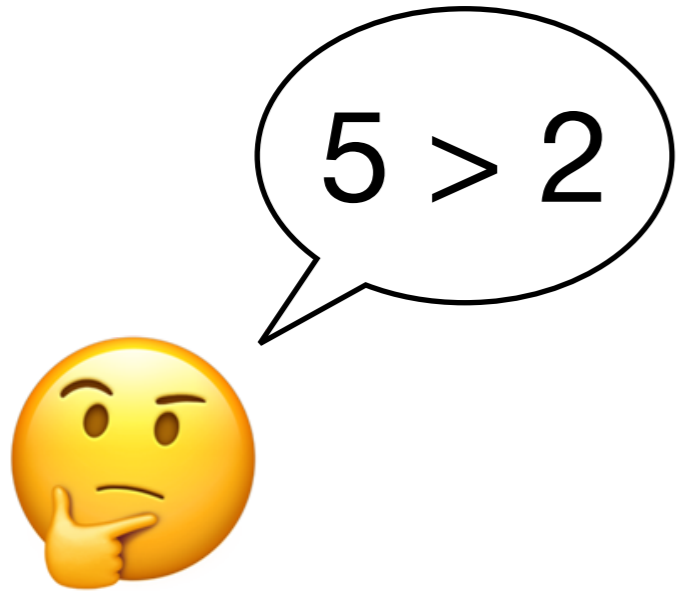
# Insertion dans un ABR



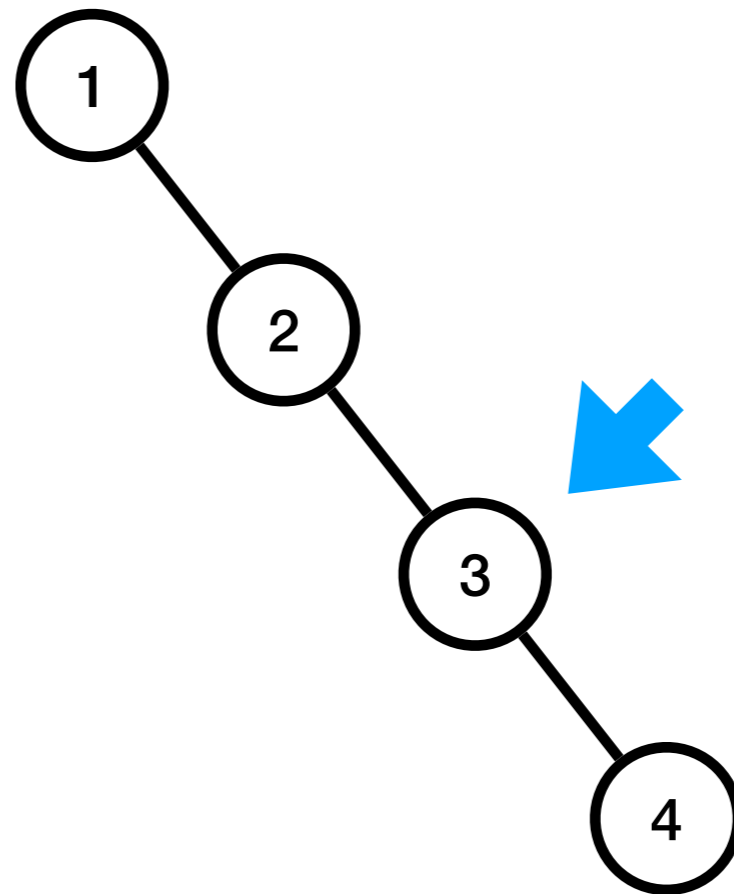
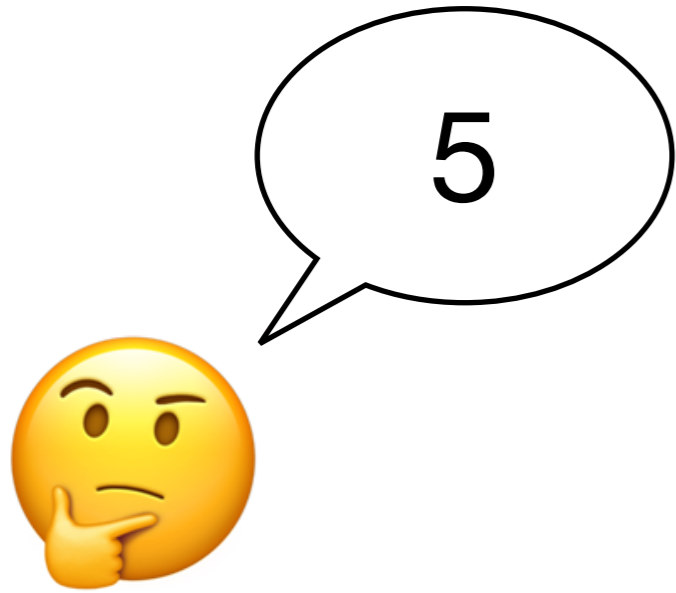
# Insertion dans un ABR



# Insertion dans un ABR

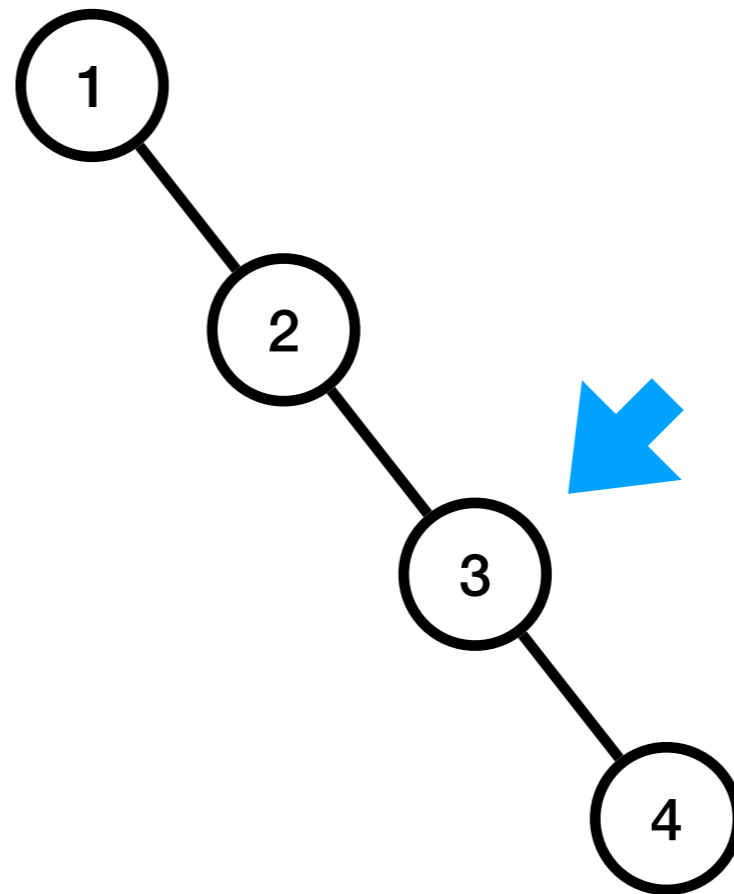
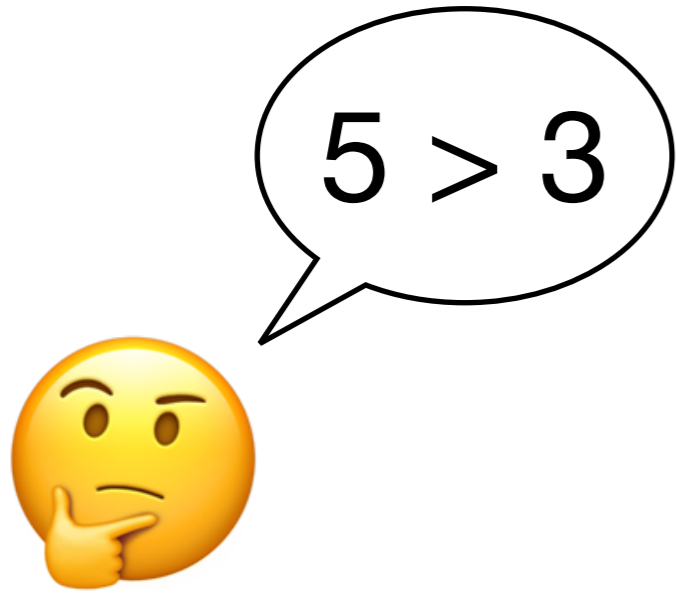


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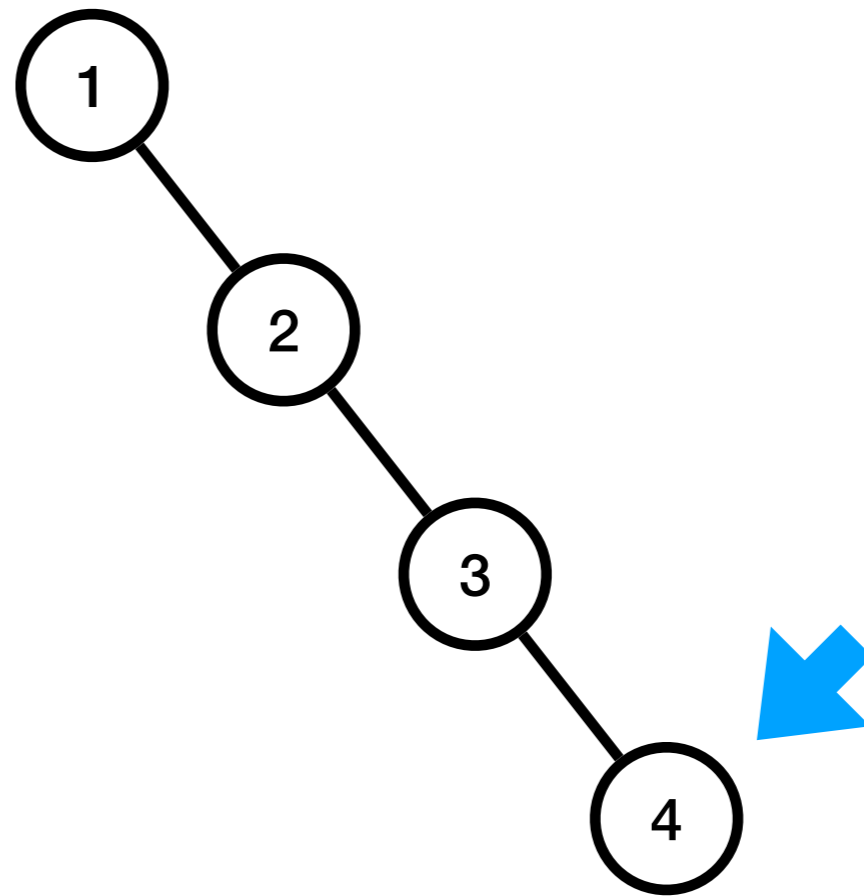
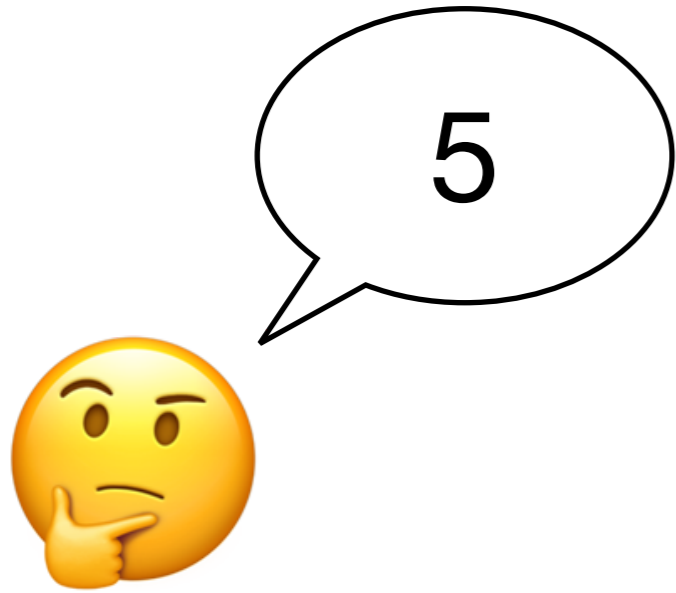




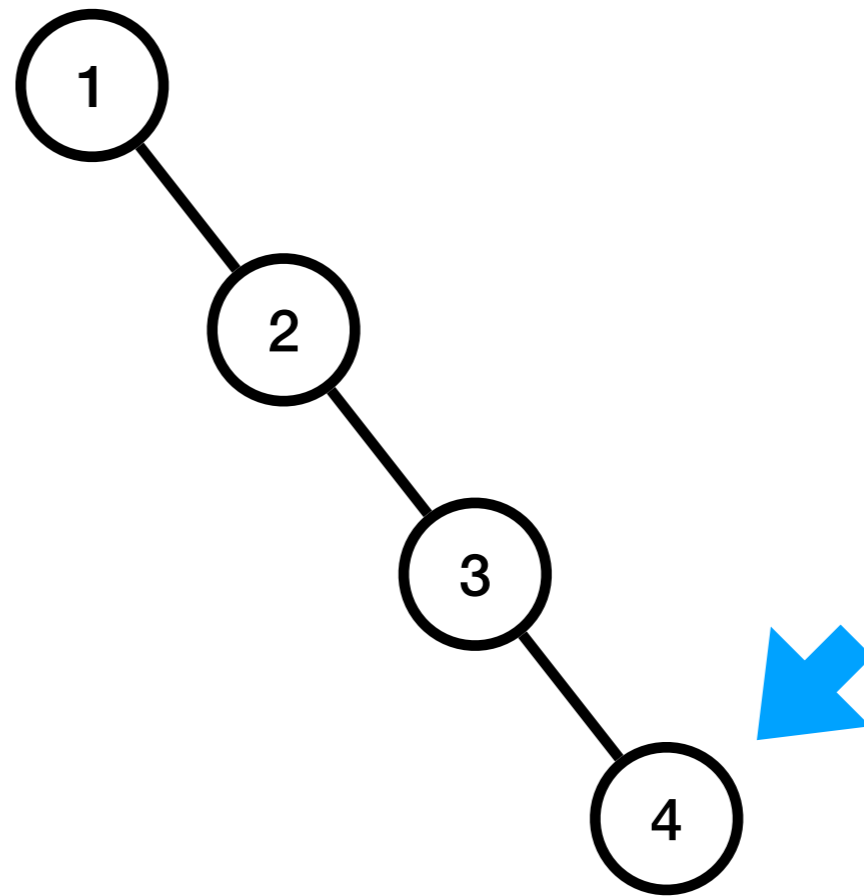
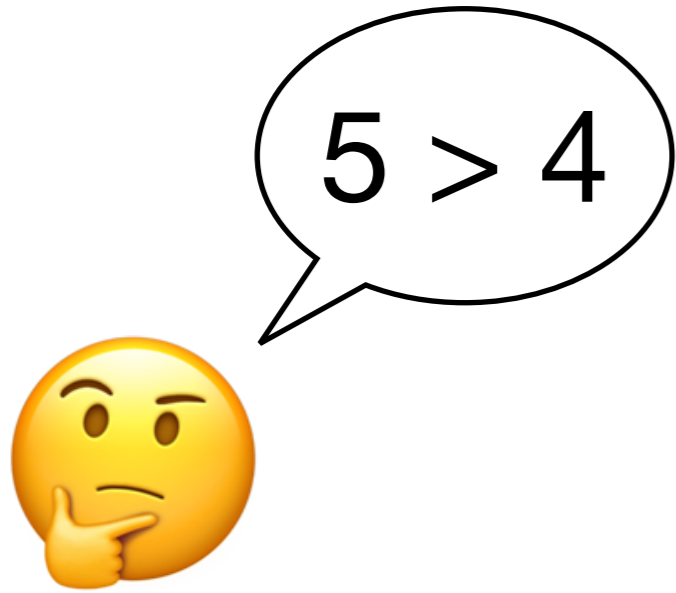
# Insertion dans un ABR



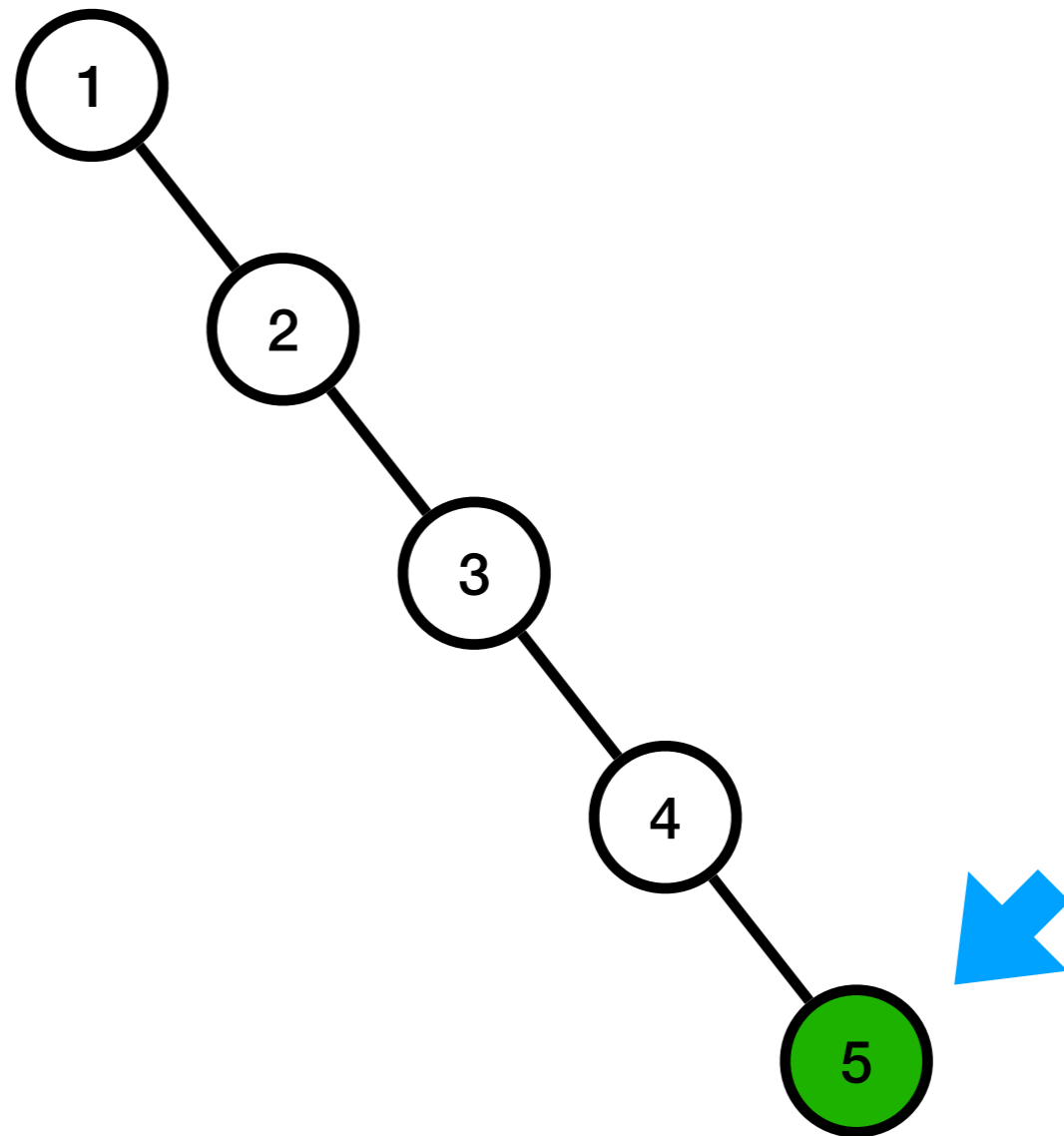
# Insertion dans un ABR



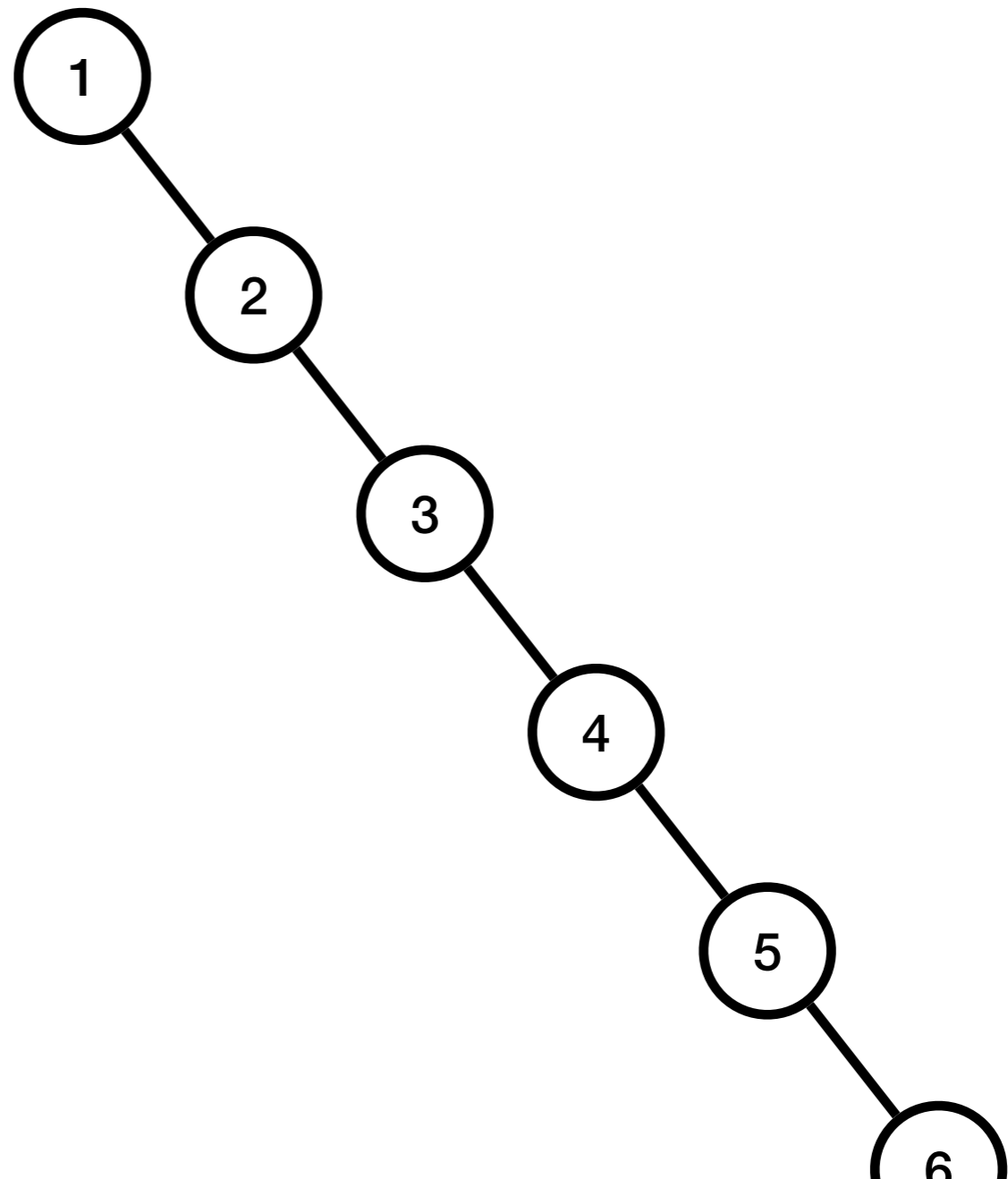
# Insertion dans un ABR



# Insertion dans un ABR



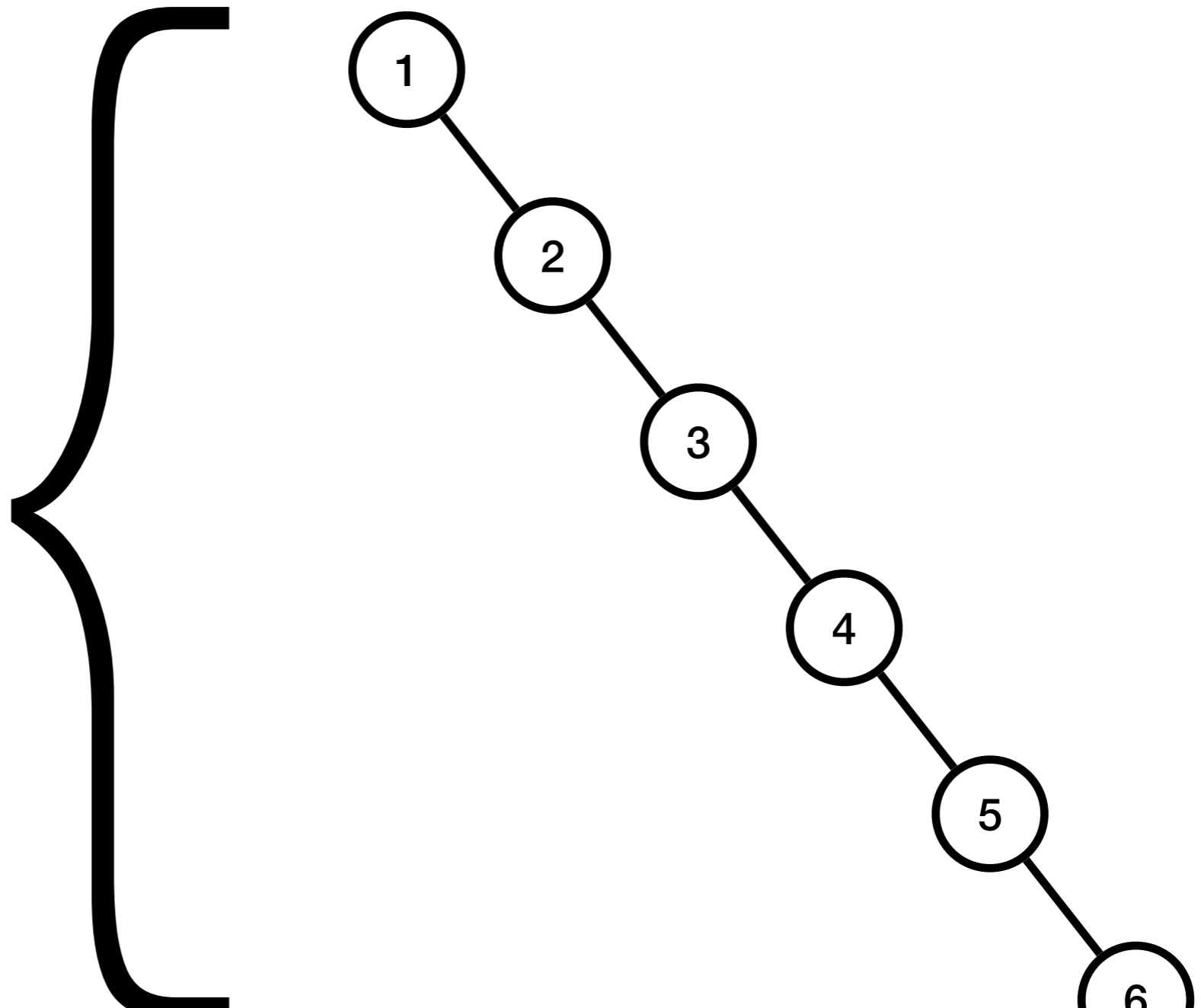
# Insertion dans un ABR



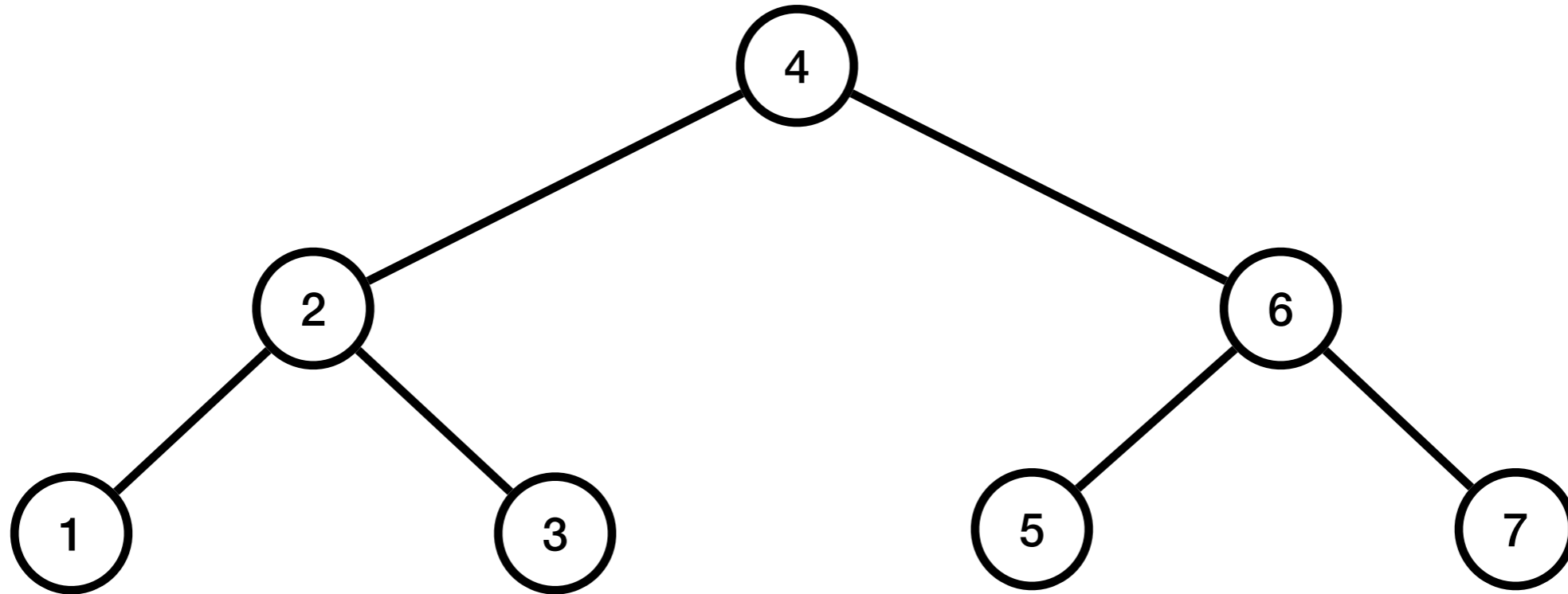
# Insertion dans un ABR



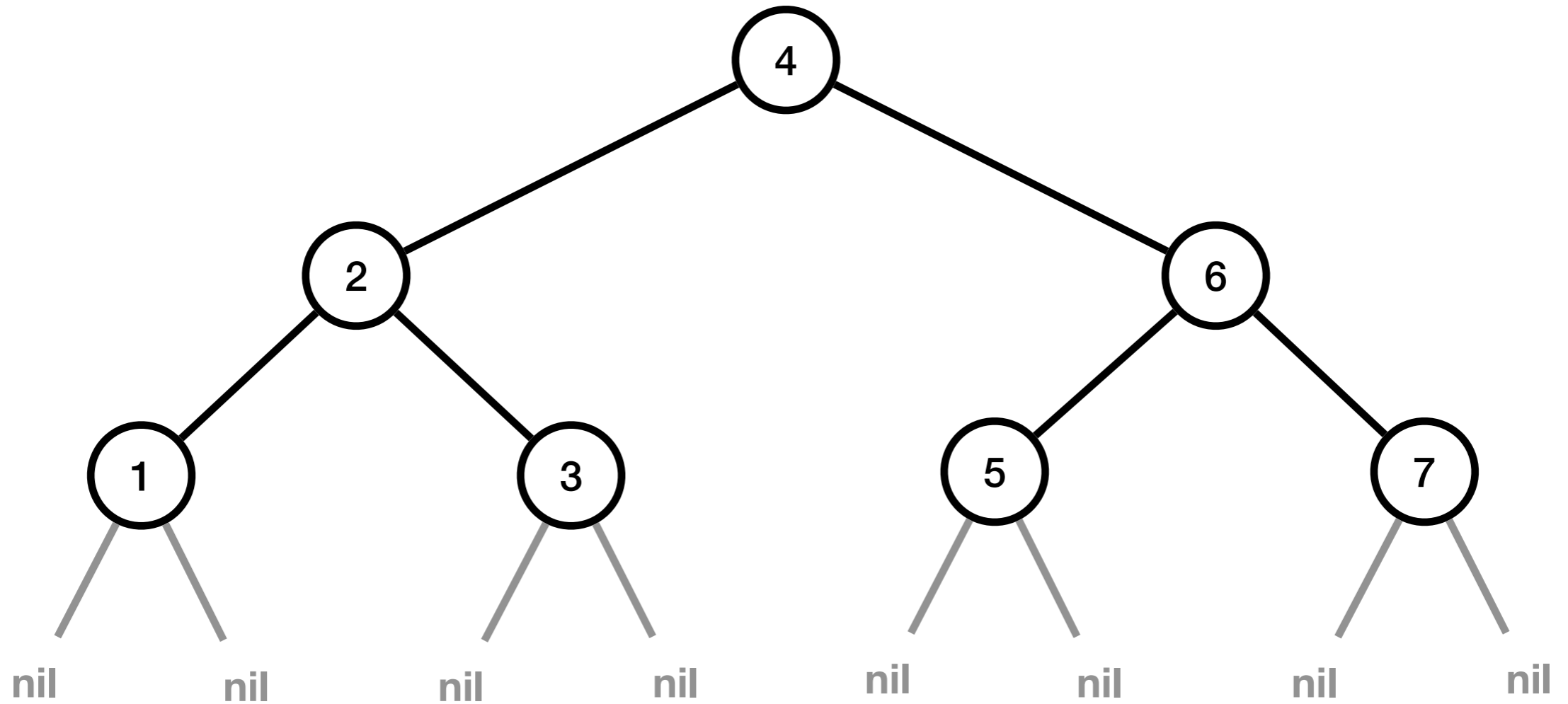
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# Parcours infixe d'ABR

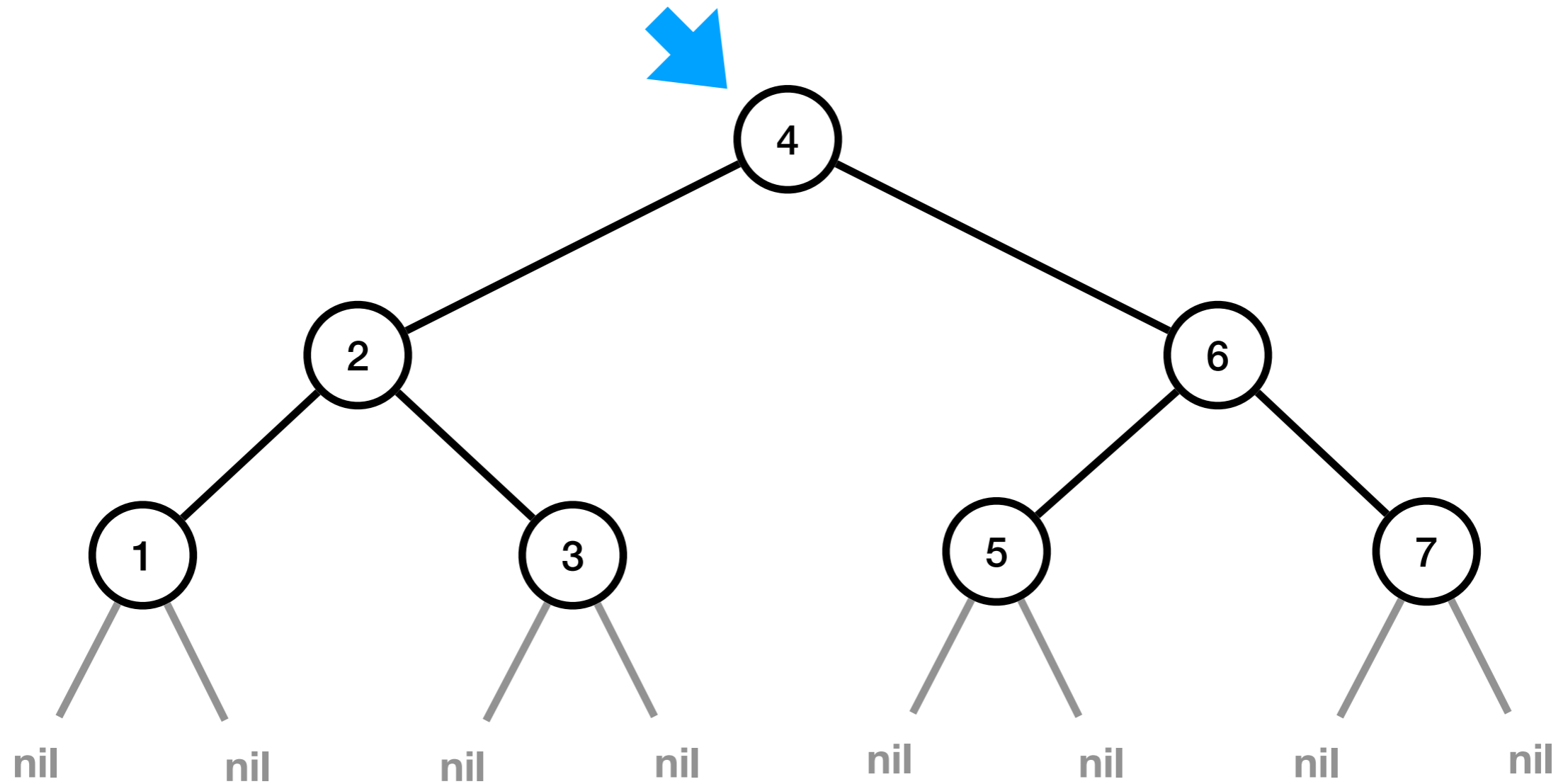


# Parcours infixe d'ABR

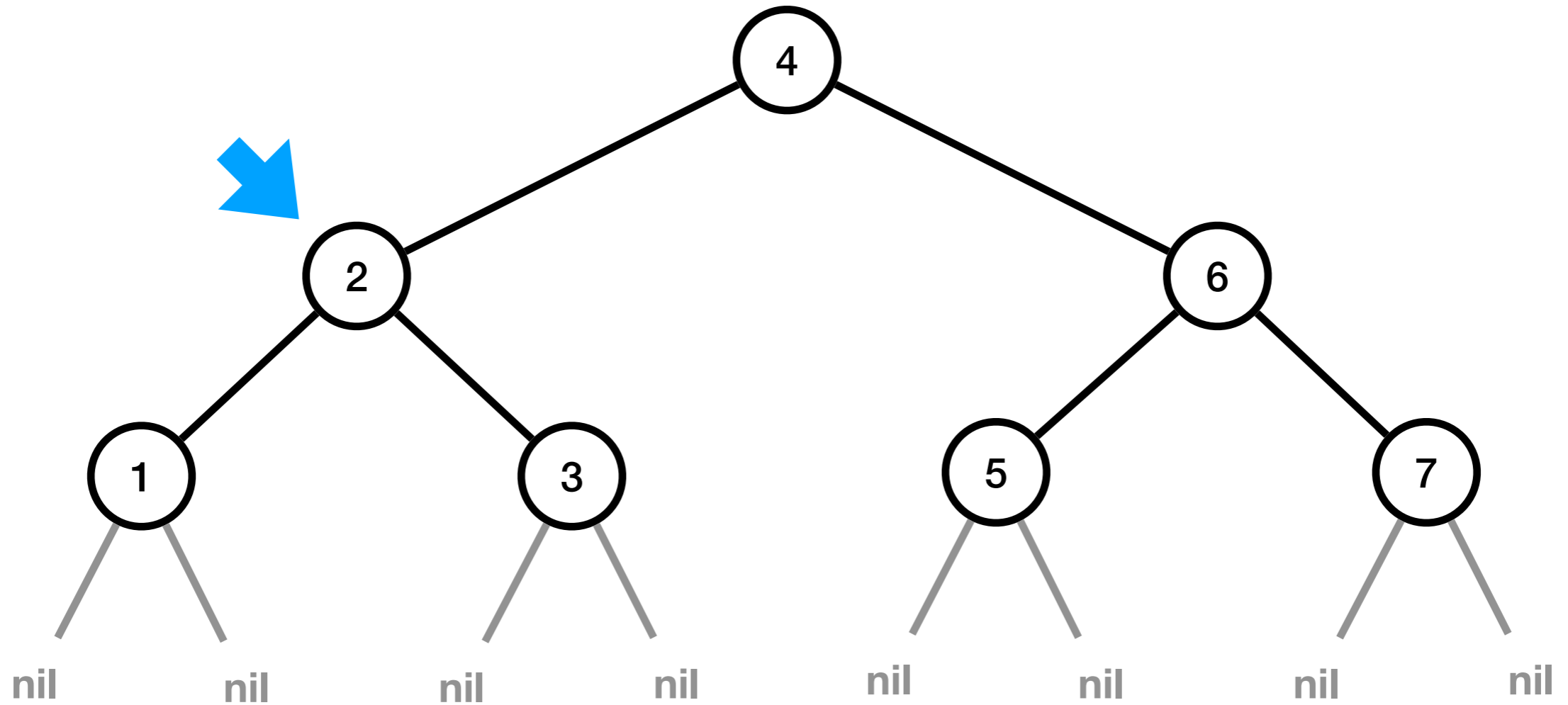




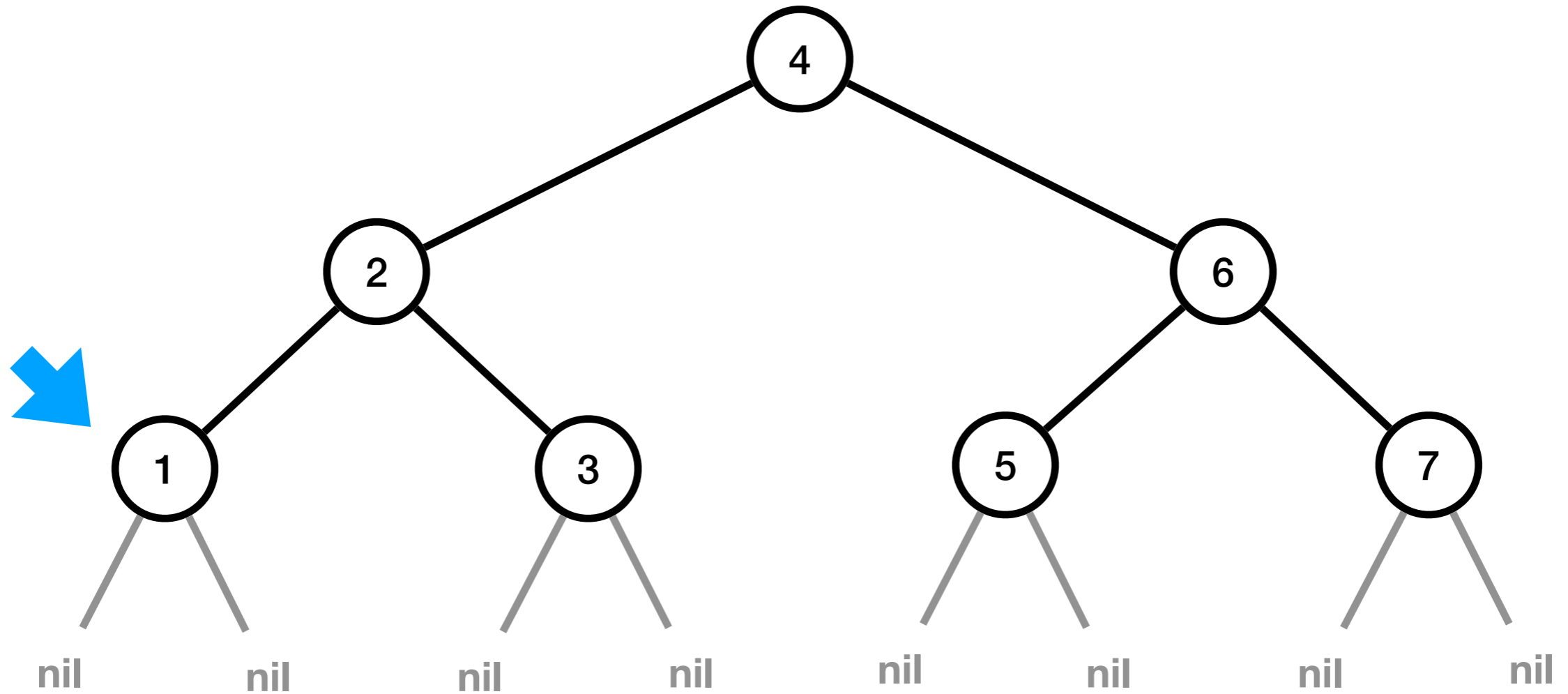
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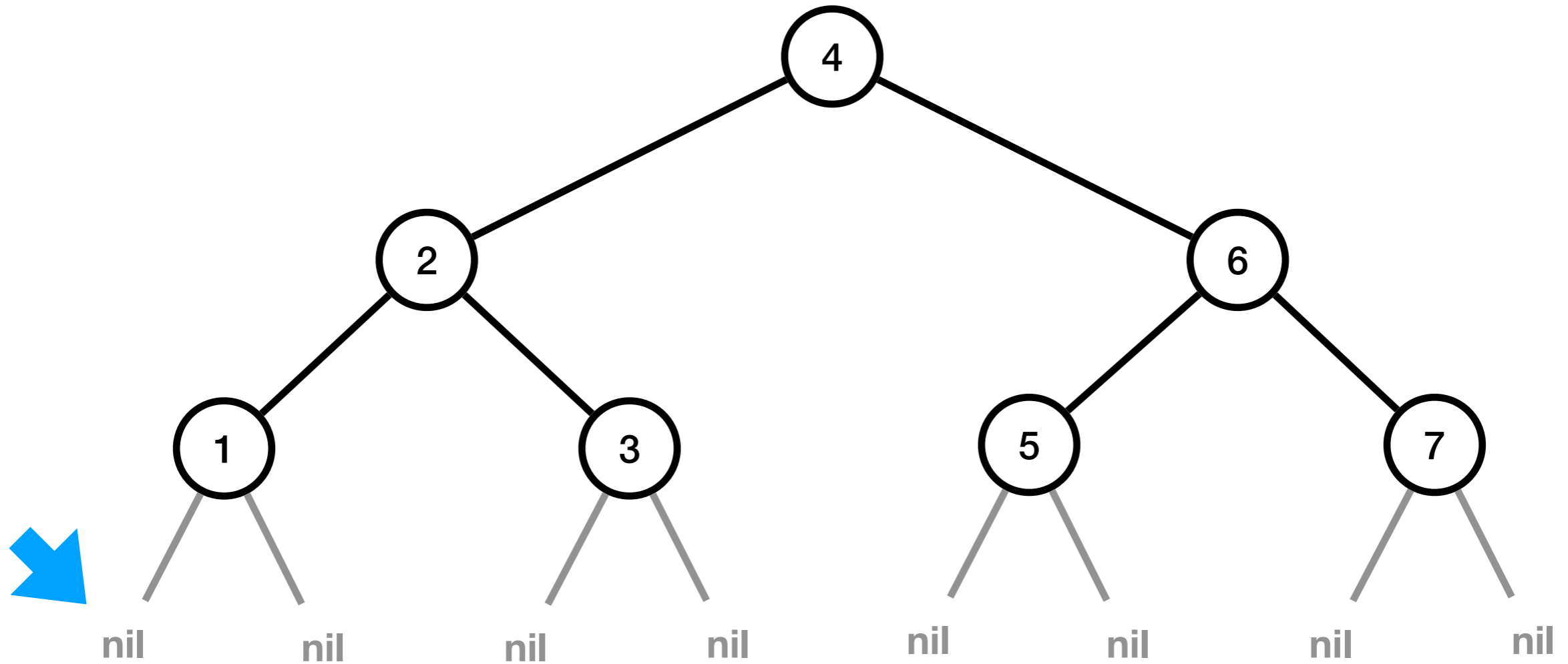
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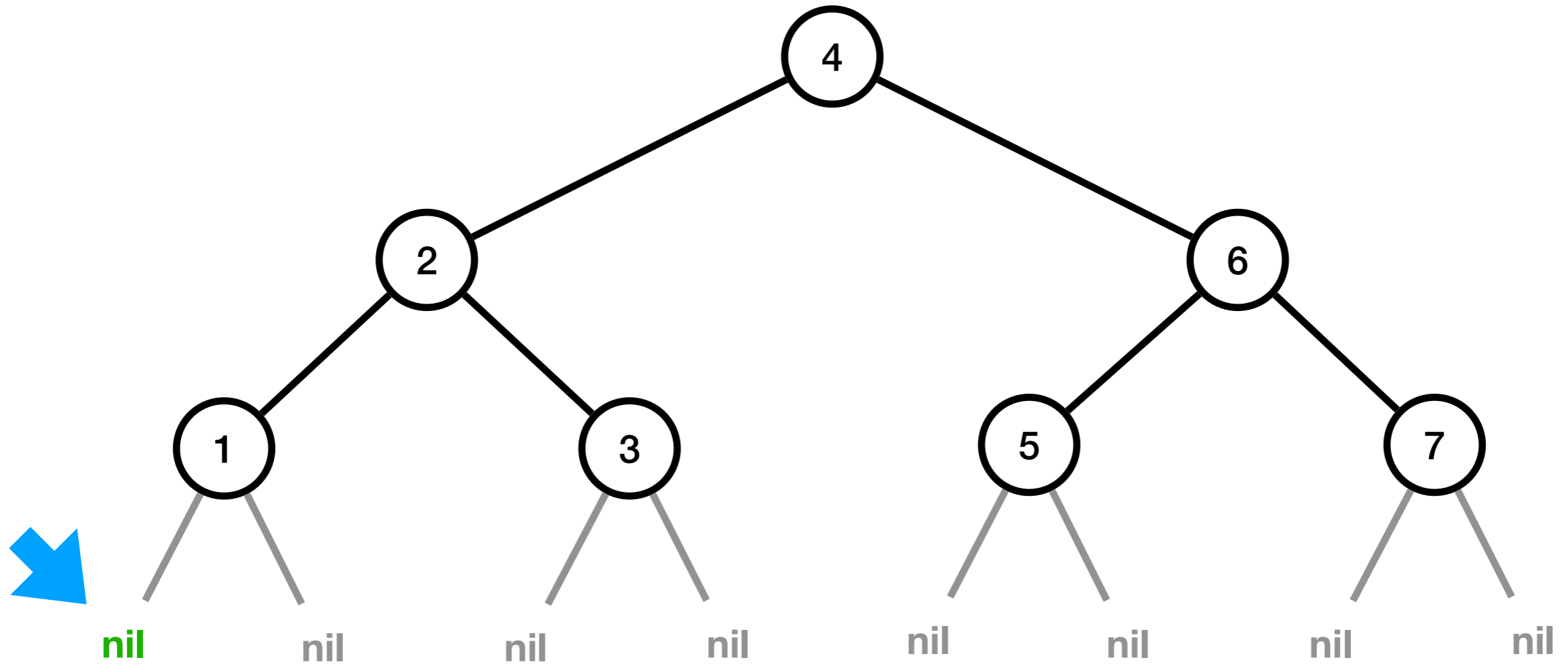
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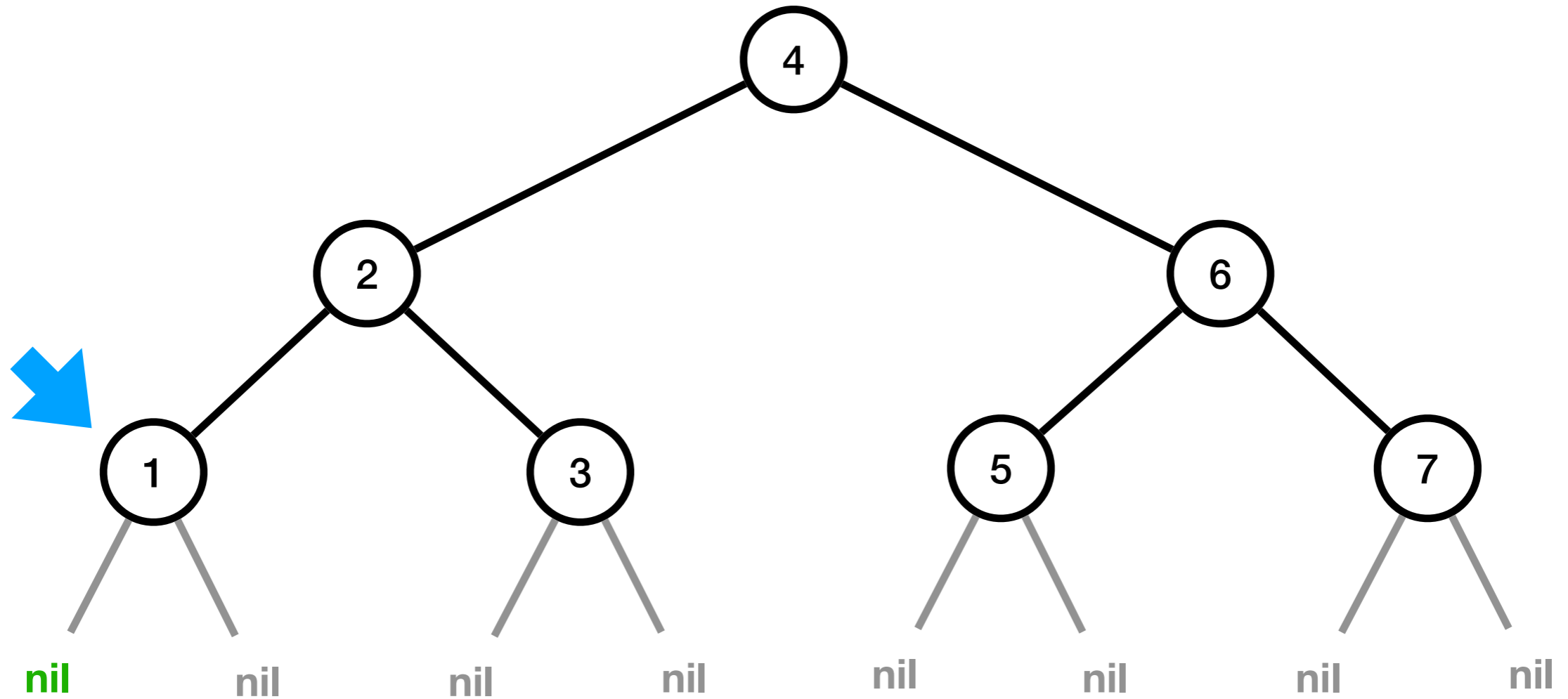
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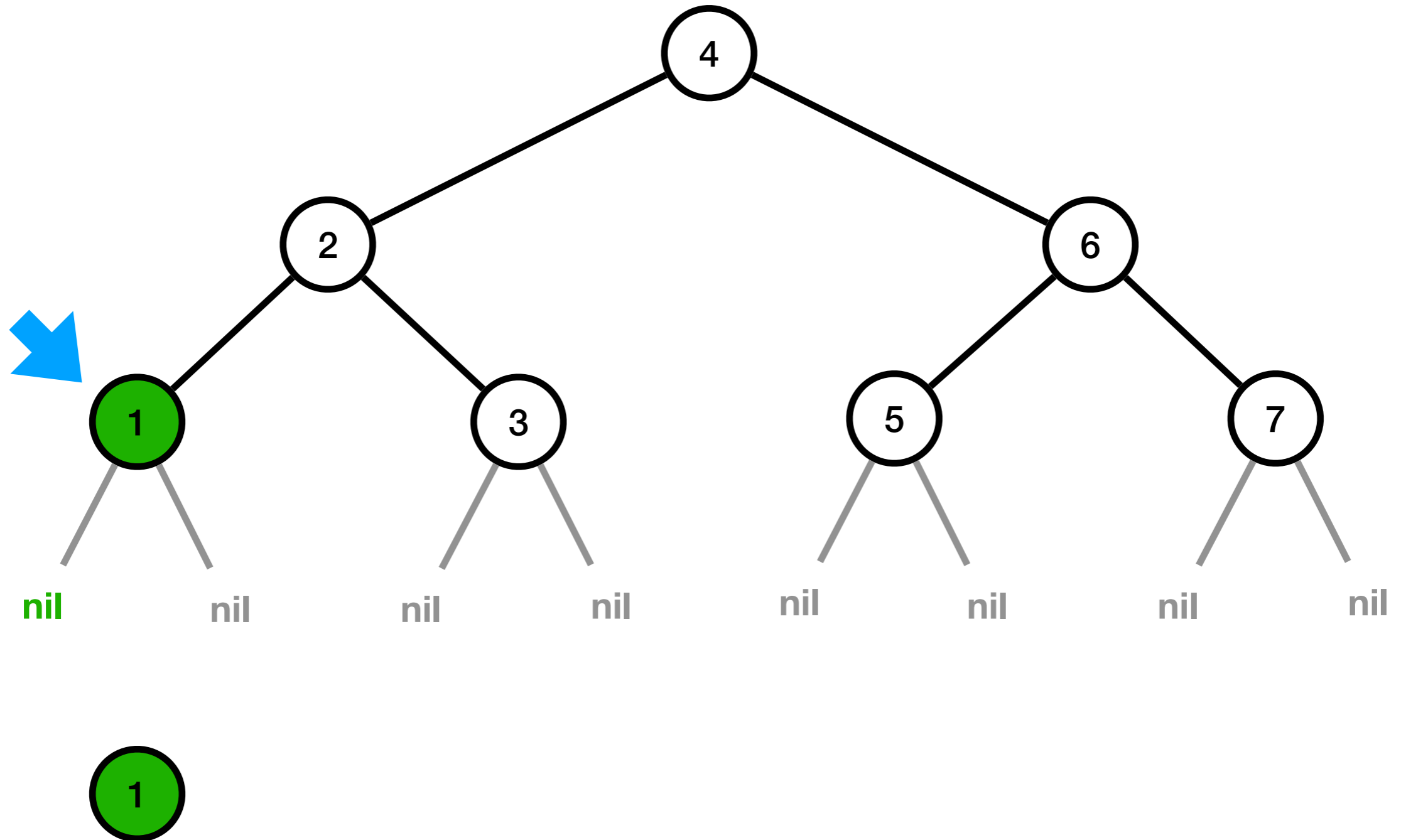
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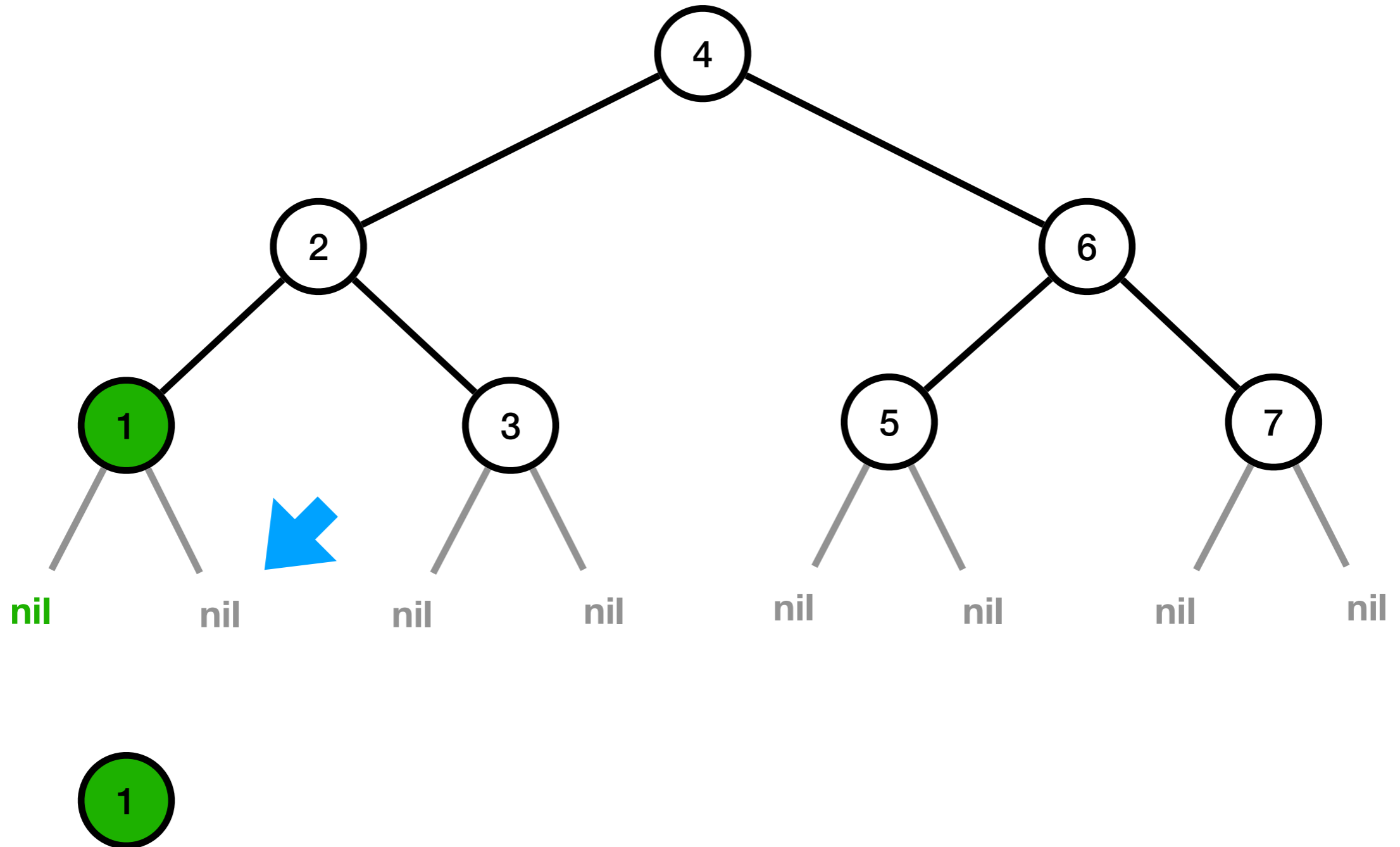
# Parcours infixe d'ABR



# Parcours infixe d'ABR

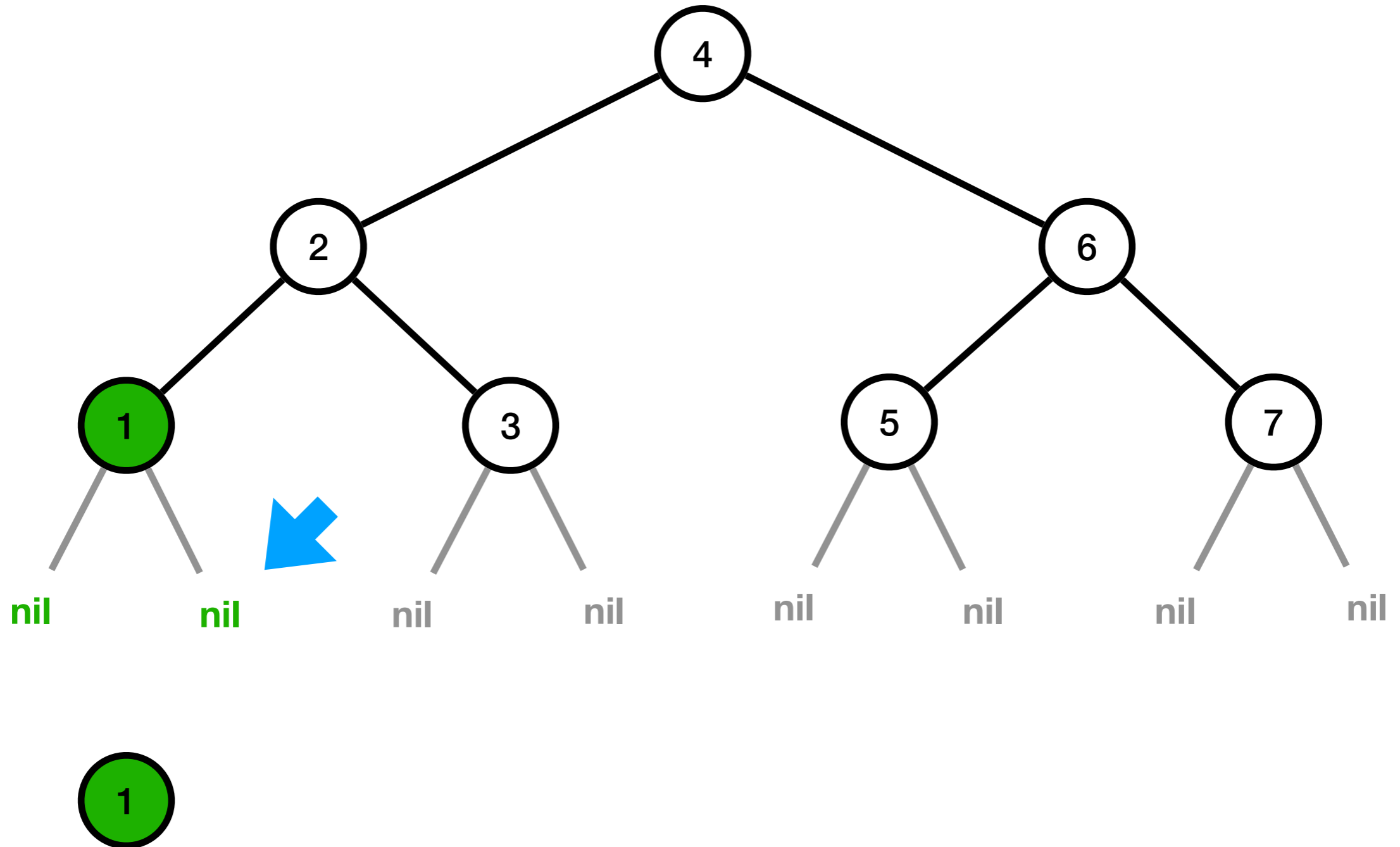


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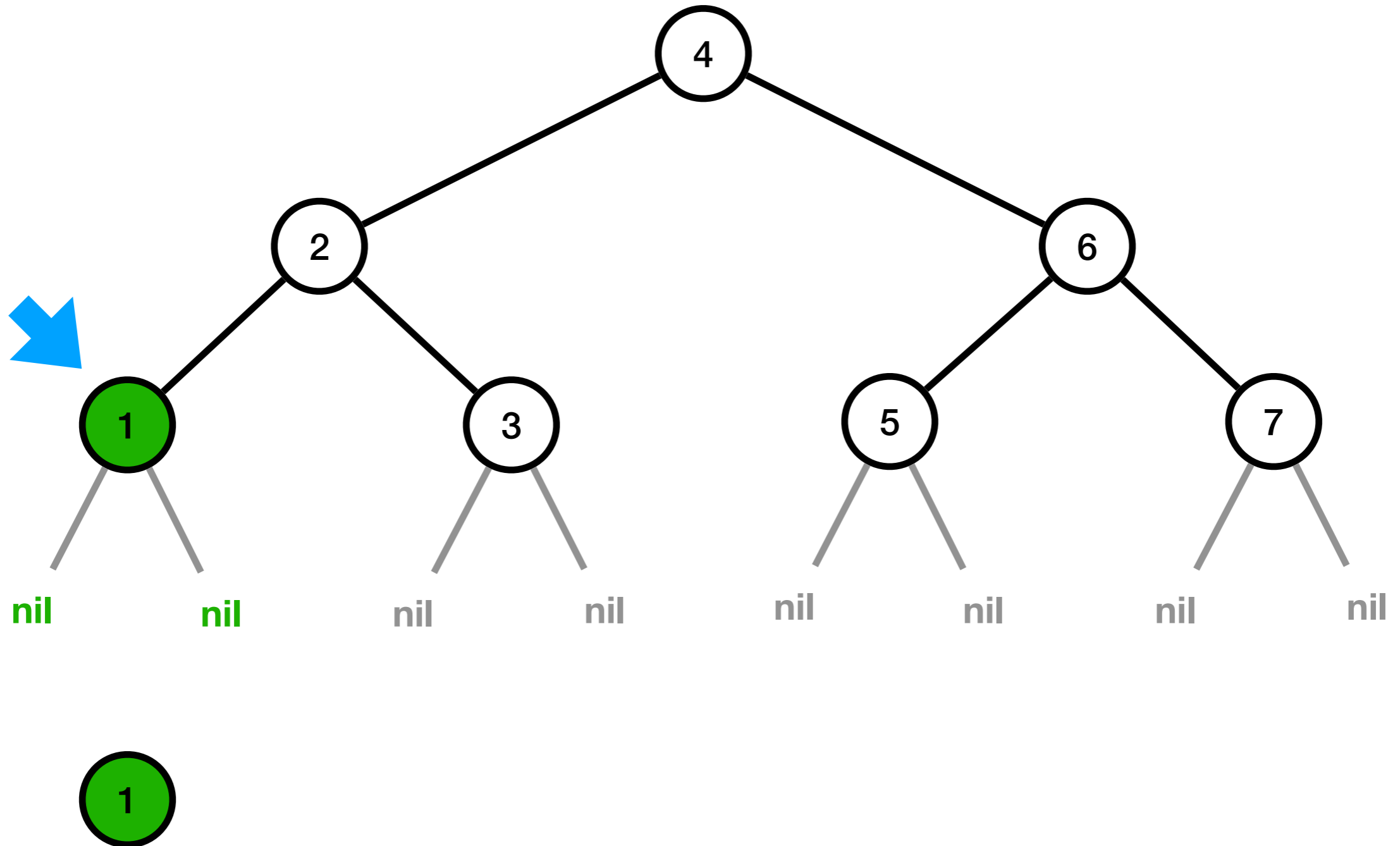




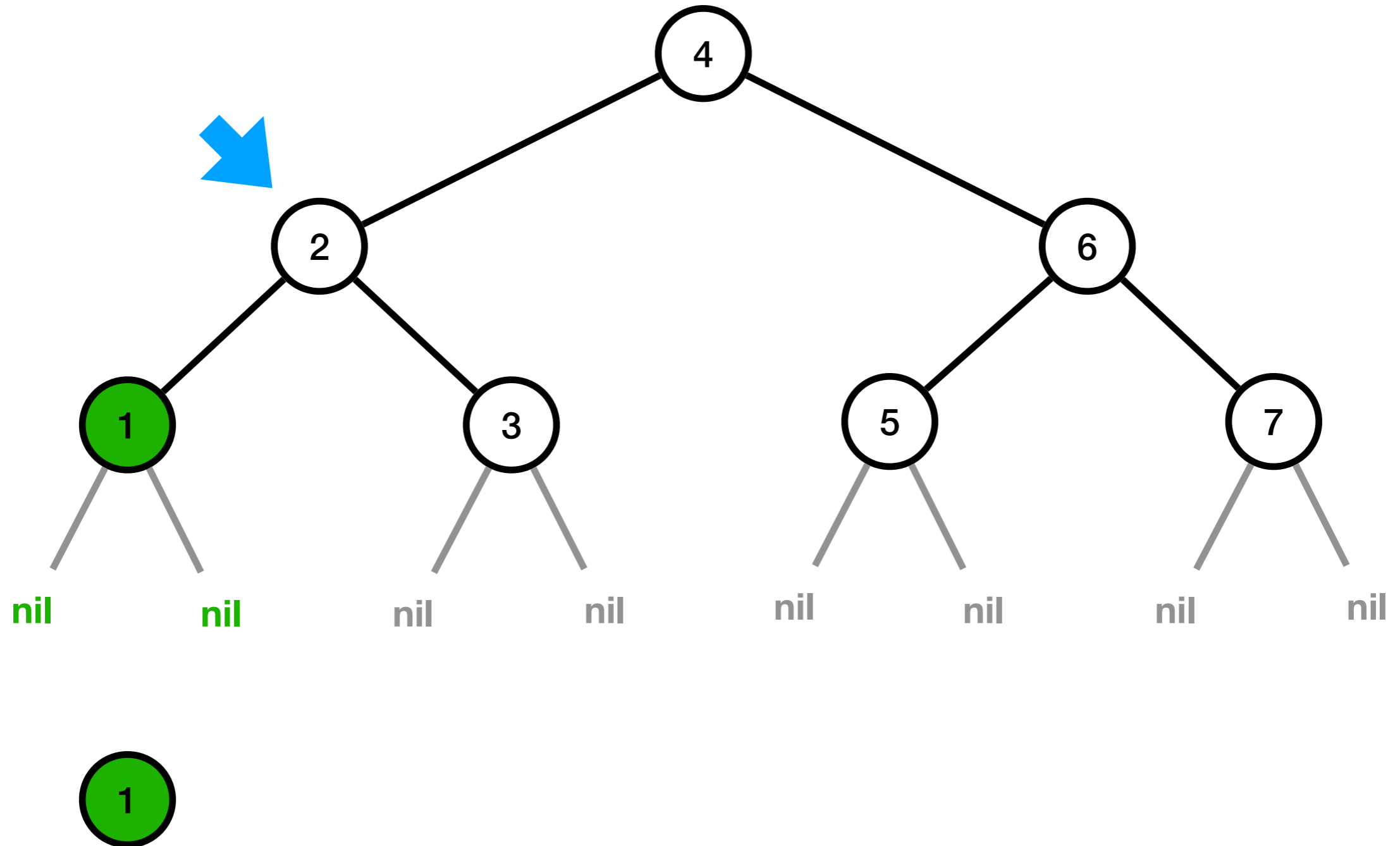
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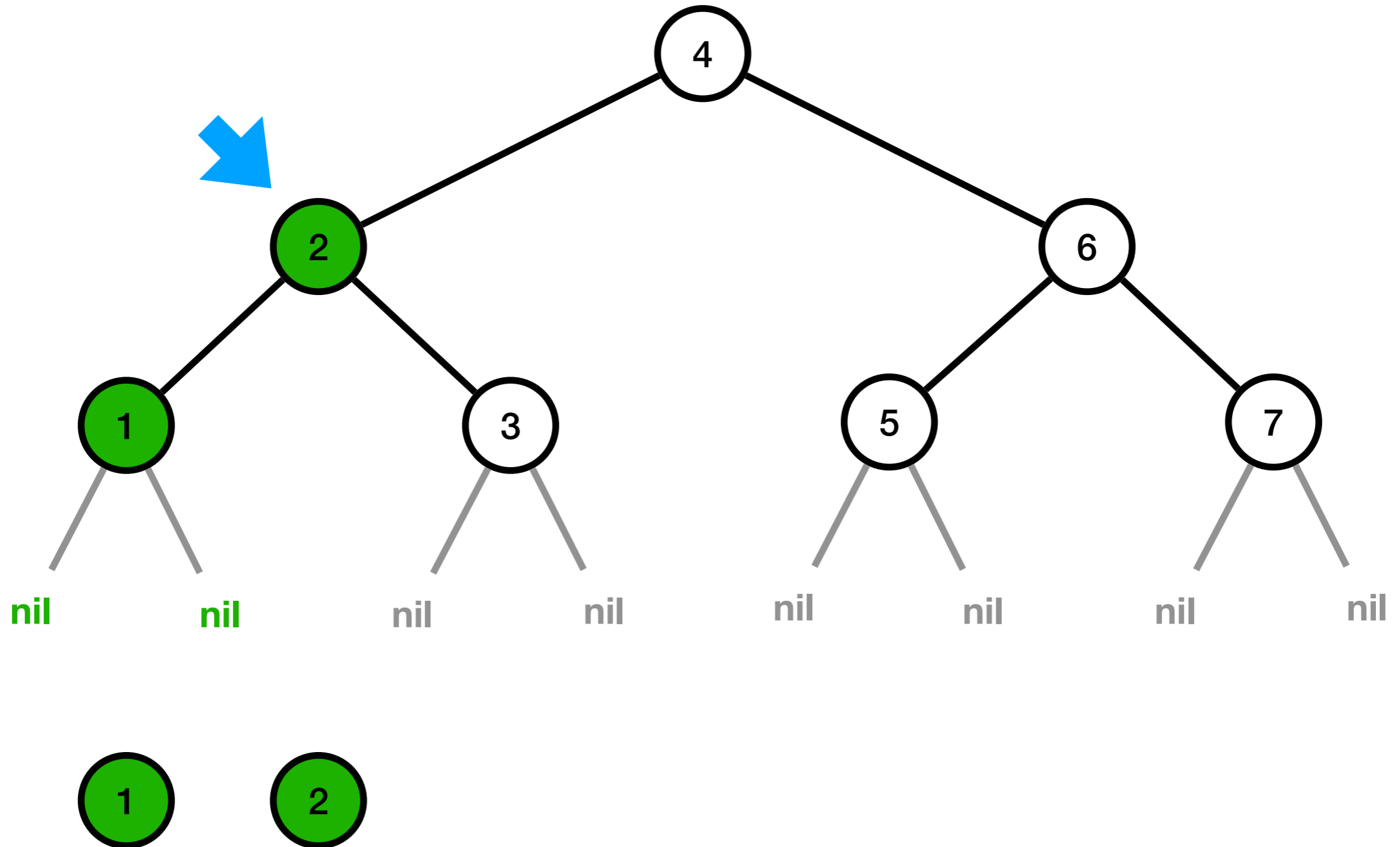
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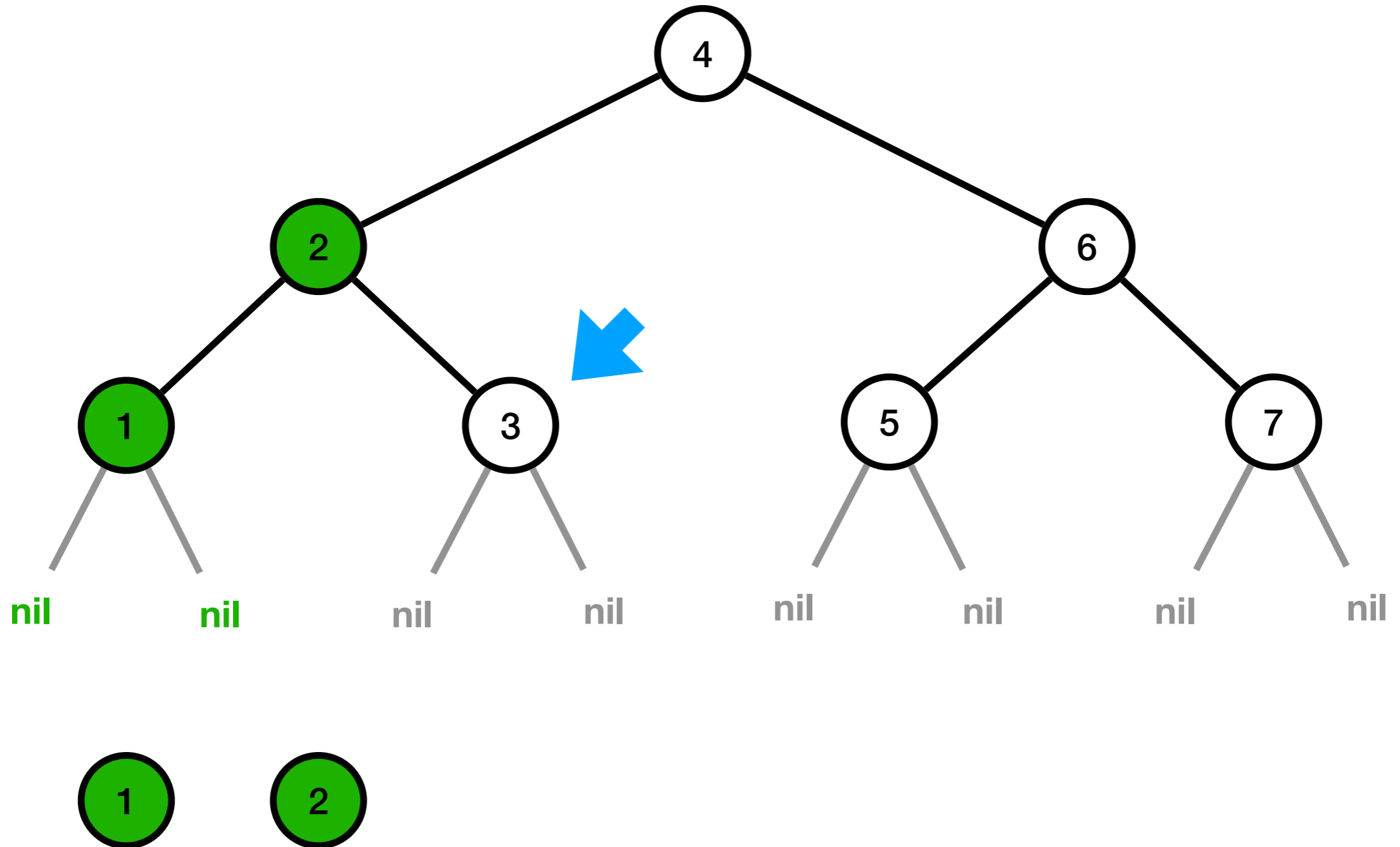
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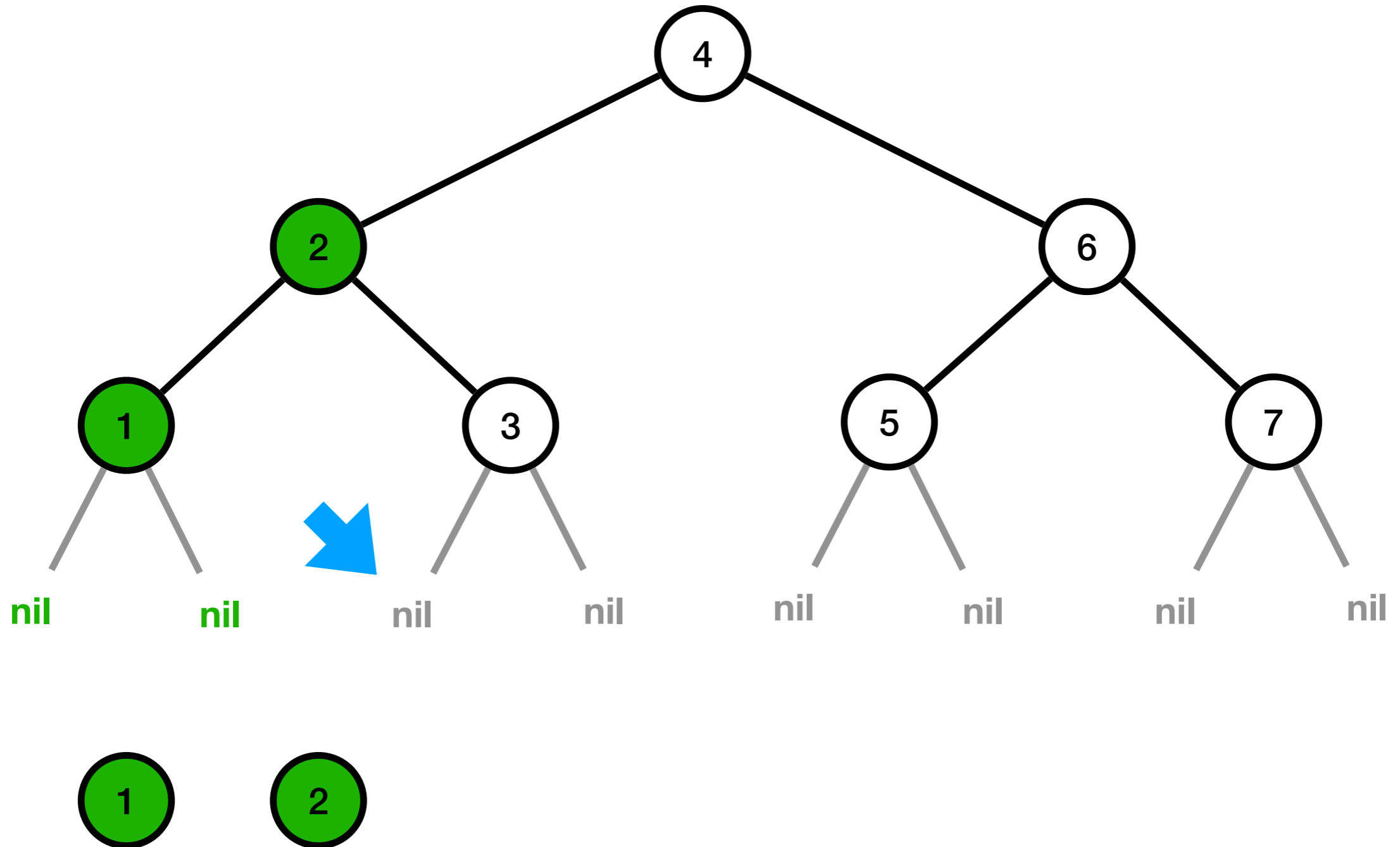
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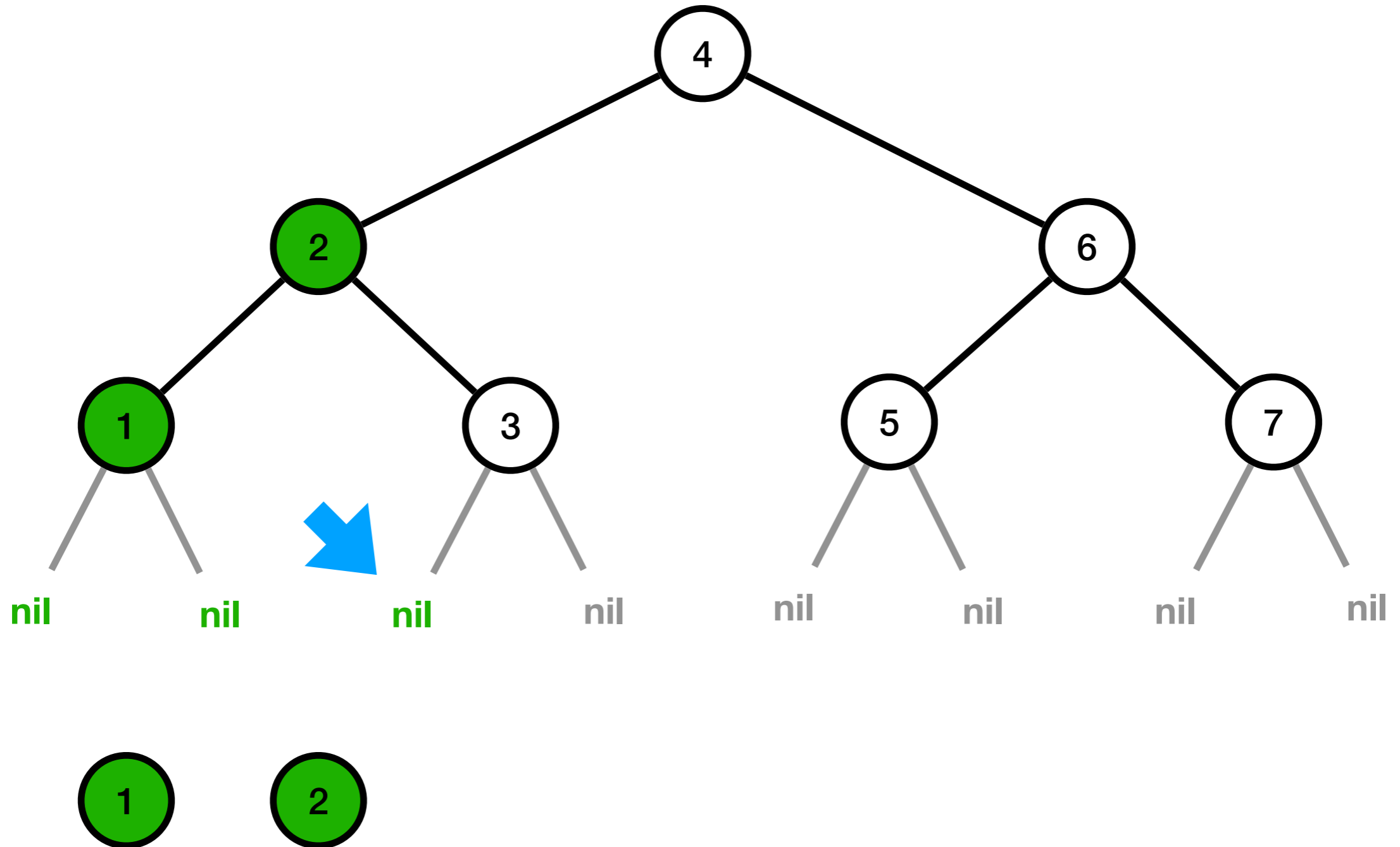
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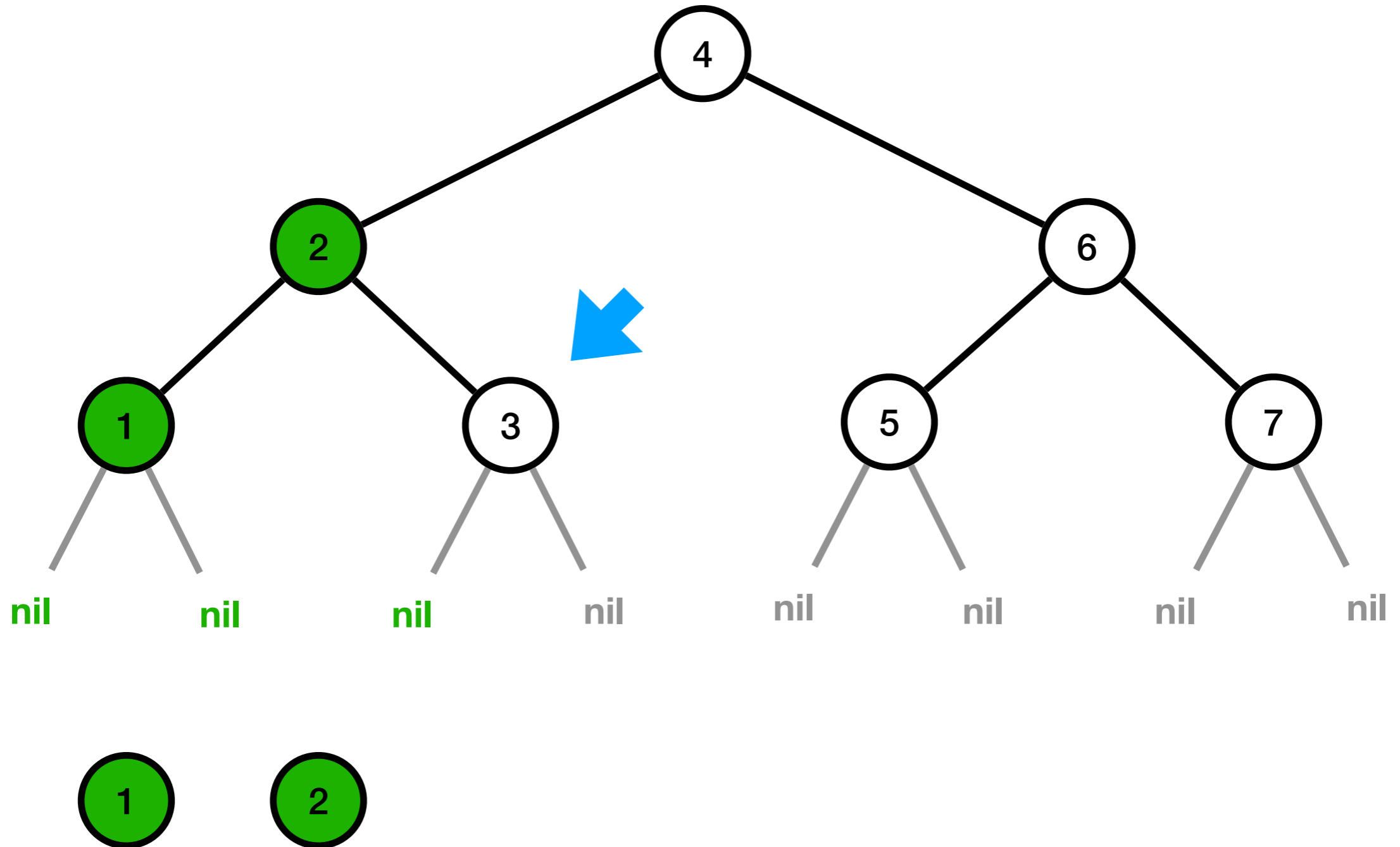
# Parcours infixe d'ABR



# Parcours infixe d'ABR

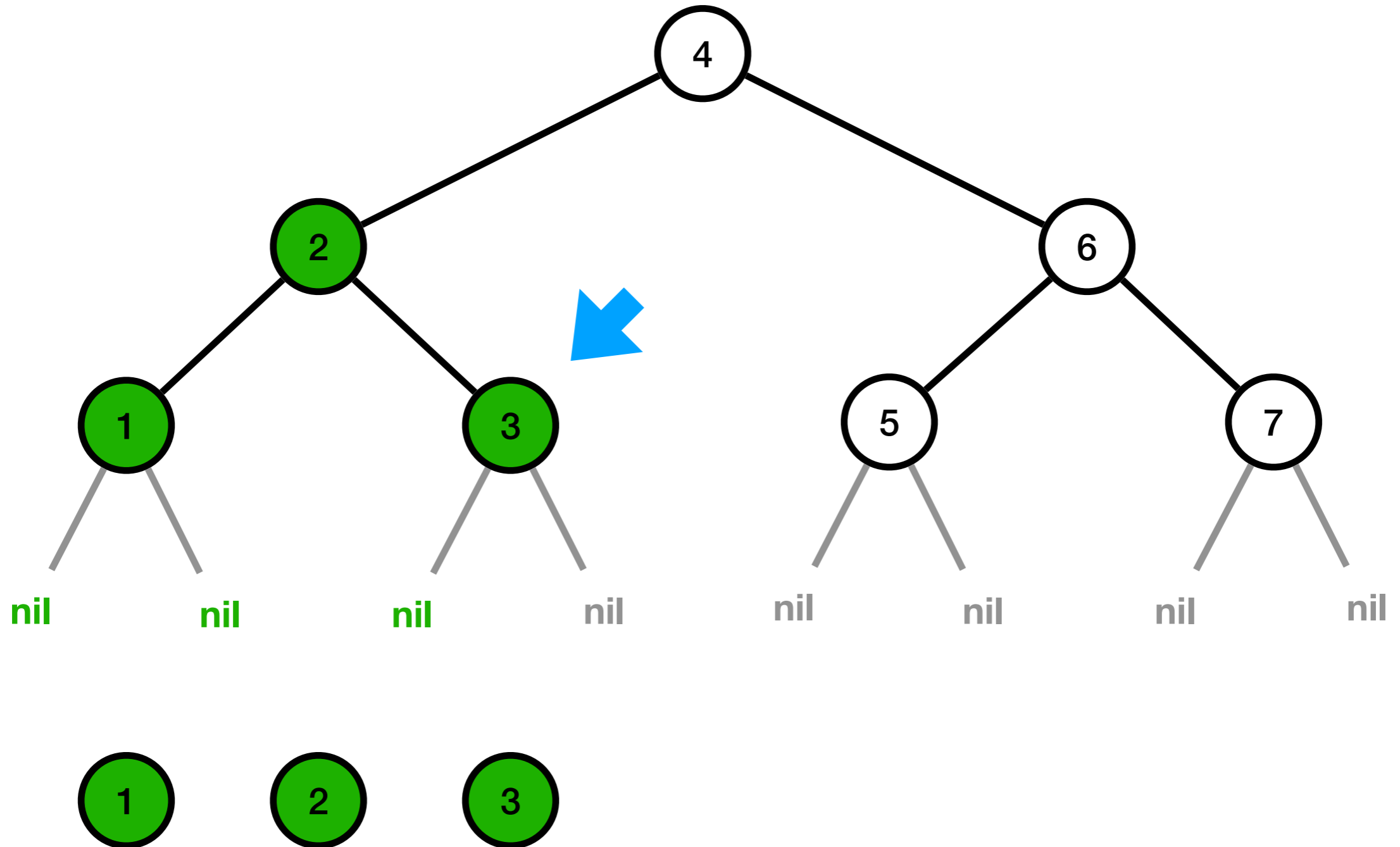


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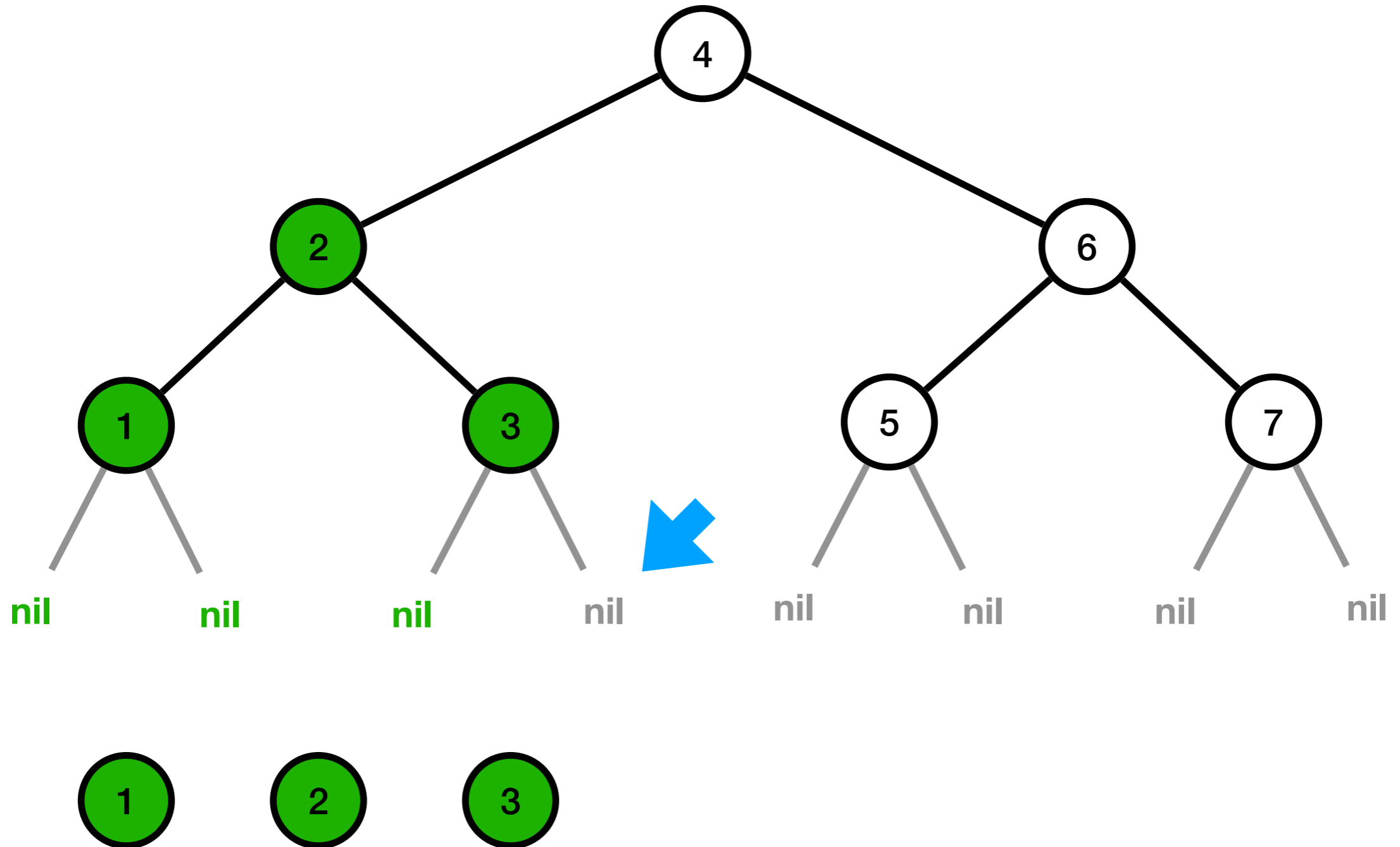




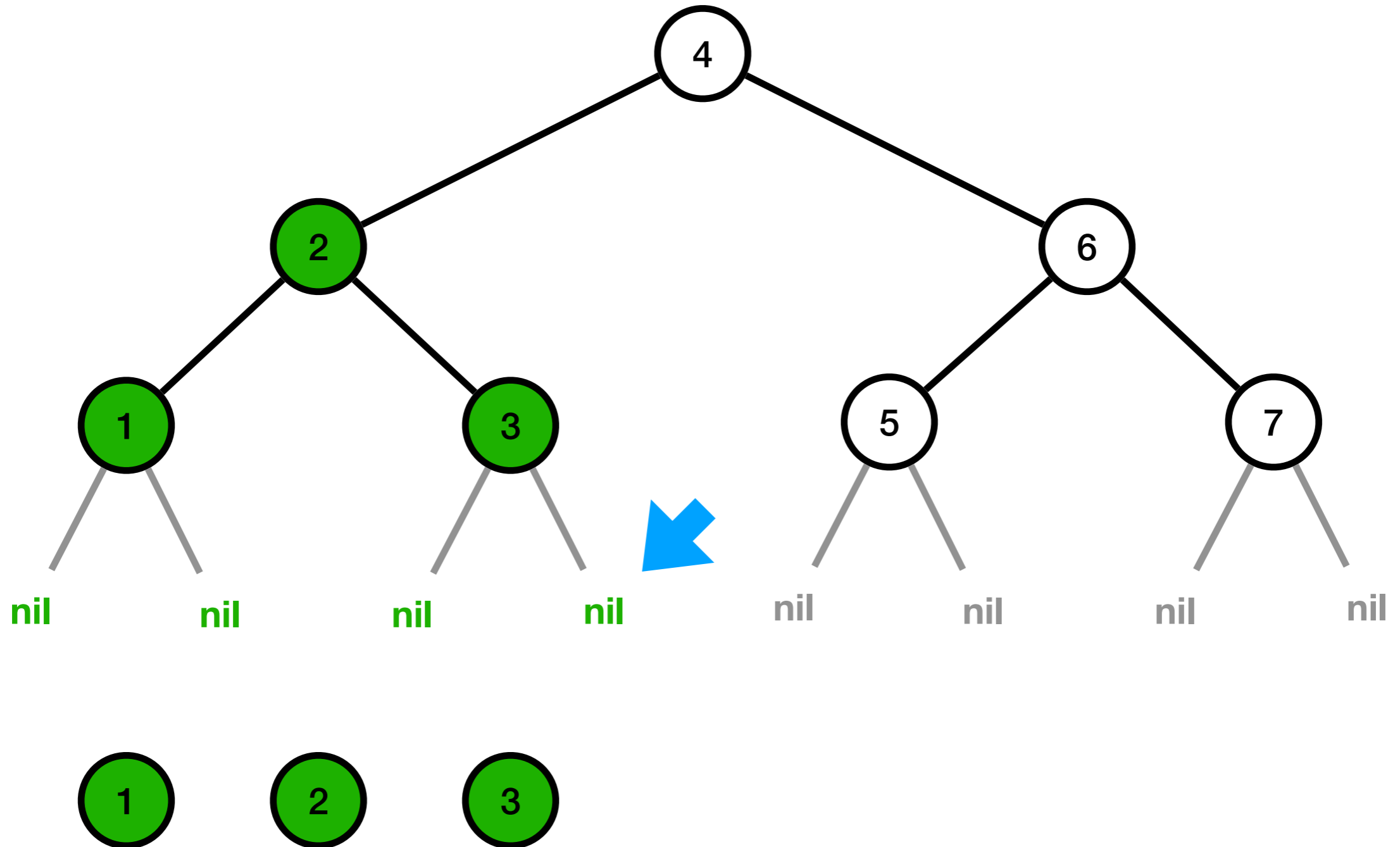
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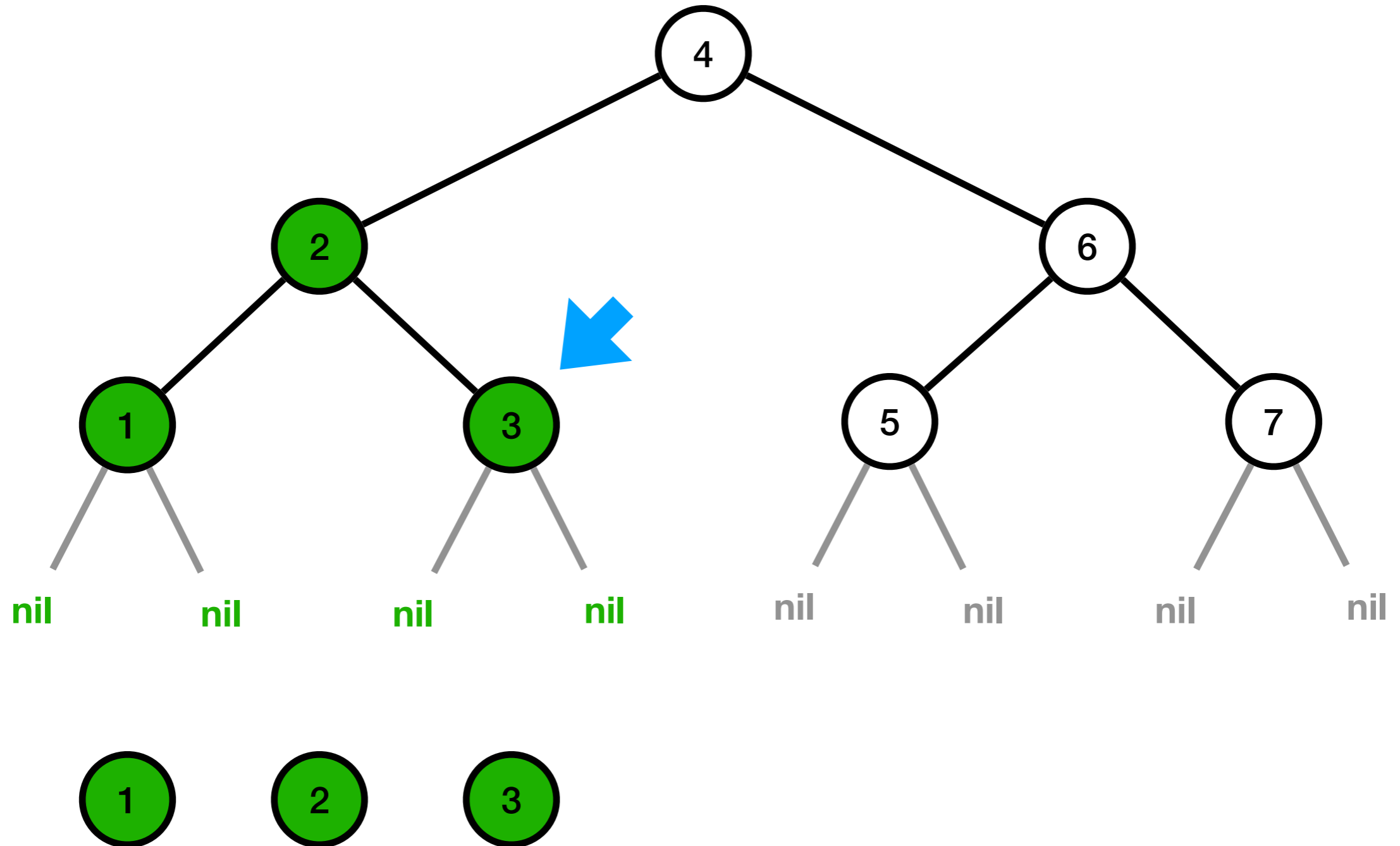
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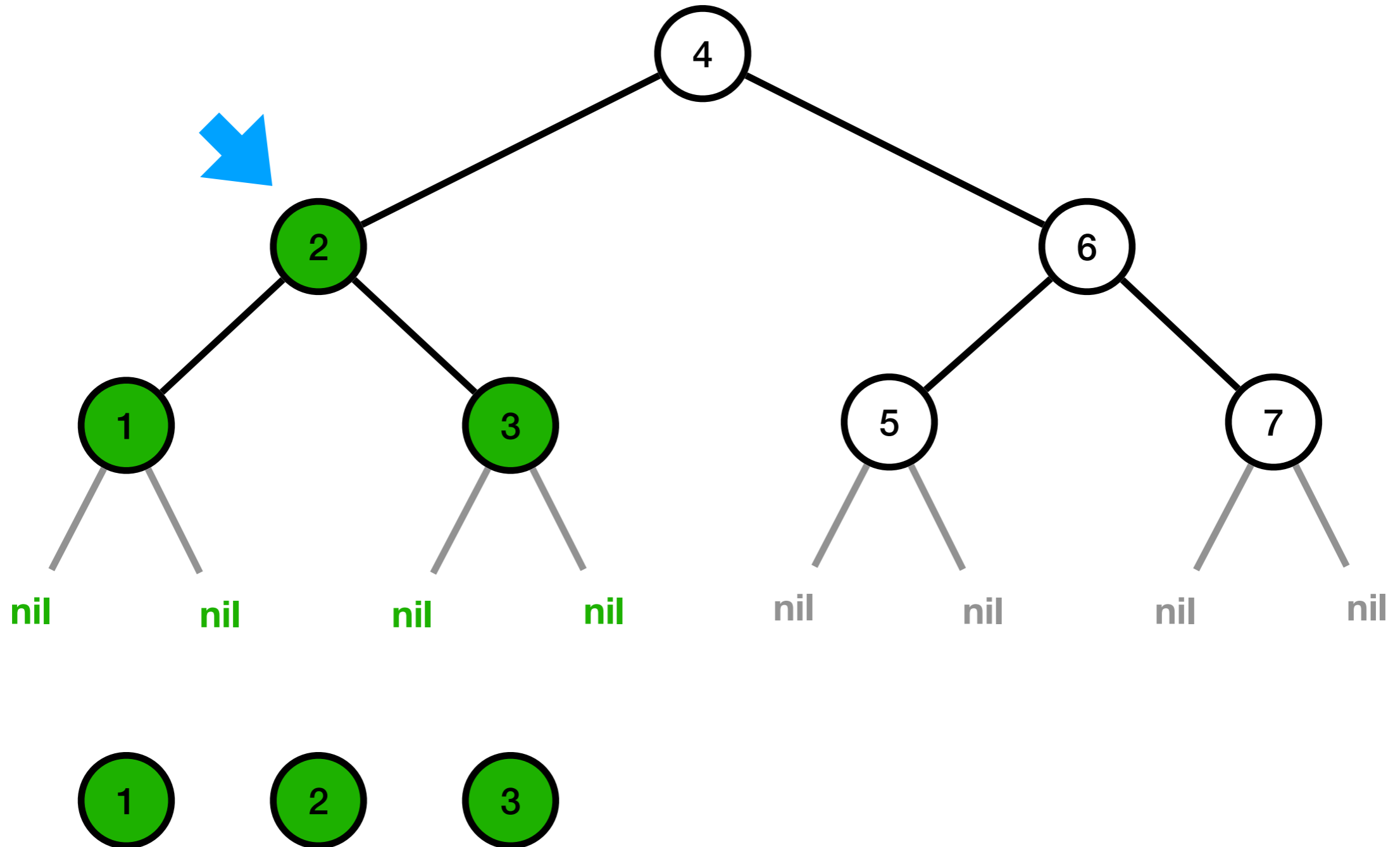
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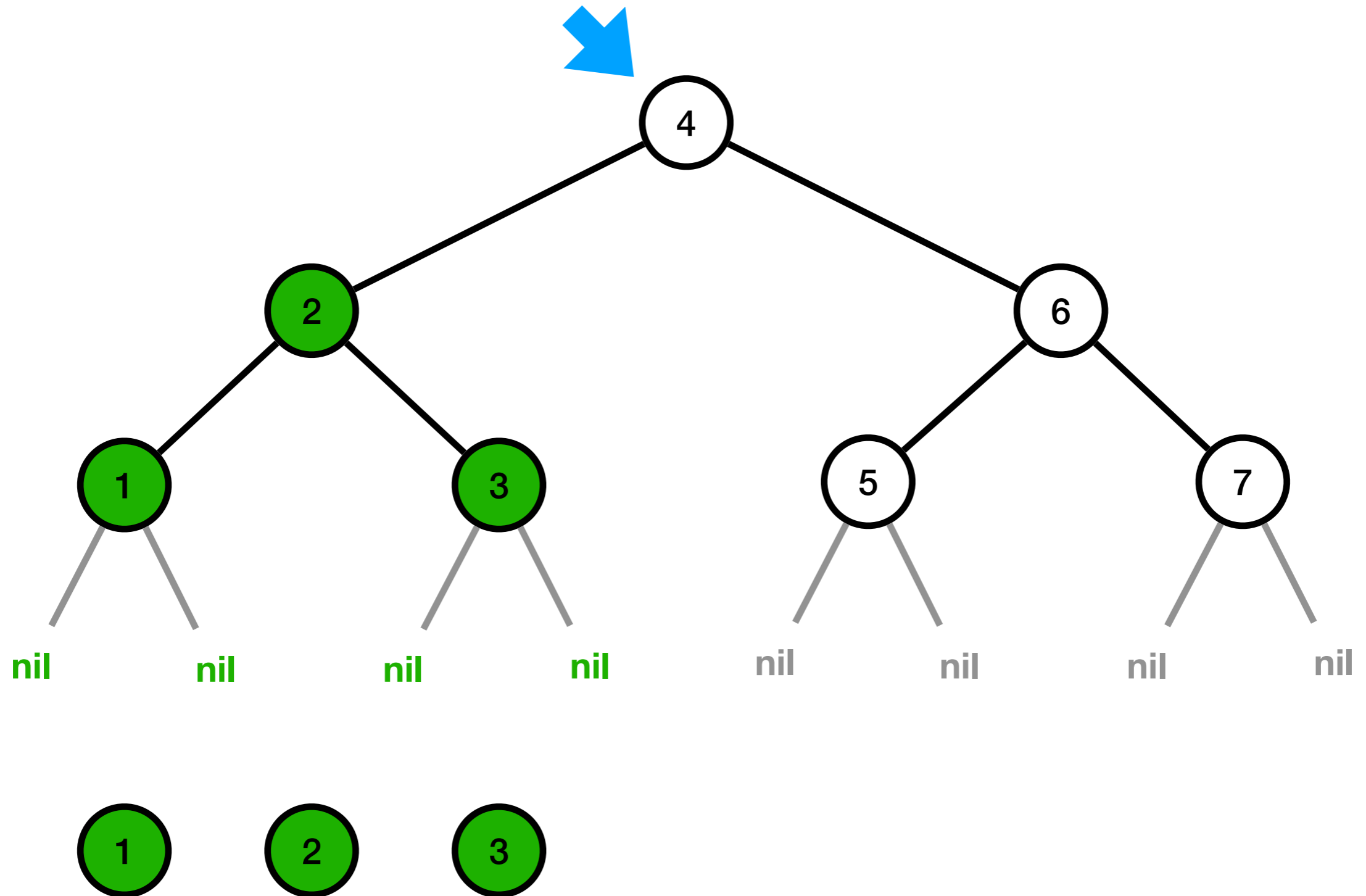
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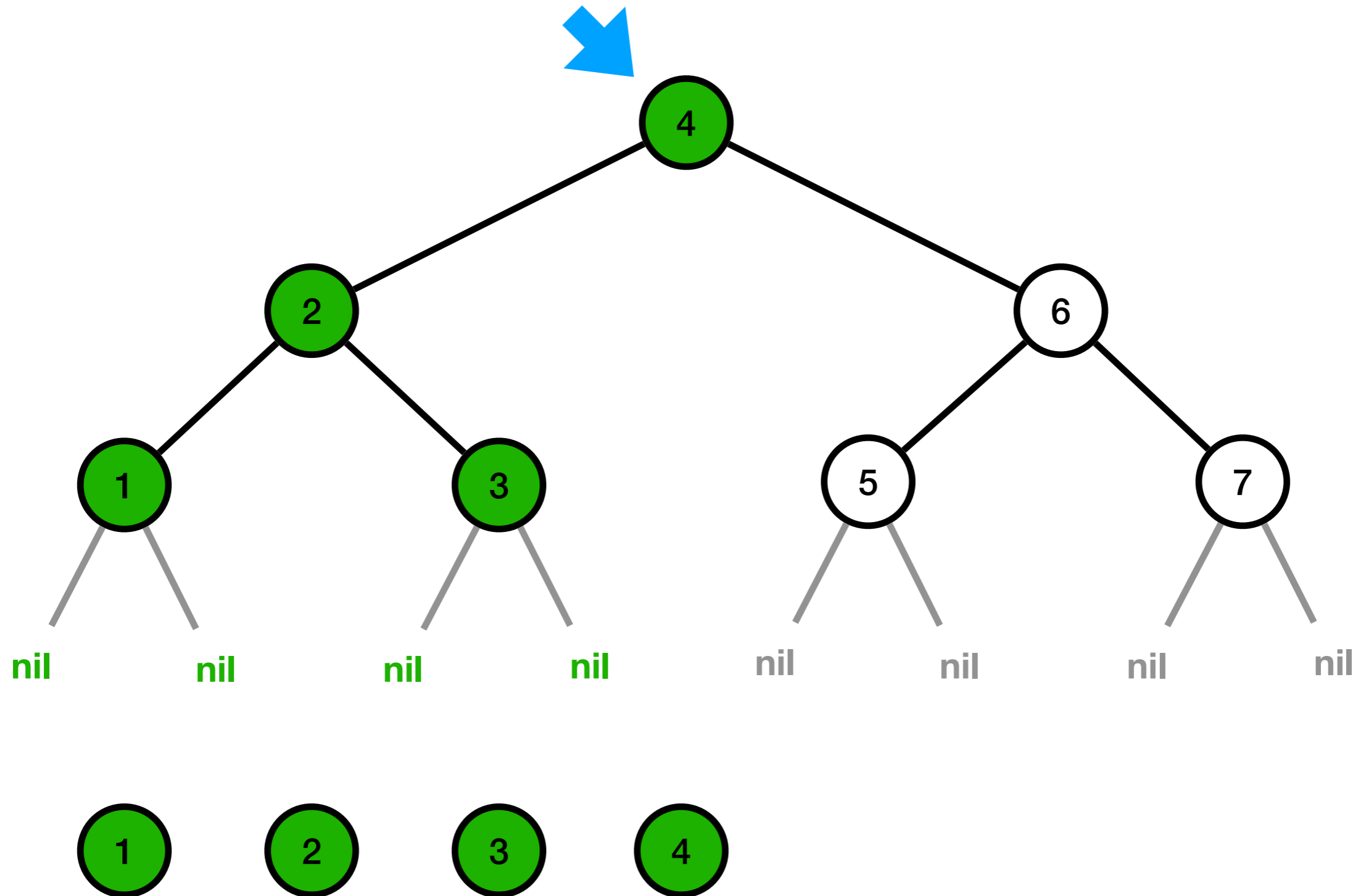
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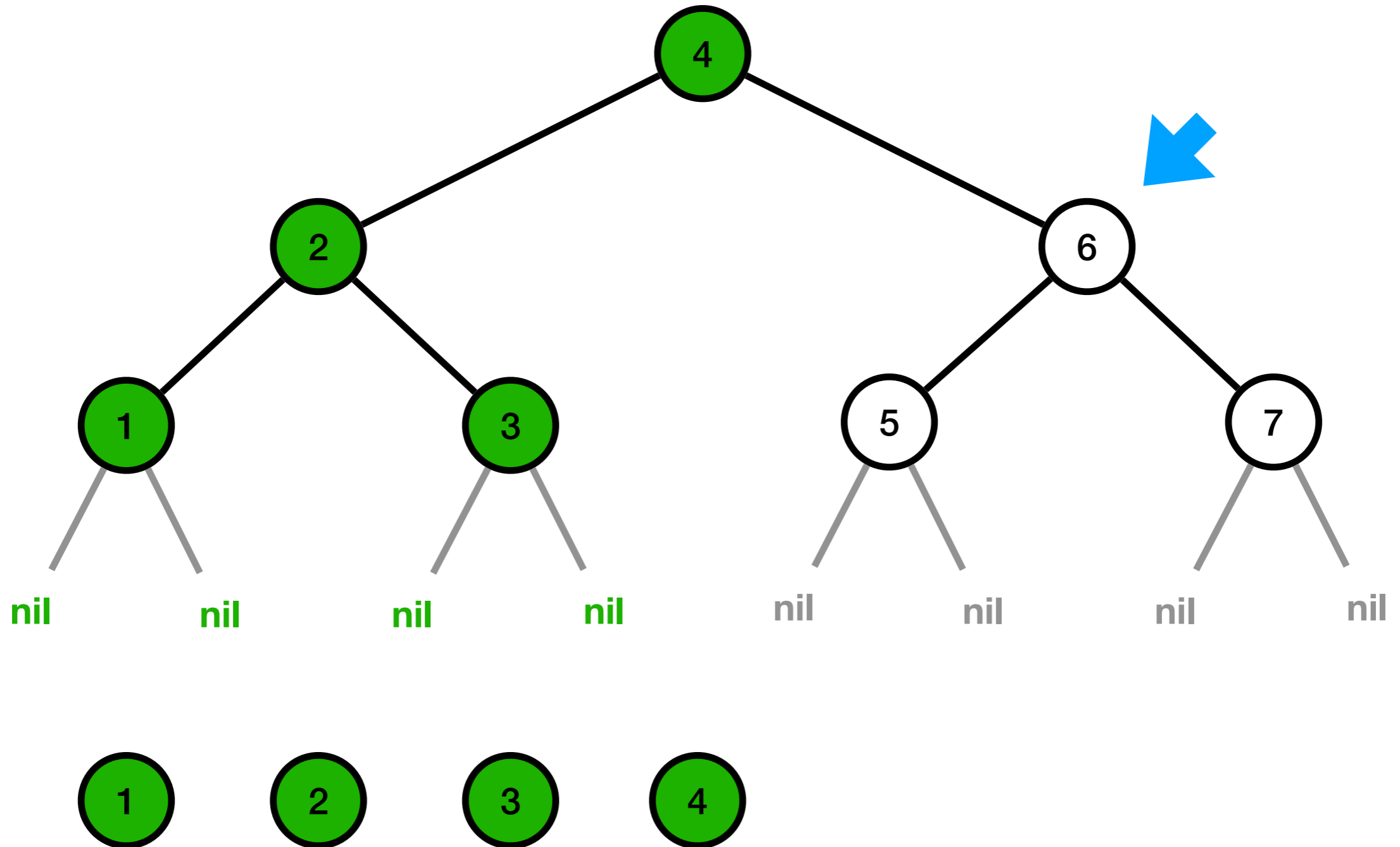
# Parcours infixe d'ABR



# Parcours infixe d'ABR

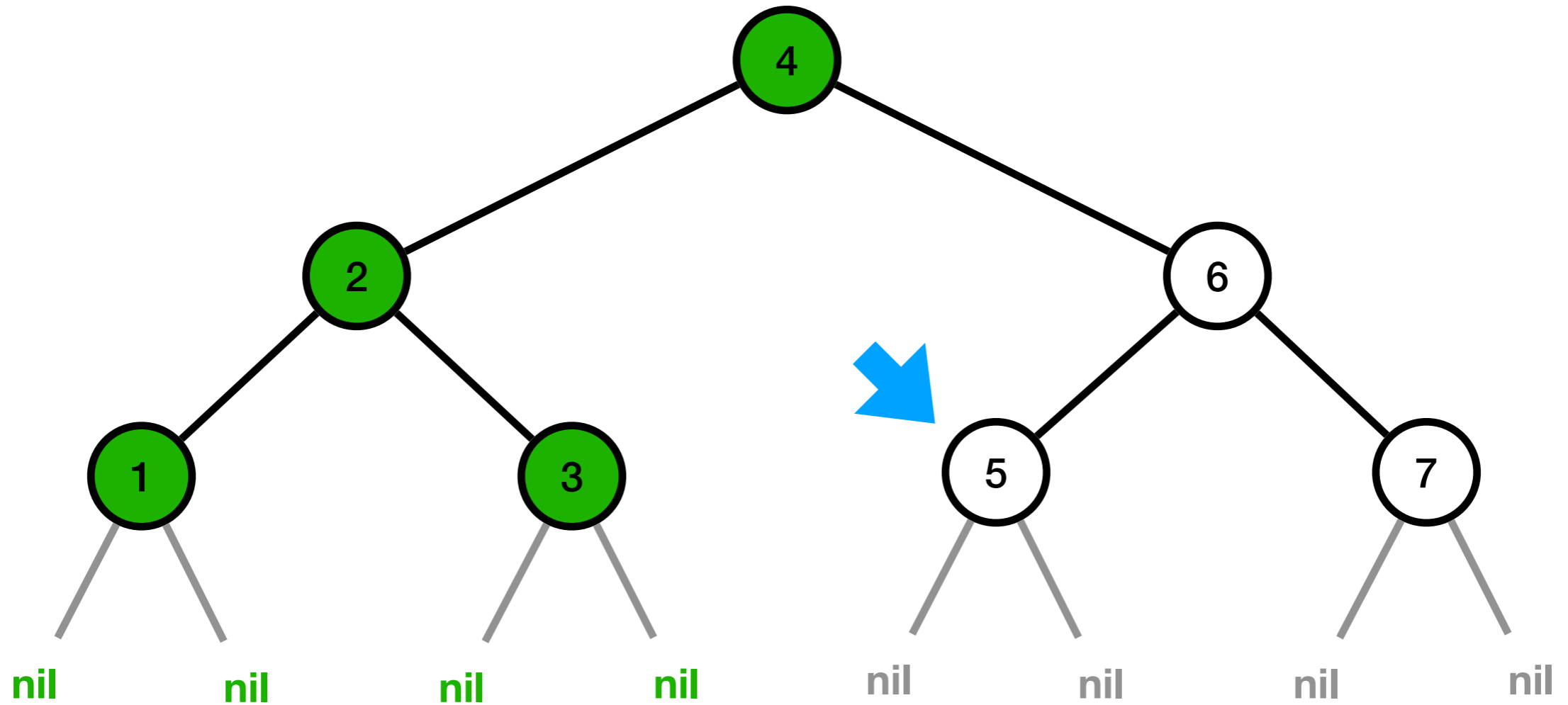


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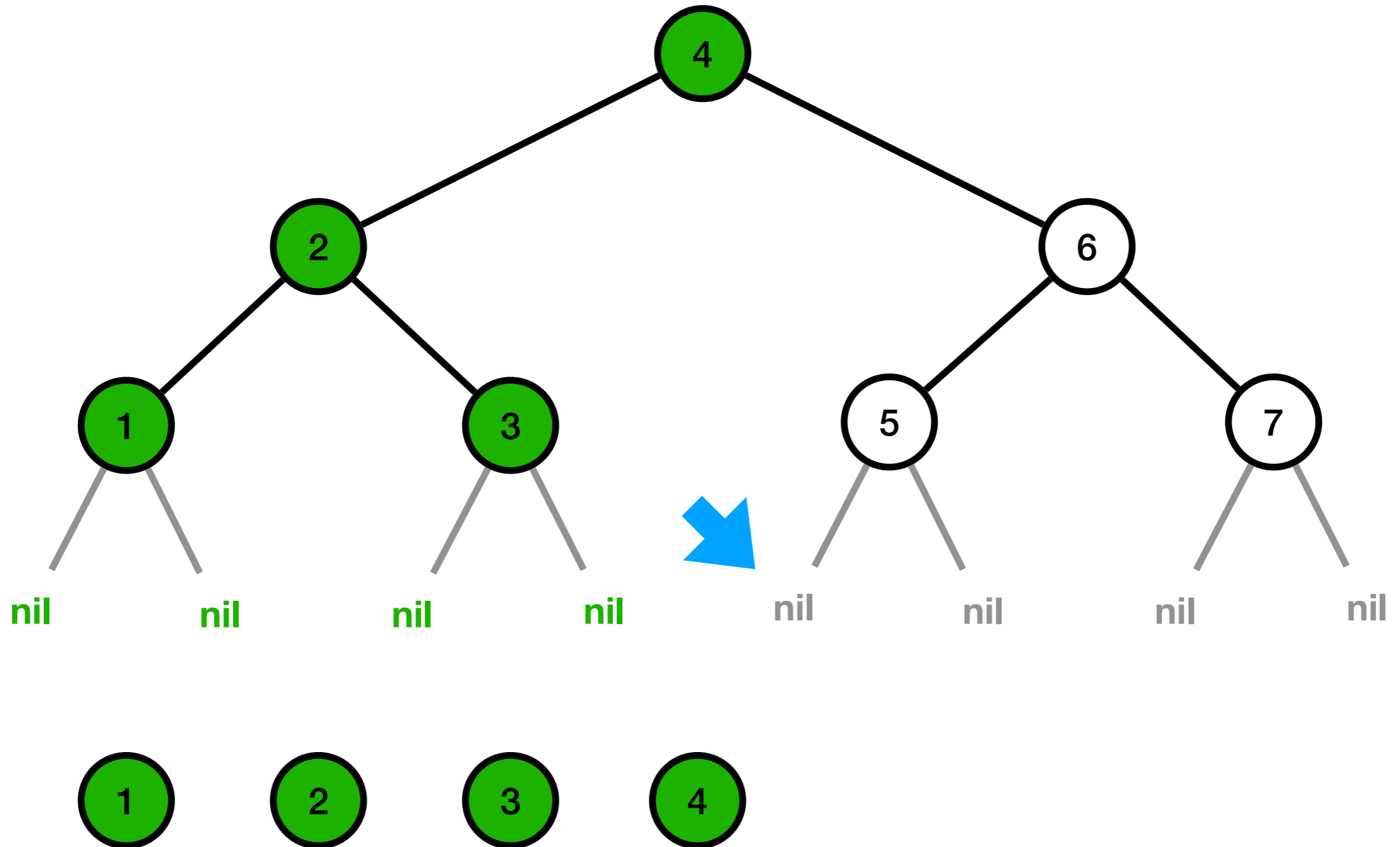




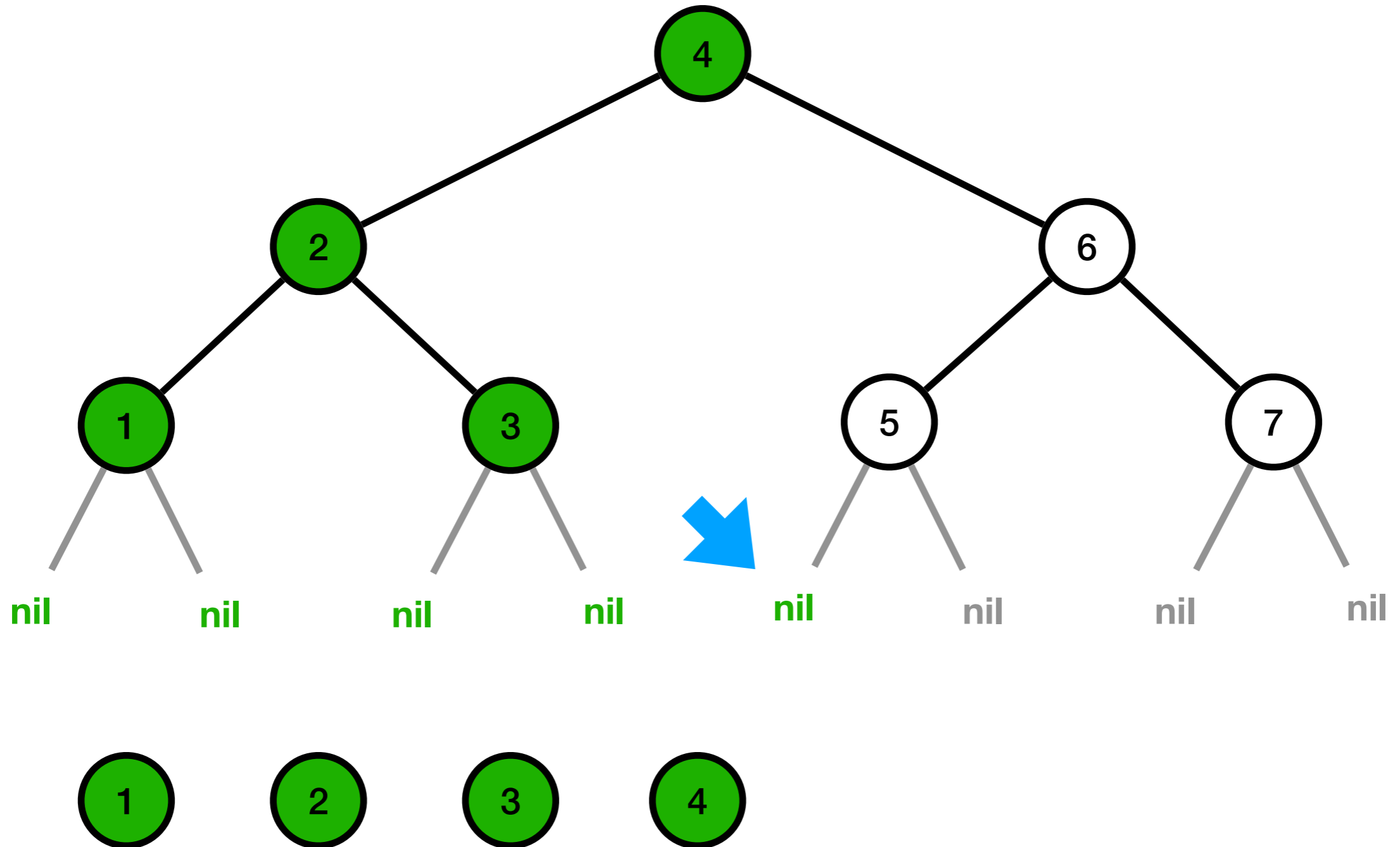
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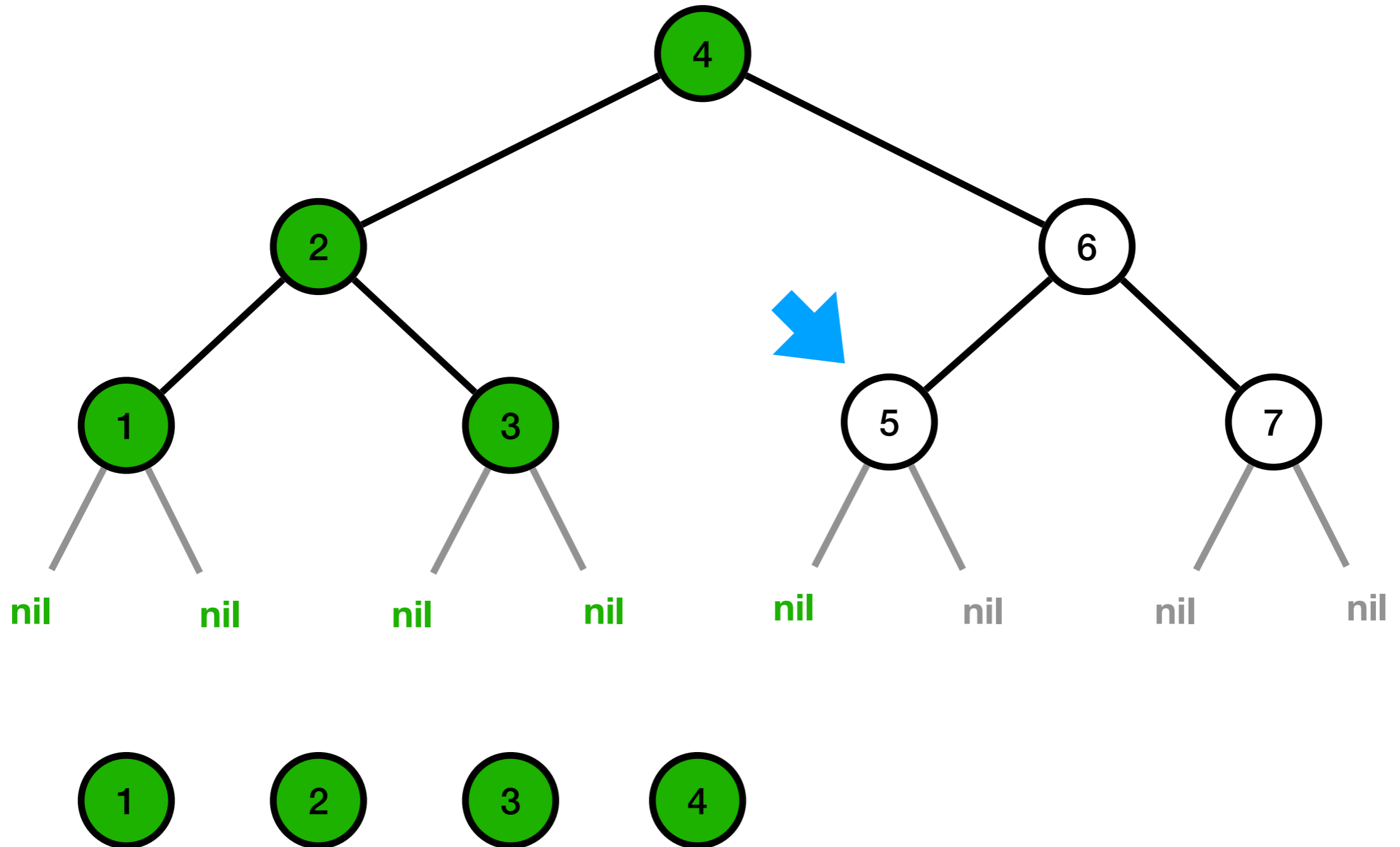
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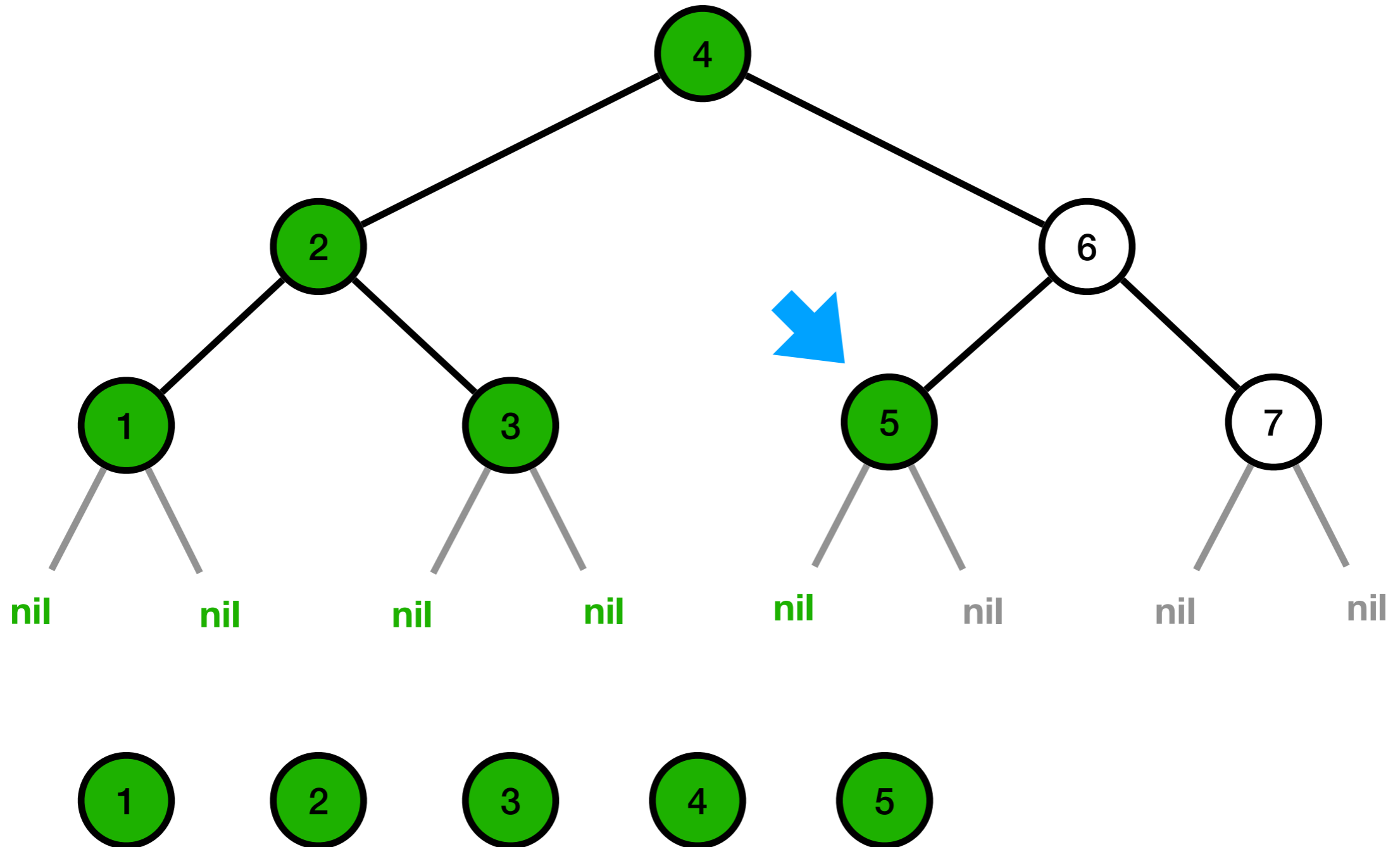
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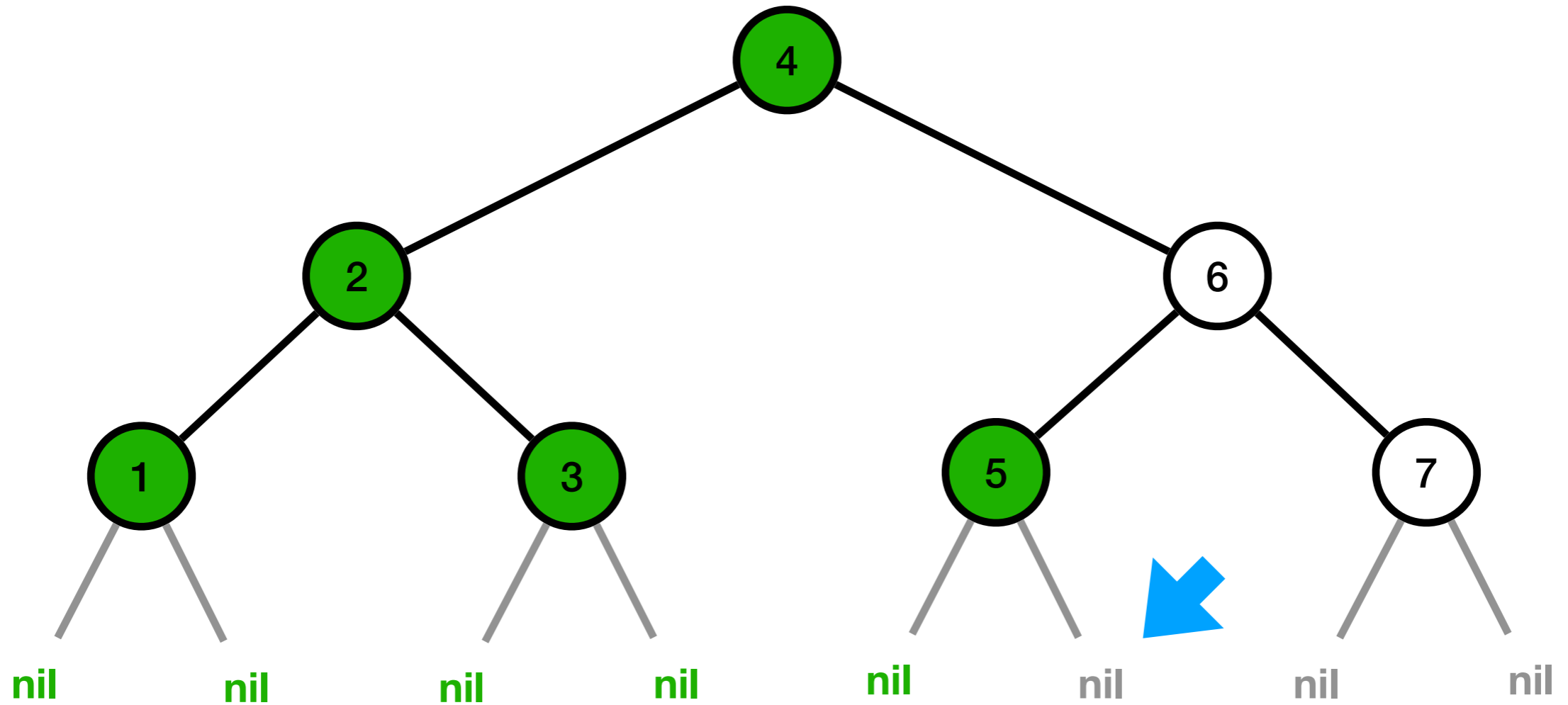
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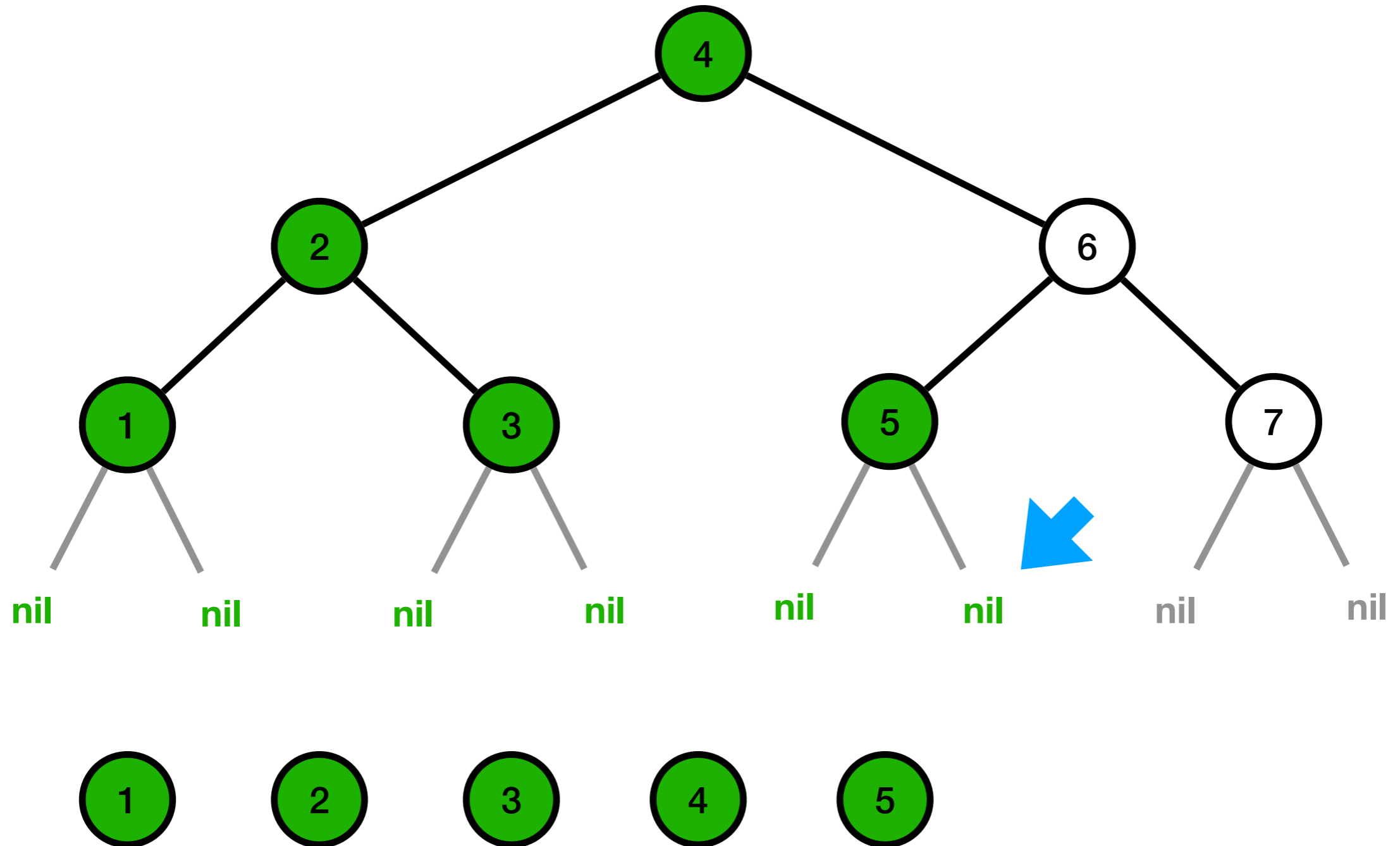
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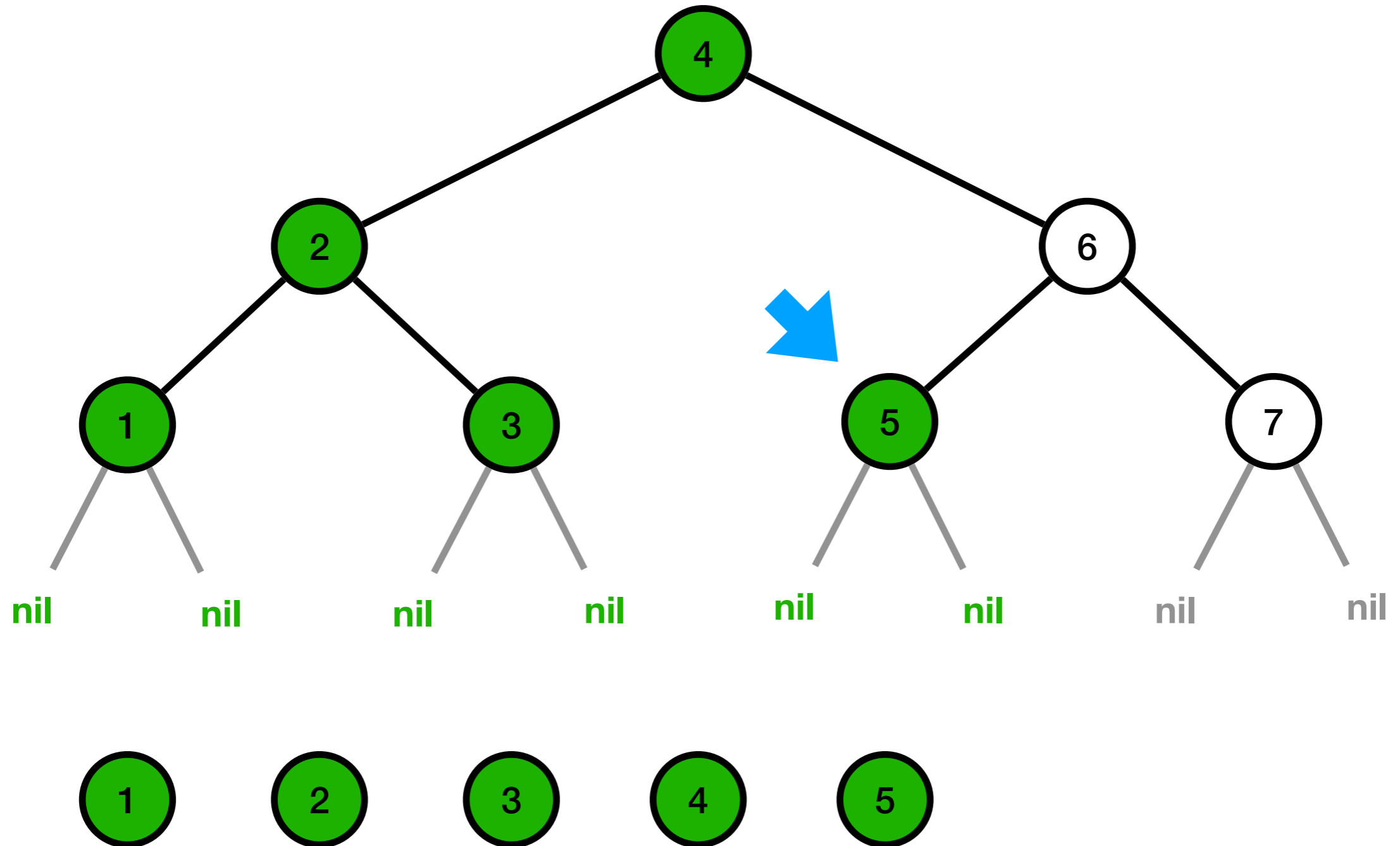
# Parcours infixe d'ABR



# Parcours infixe d'ABR

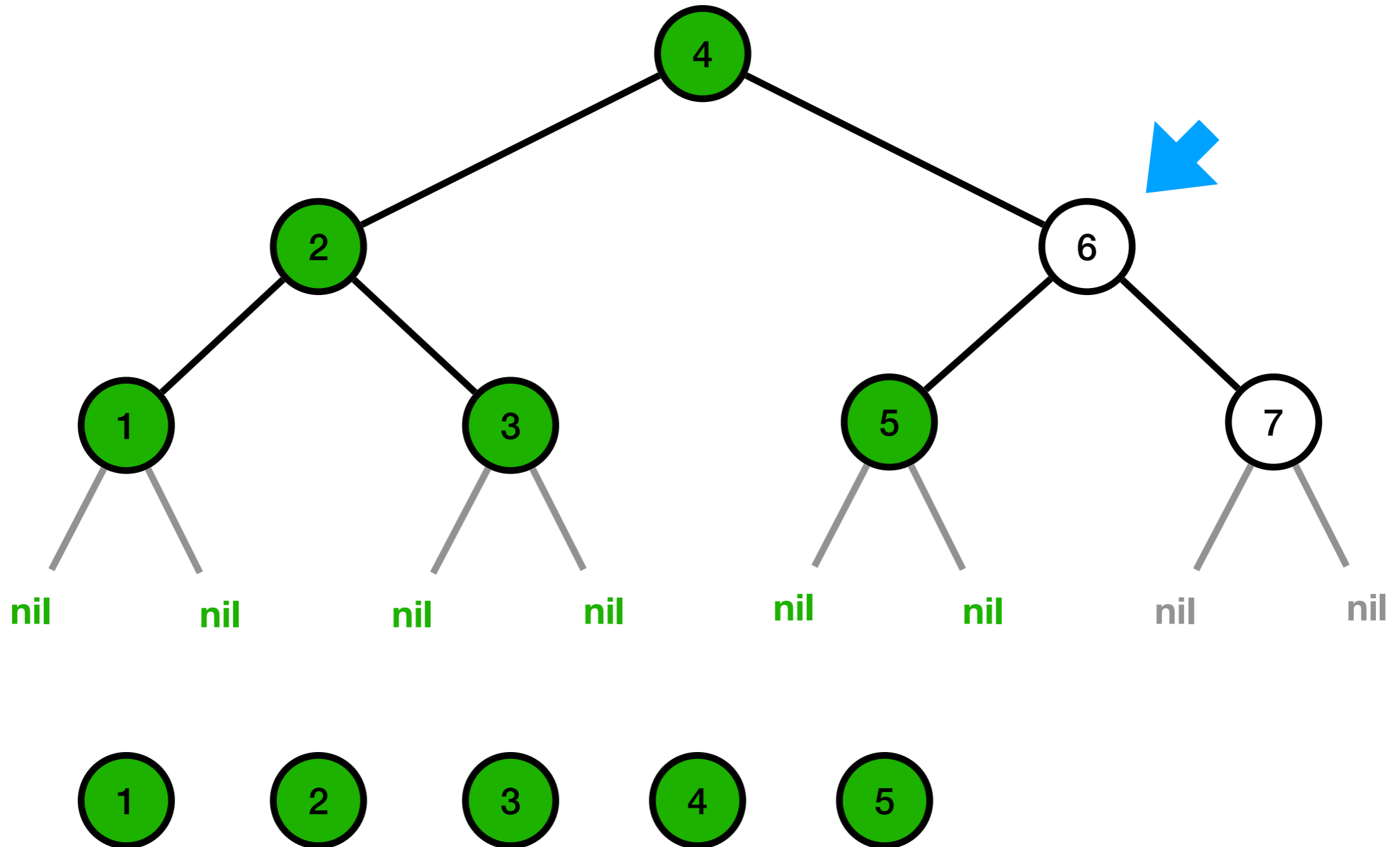


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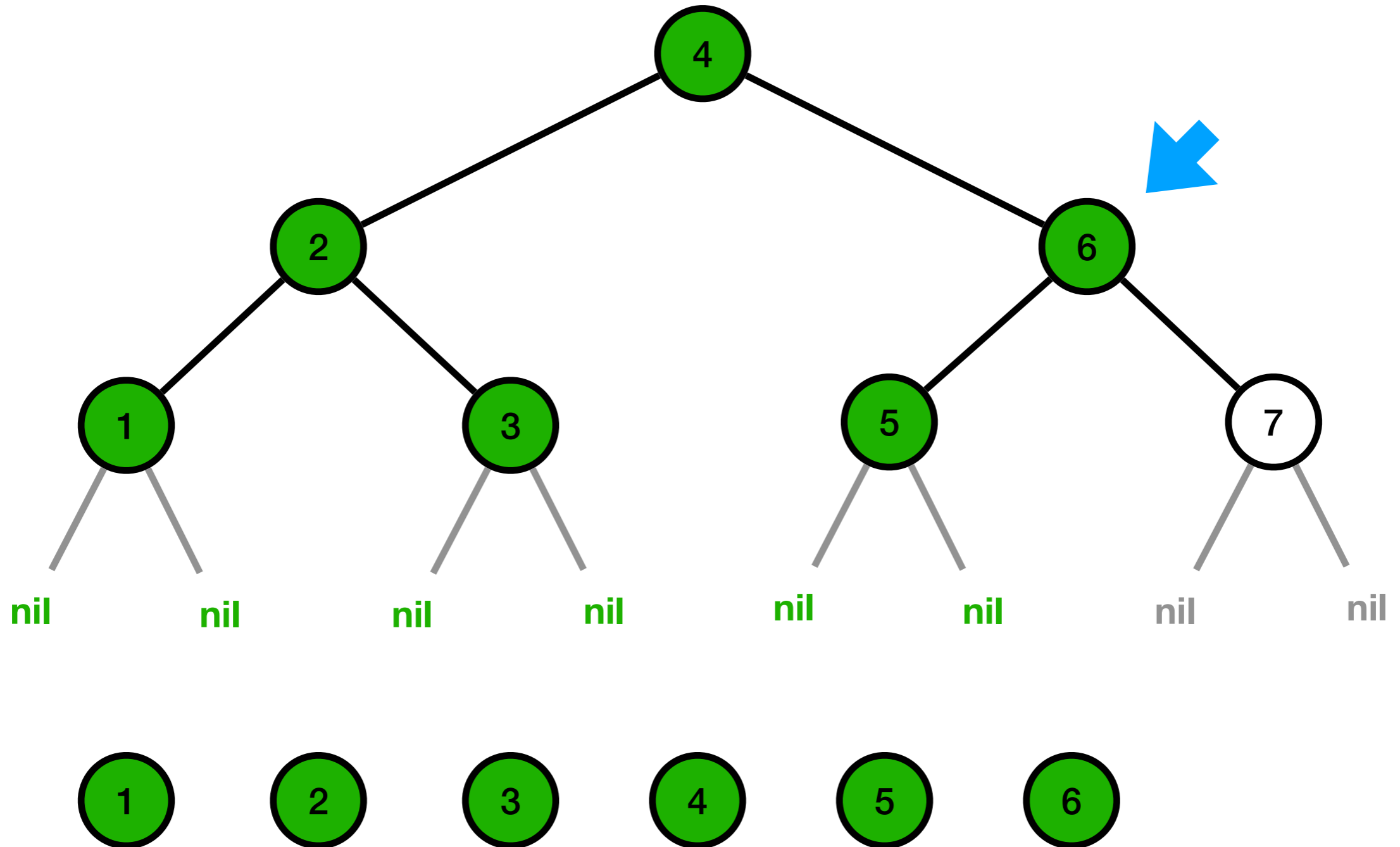




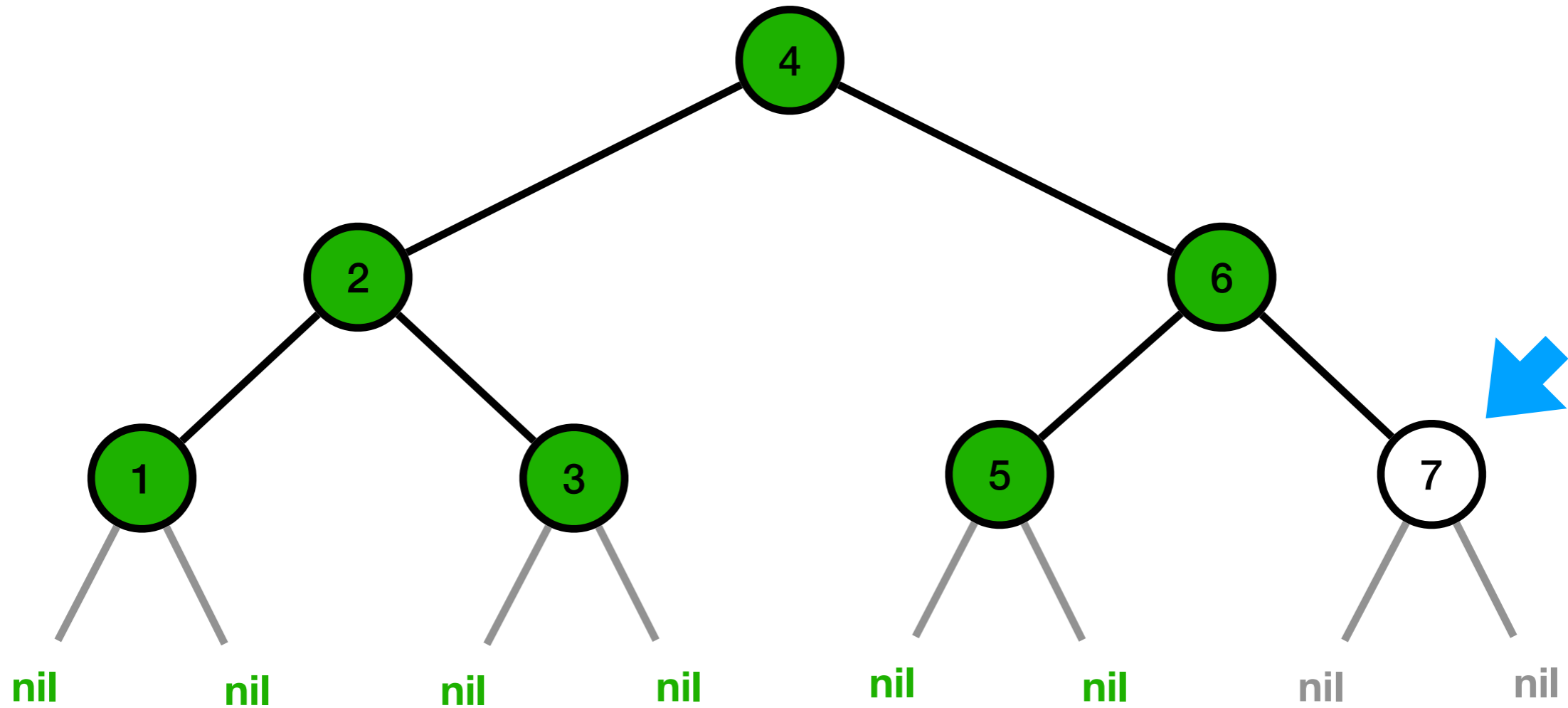
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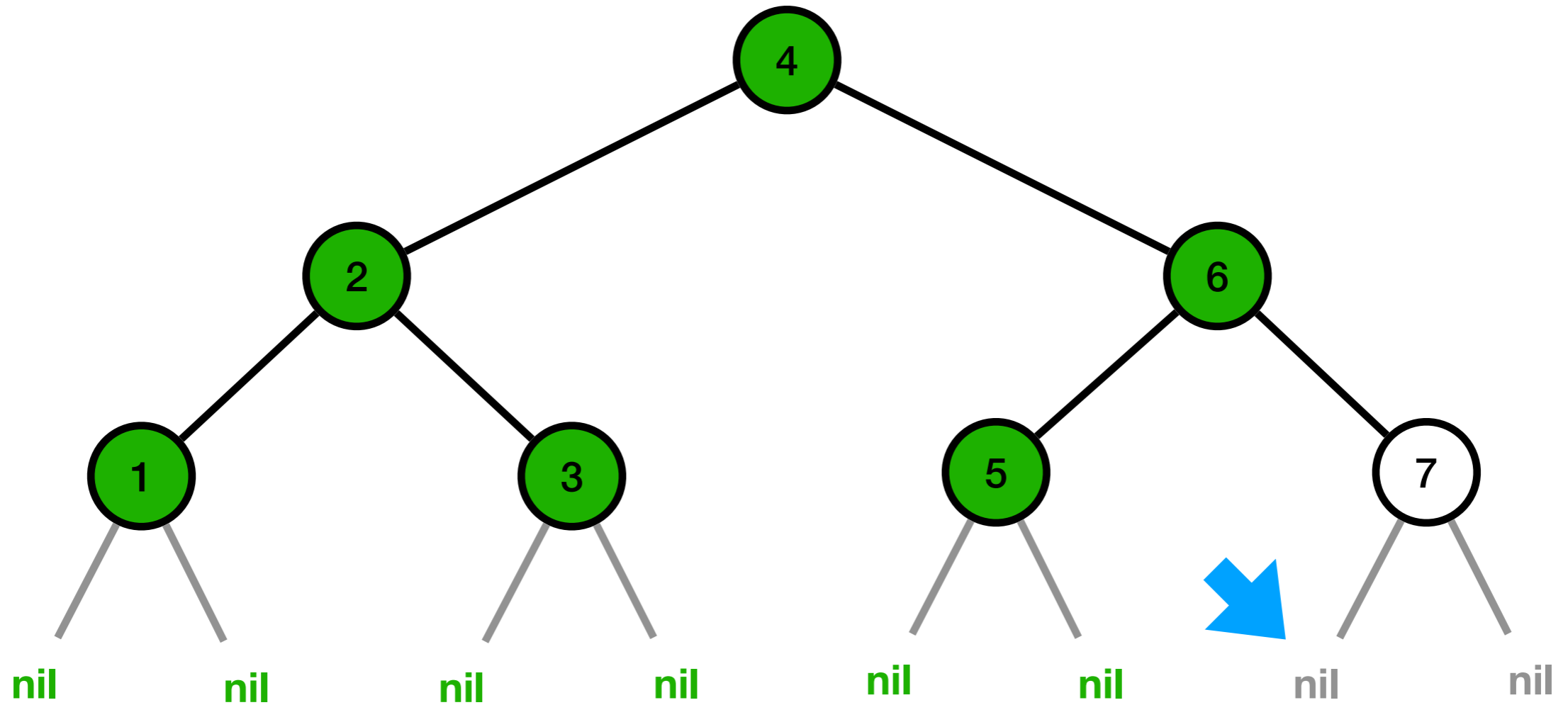
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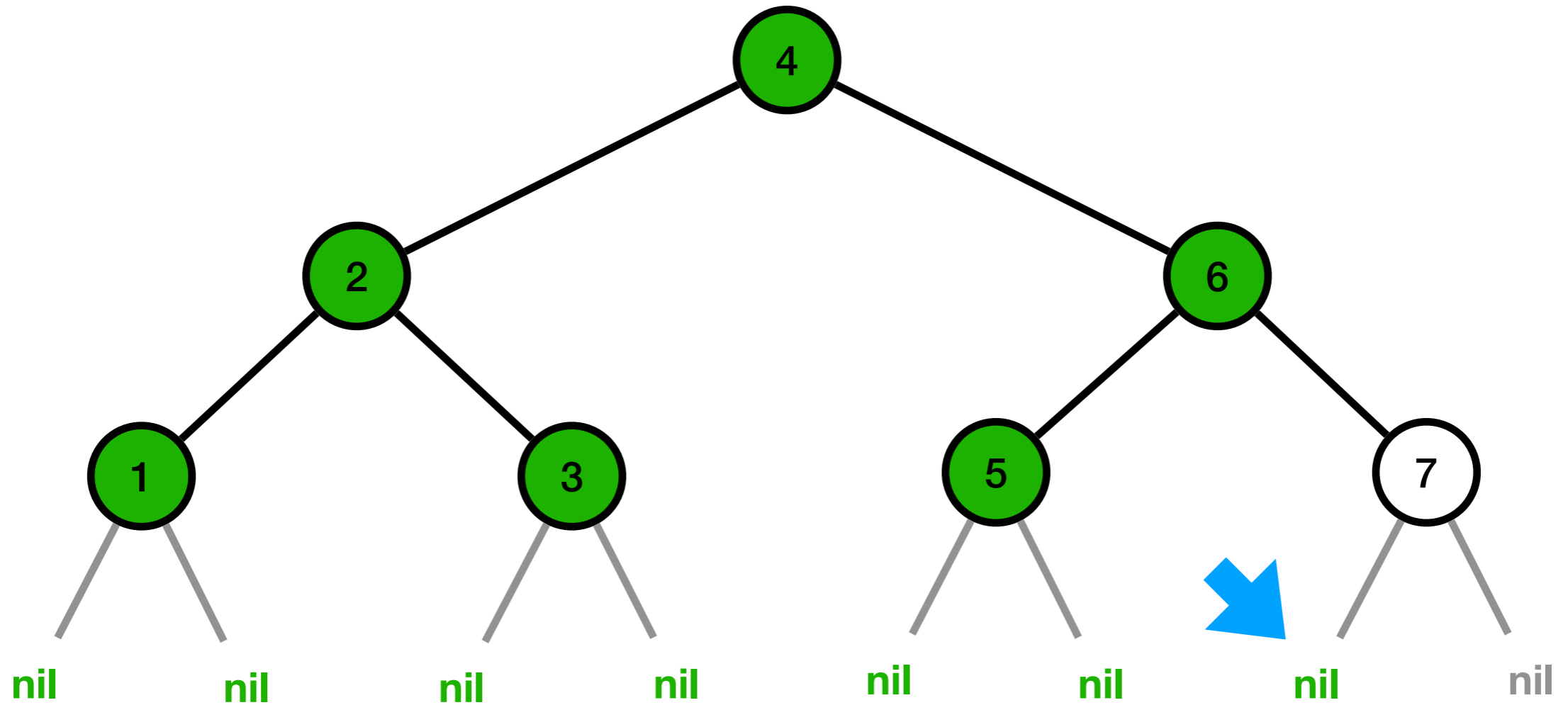
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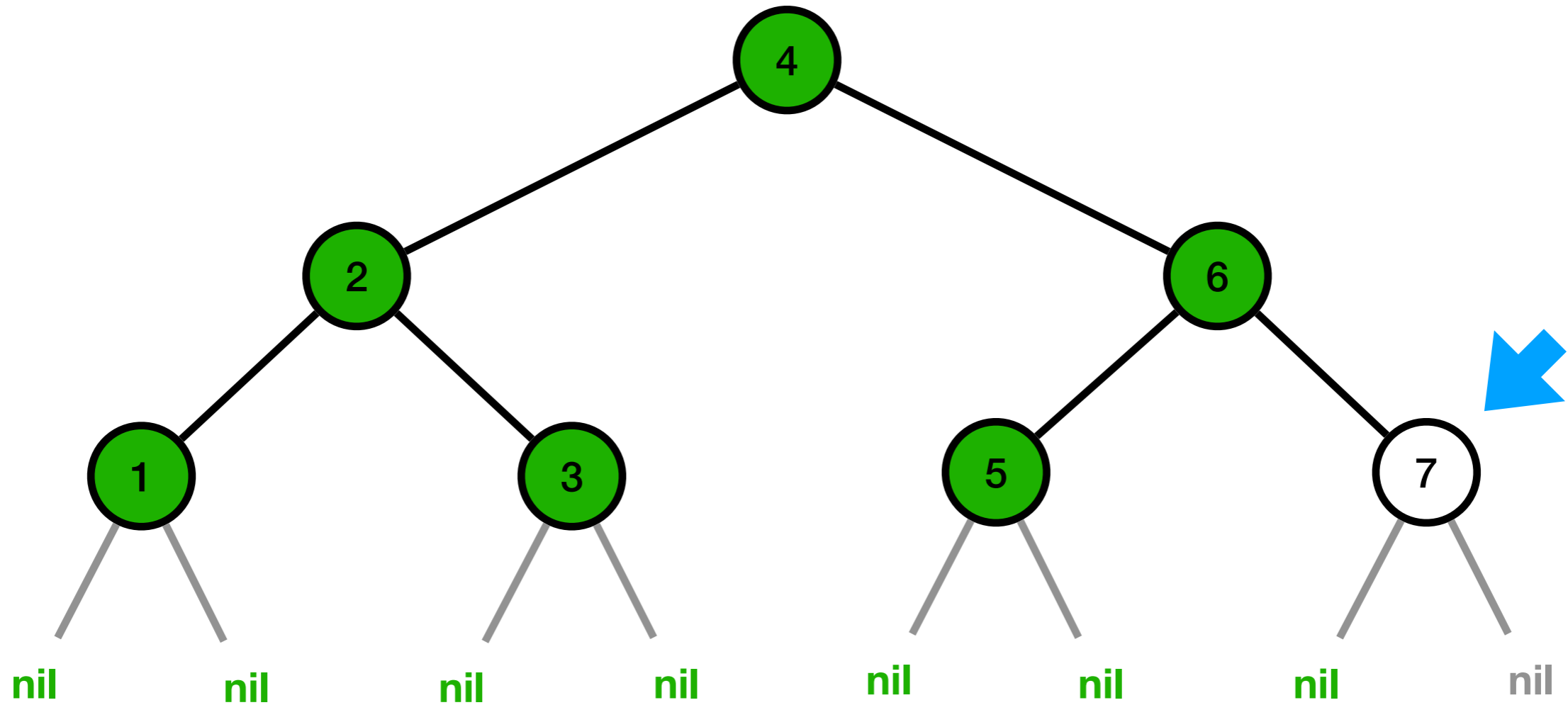
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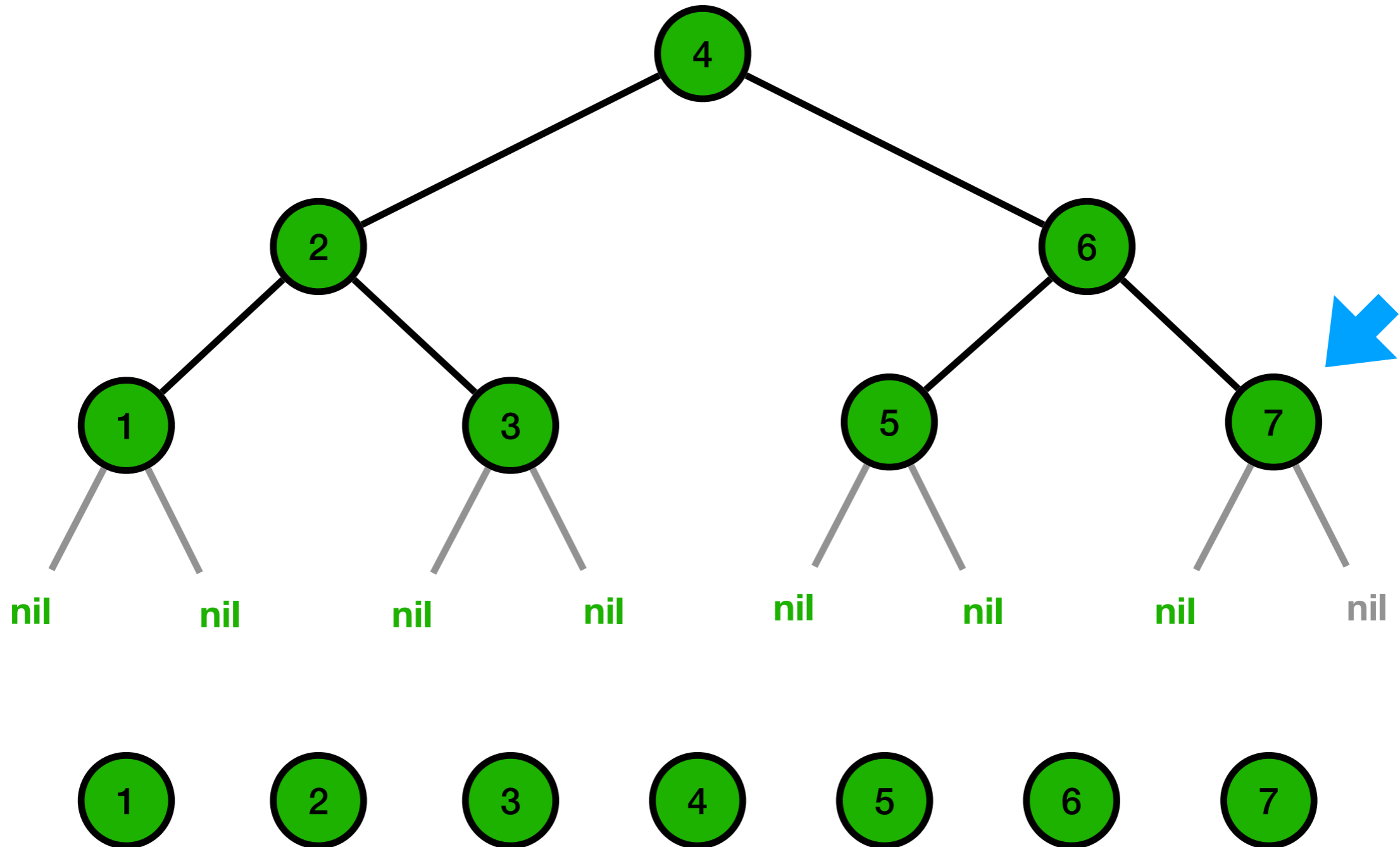
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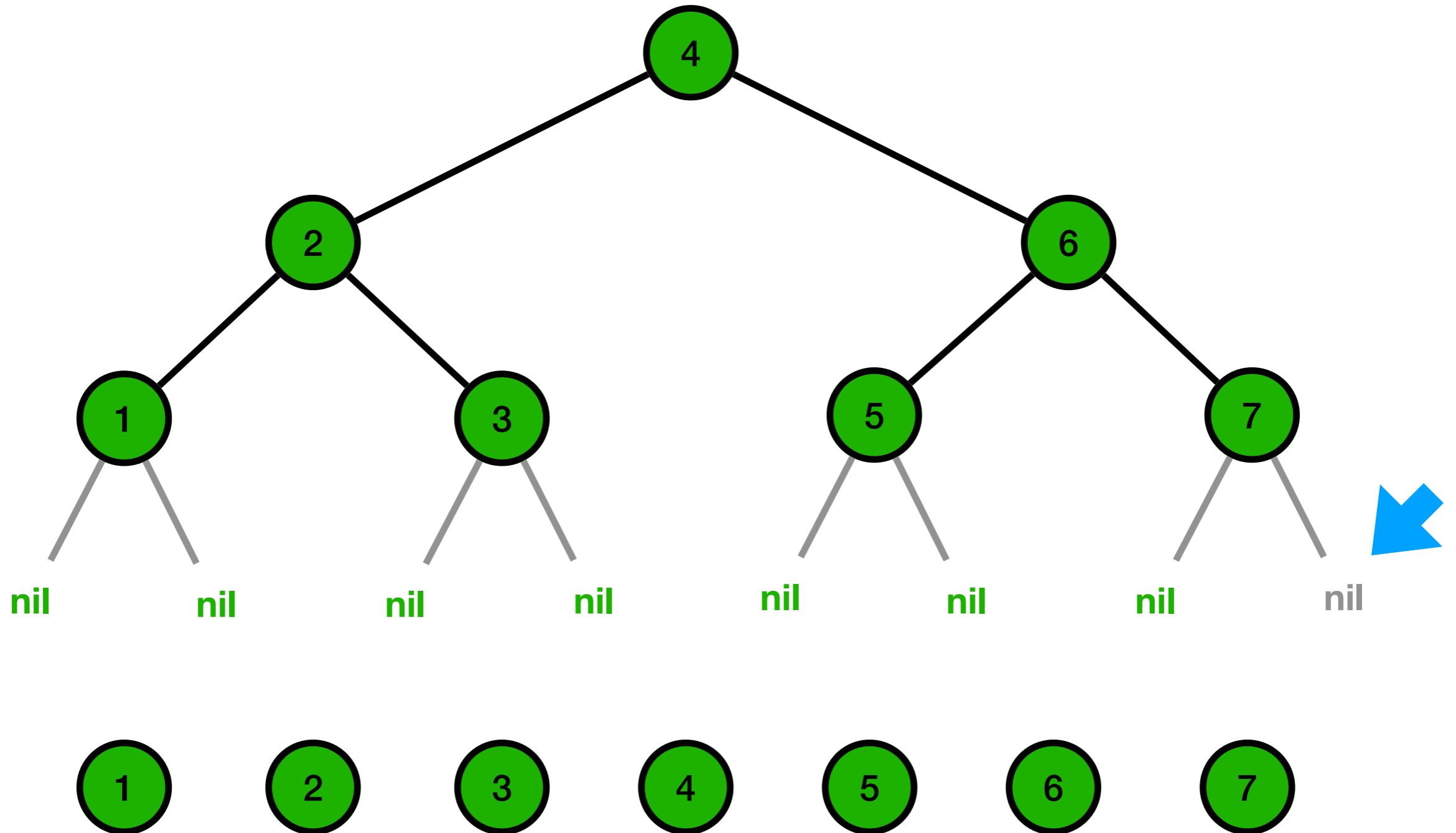
# Parcours infixe d'ABR



# Parcours infixe d'ABR

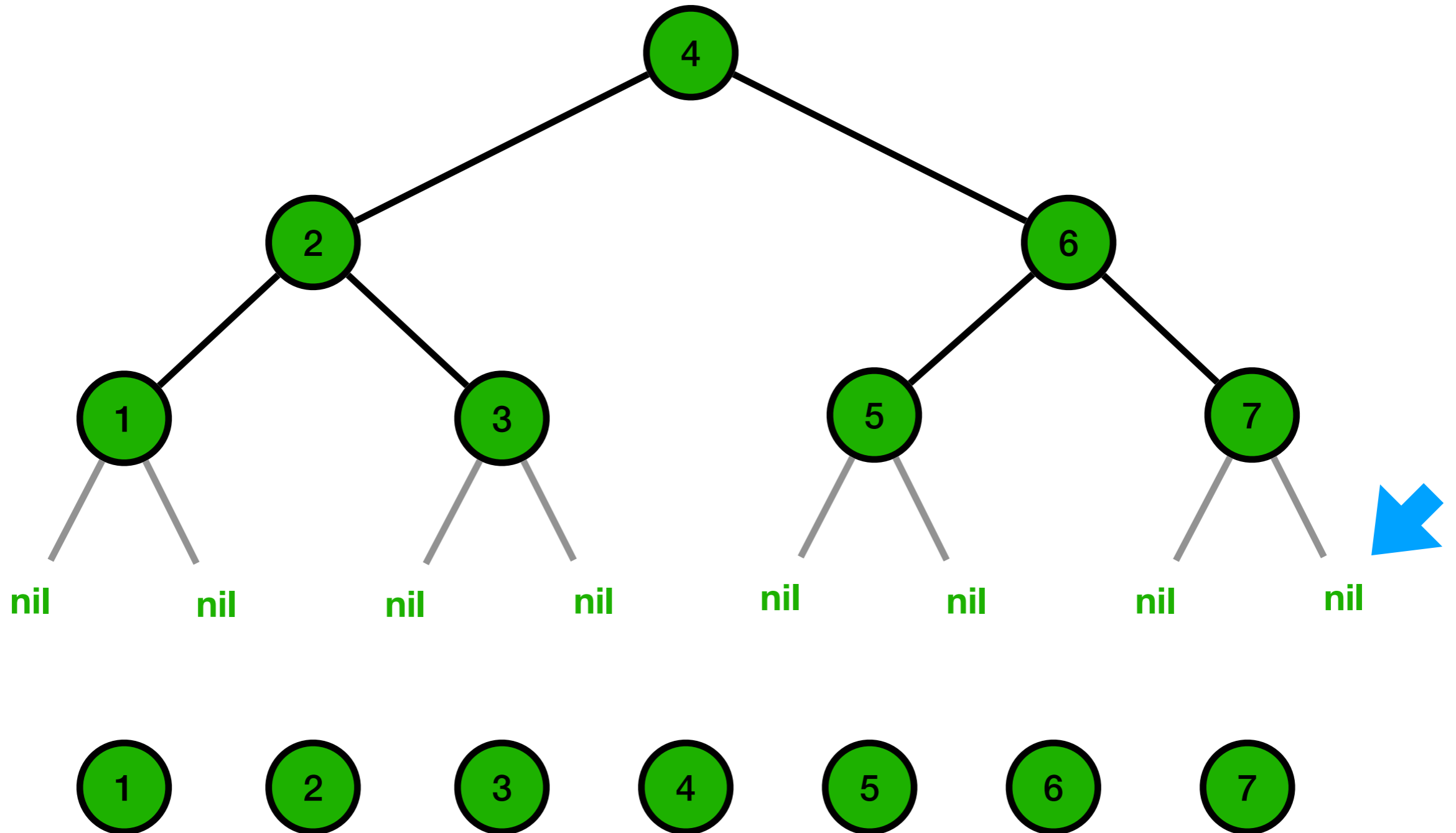


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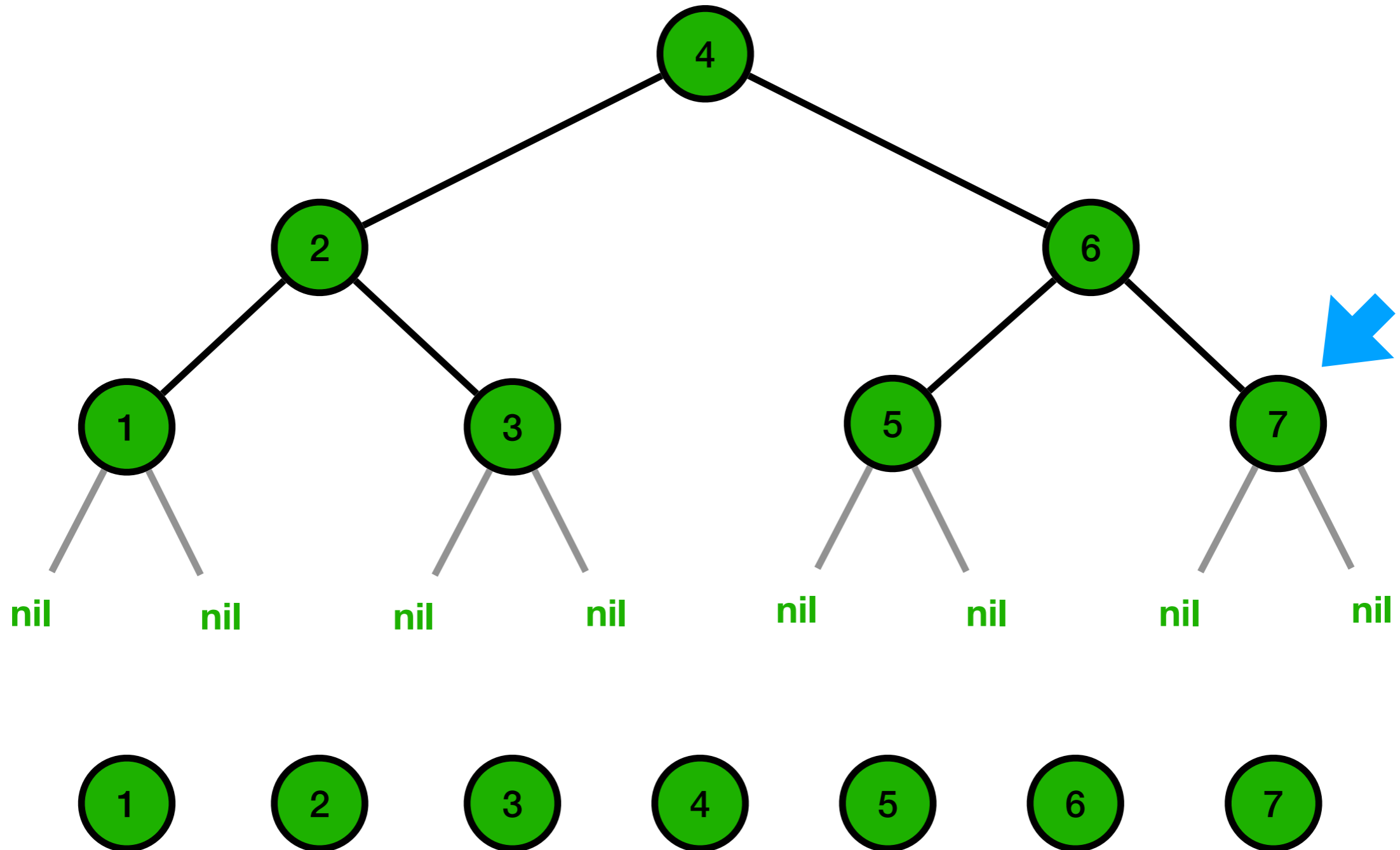




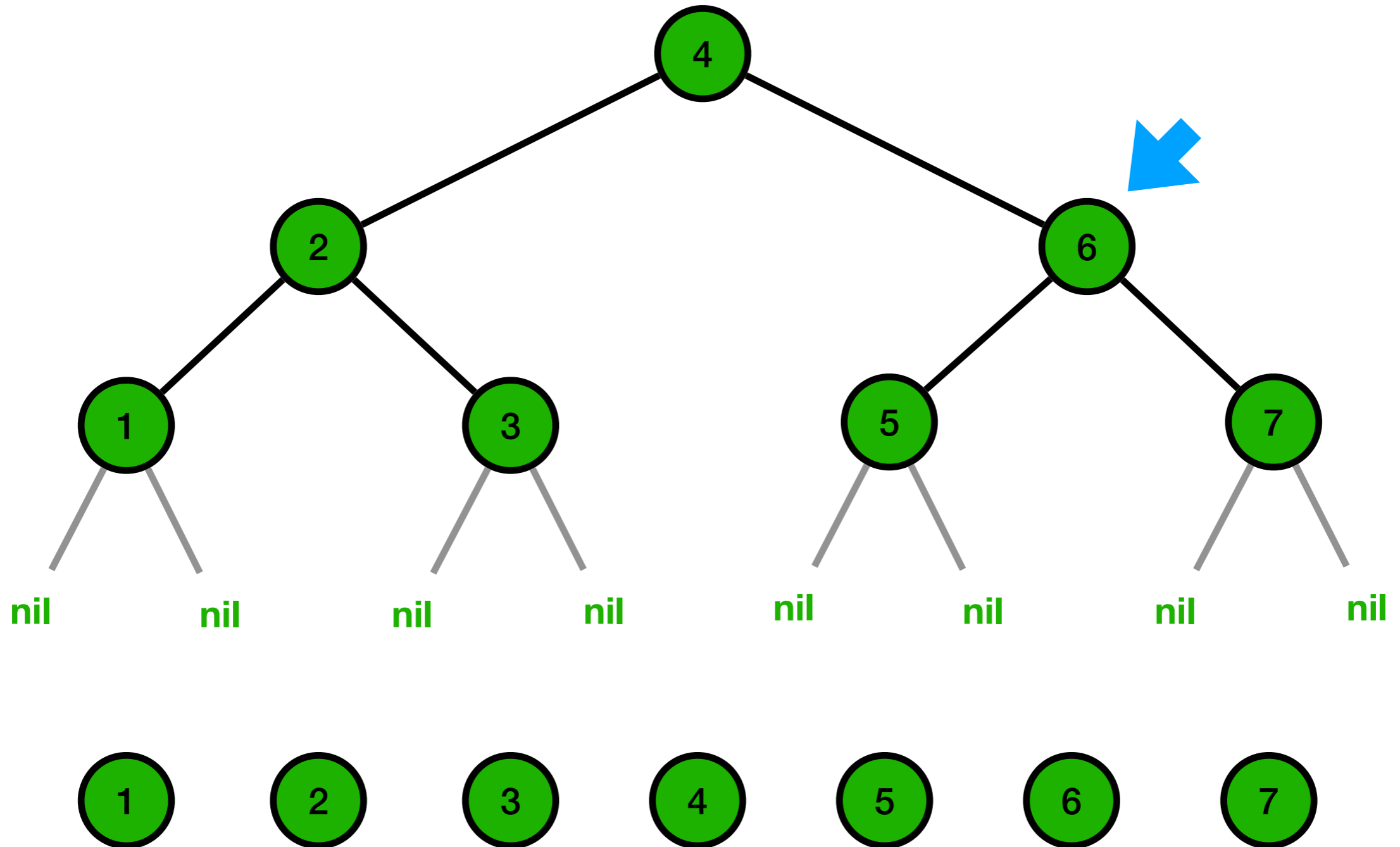
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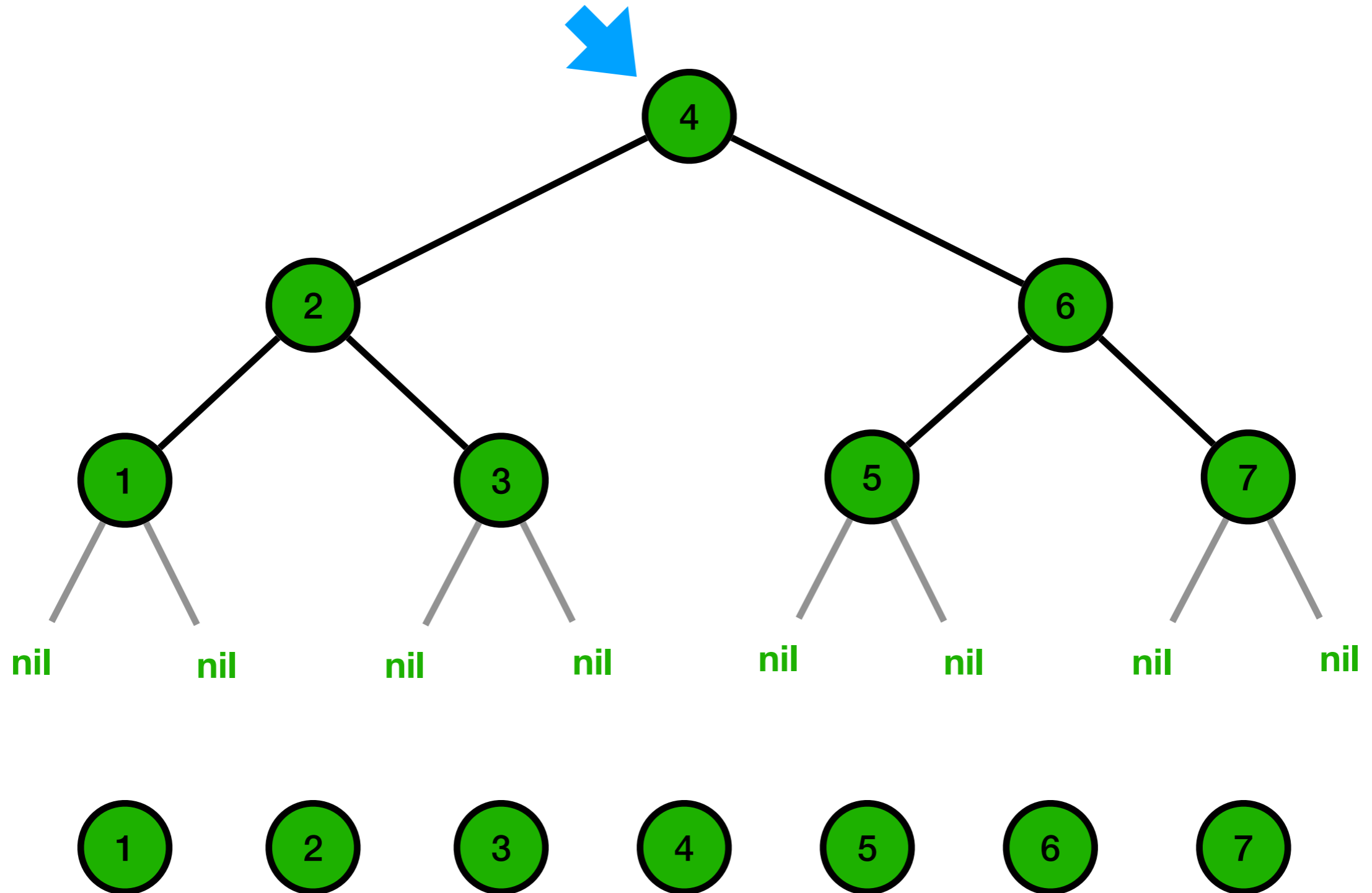
# Parcours infixe d'ABR



# Parcours infixe d'ABR



# Parcours infixe d'ABR



# Parcours infixe d'ABR

