

# Fundamentals of Artificial Intelligence

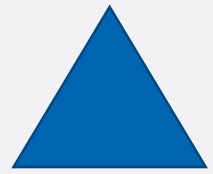
## Laboratory

Dr. Mauro Dragoni

Department of Information Engineering and Computer Science  
Academic Year 2022/2023

## Exercise 6.1

- Minimax with alpha-beta pruning



- MAX nodes. The goal at a MAX node is to maximize the value of the subtree rooted at that node. To do this, a MAX node chooses the child with the greatest value, and that becomes the value of the MAX node.

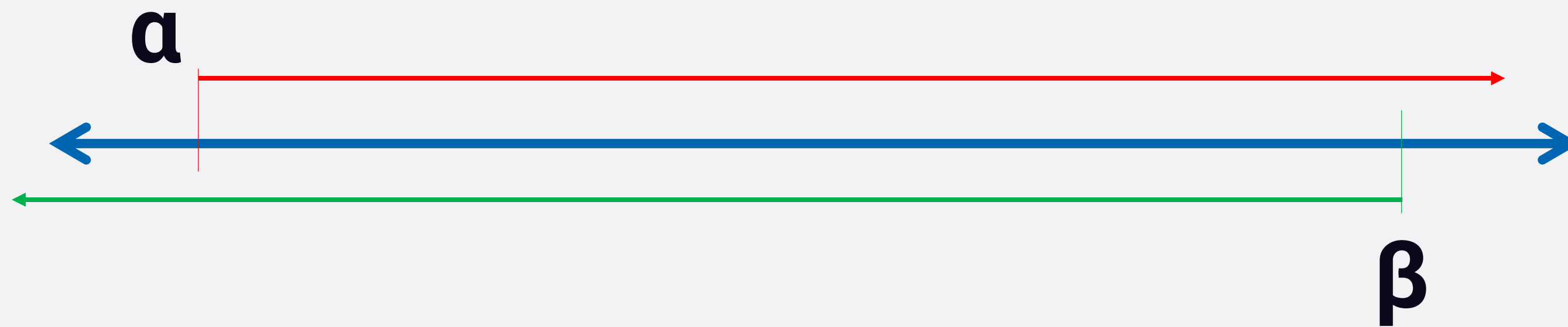


- MIN nodes. The goal at a MIN node is to minimize the value of the subtree rooted at that node. To do this, a MIN node chooses the child with the least (smallest) value, and that becomes the value of the MIN node.
- $\alpha$ : Alpha is the maximum lower bound of possible solutions. It is equivalent to  $\geq -\infty$
- $\beta$ : Beta is the minimum upper bound of possible solutions. It is equivalent to  $\leq \infty$ .

## Exercise 6.1

- Minimax with alpha-beta pruning, tips:
  - When any new node is being considered as a possible path to the solution, it can only work if:

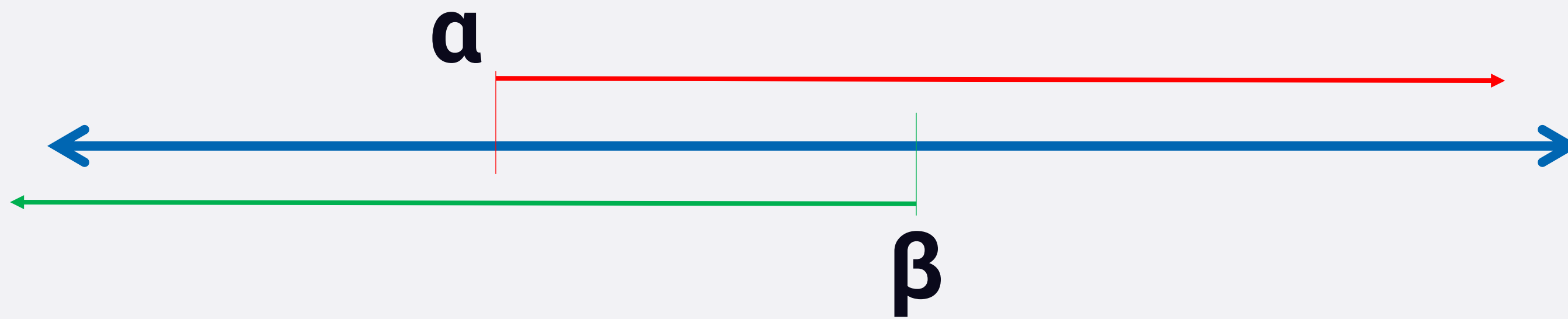
$$\alpha \leq N \leq \beta$$



## Exercise 6.1

- Minimax with alpha-beta pruning, tips:
  - When any new node is being considered as a possible path to the solution, it can only work if:

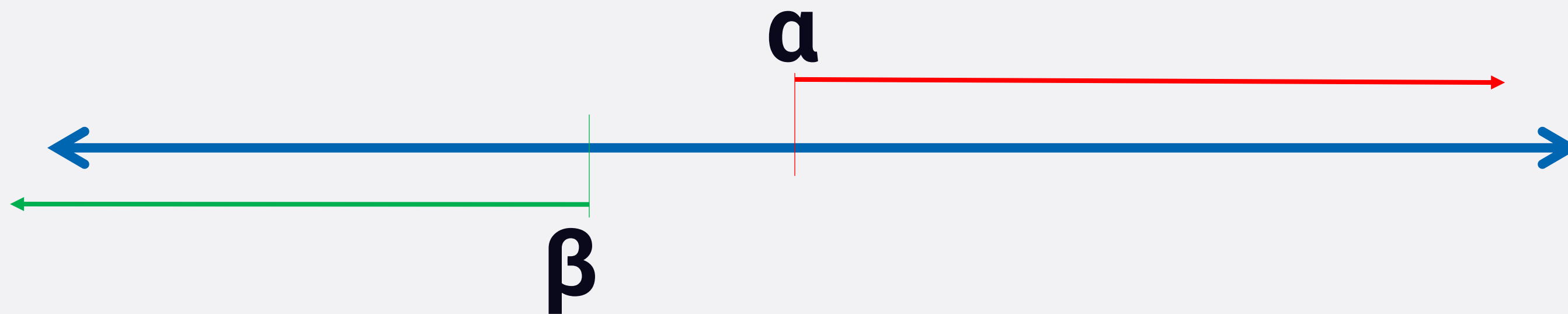
$$\alpha \leq N \leq \beta$$



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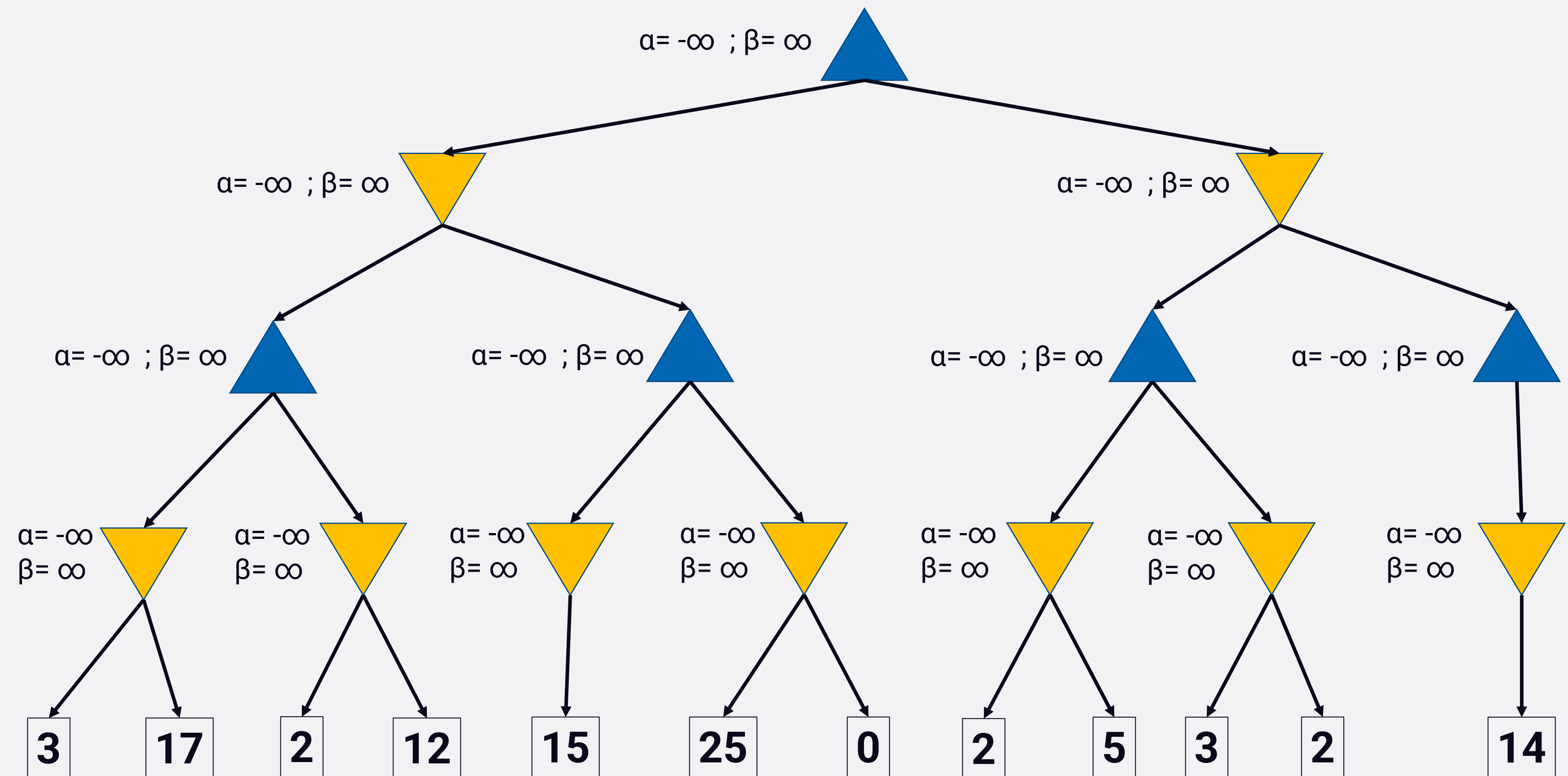
- Minimax with alpha-beta pruning, tips:
  - When any new node is being considered as a possible path to the solution, it can only work if:

$$\alpha \leq N \leq \beta$$



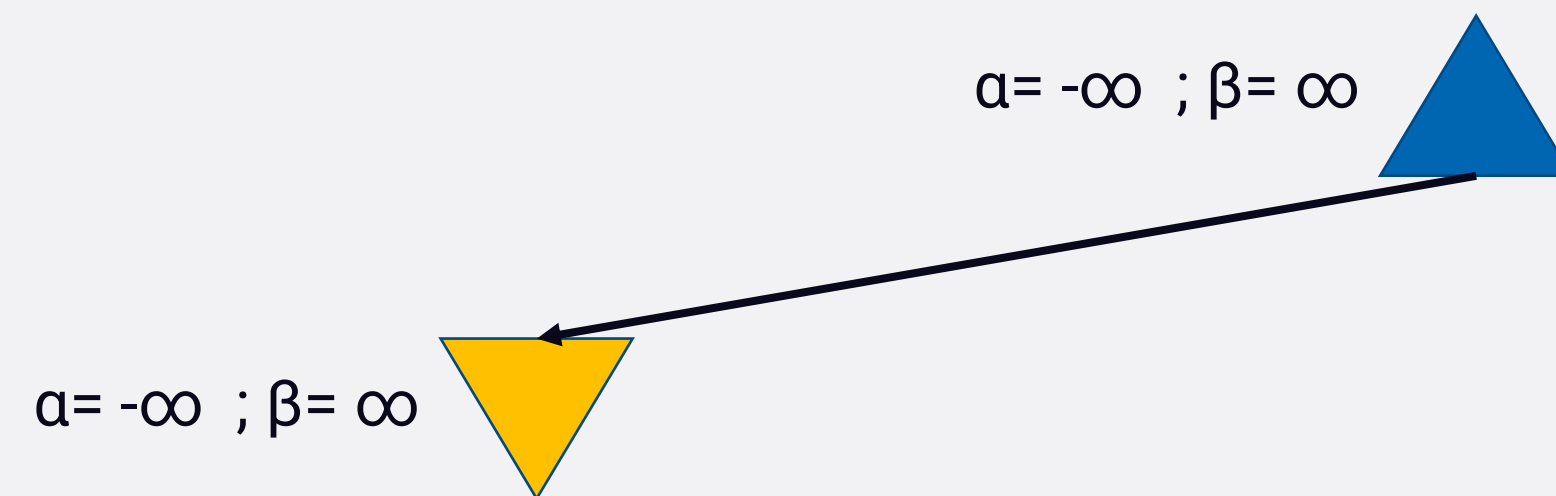
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- Minimax with alpha-beta pruning



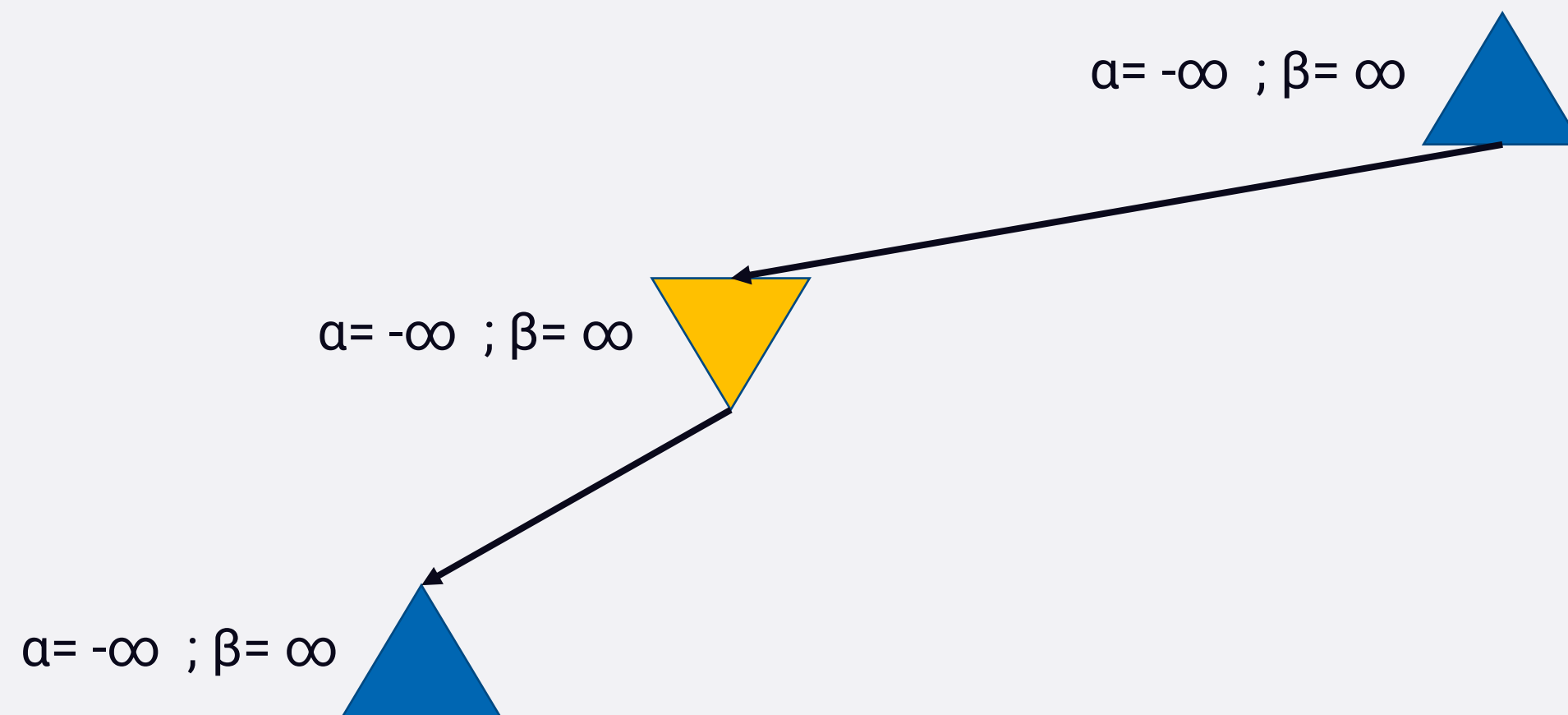
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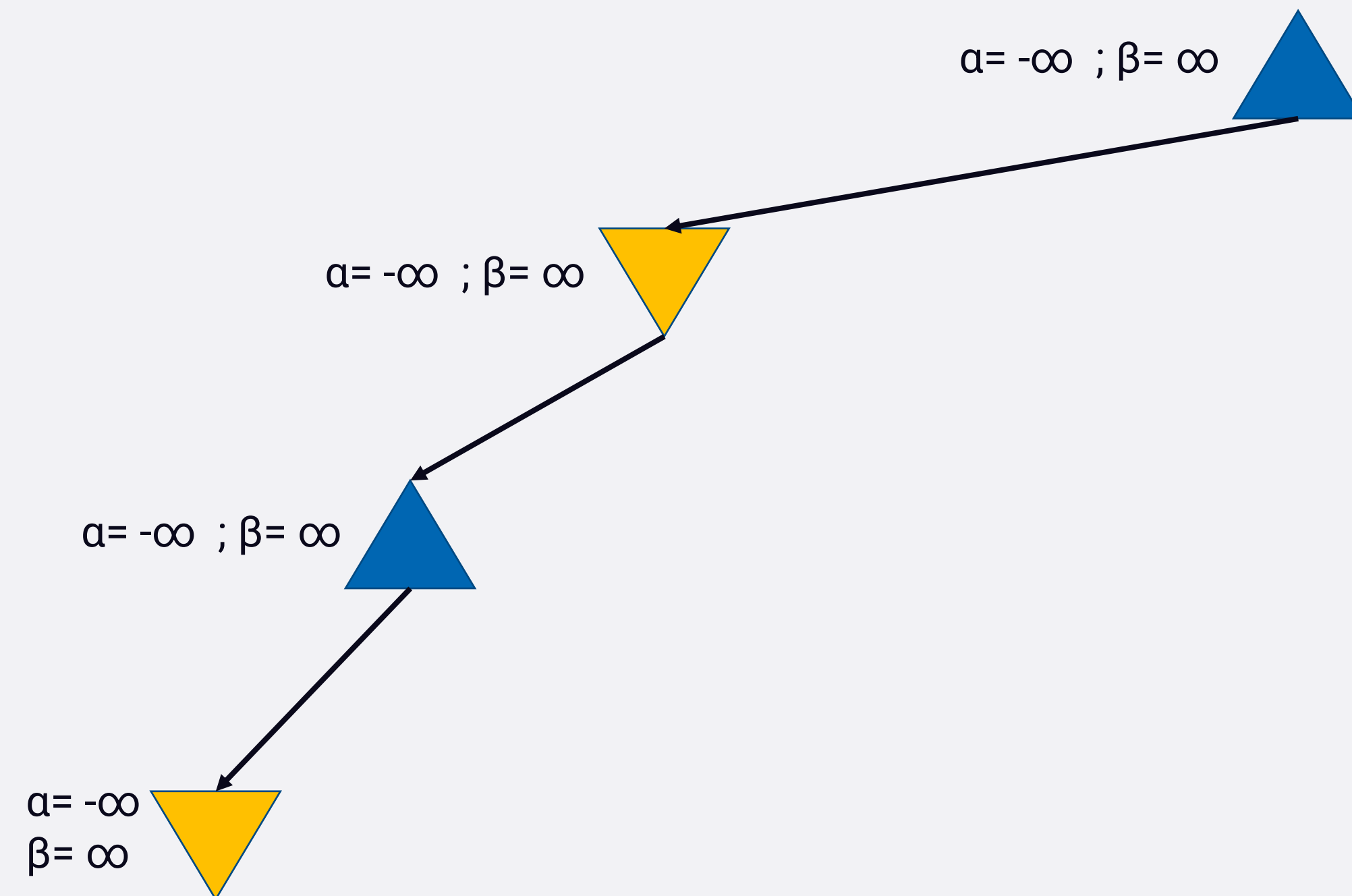
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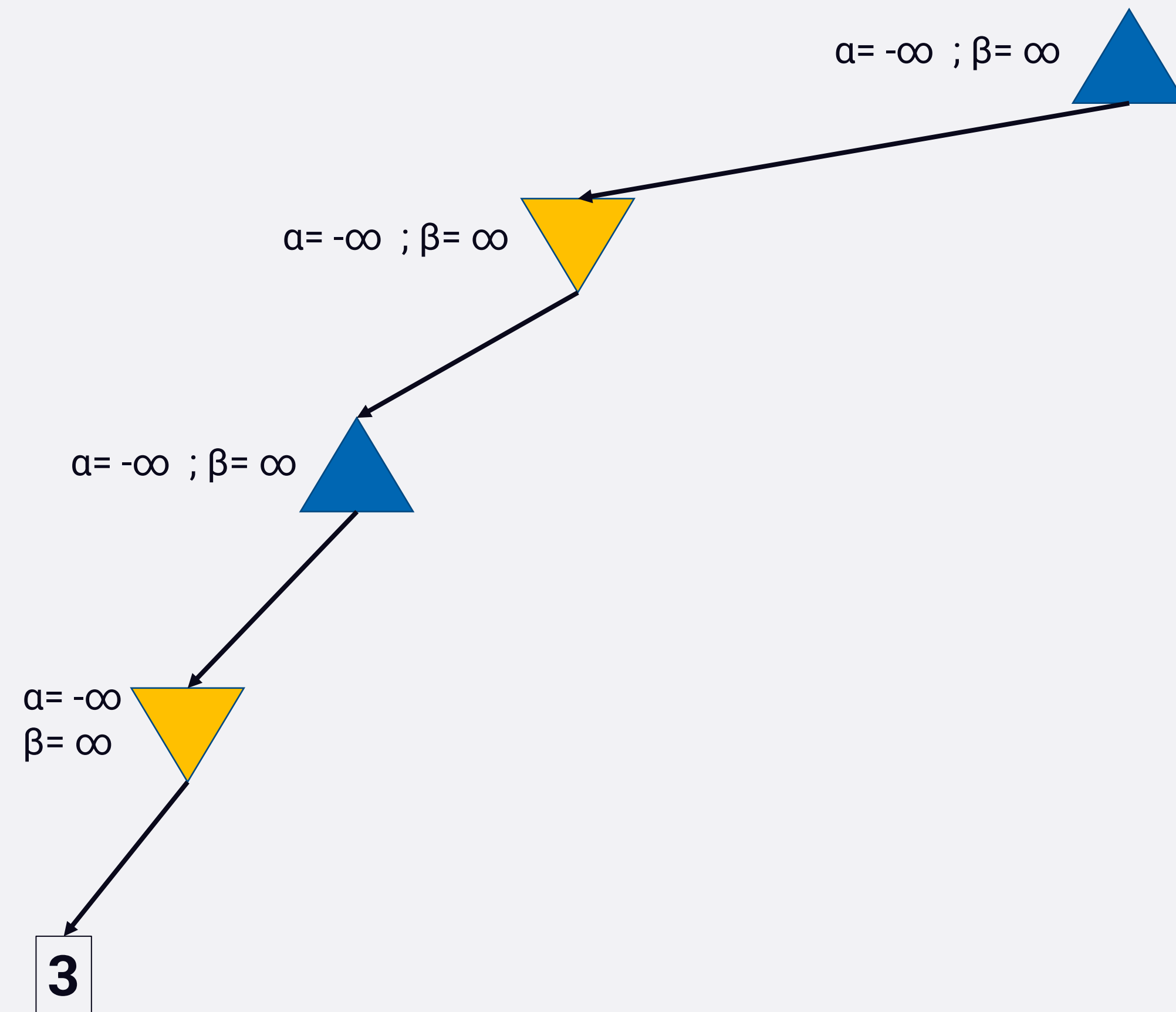
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- Minimax with alpha-beta pruning



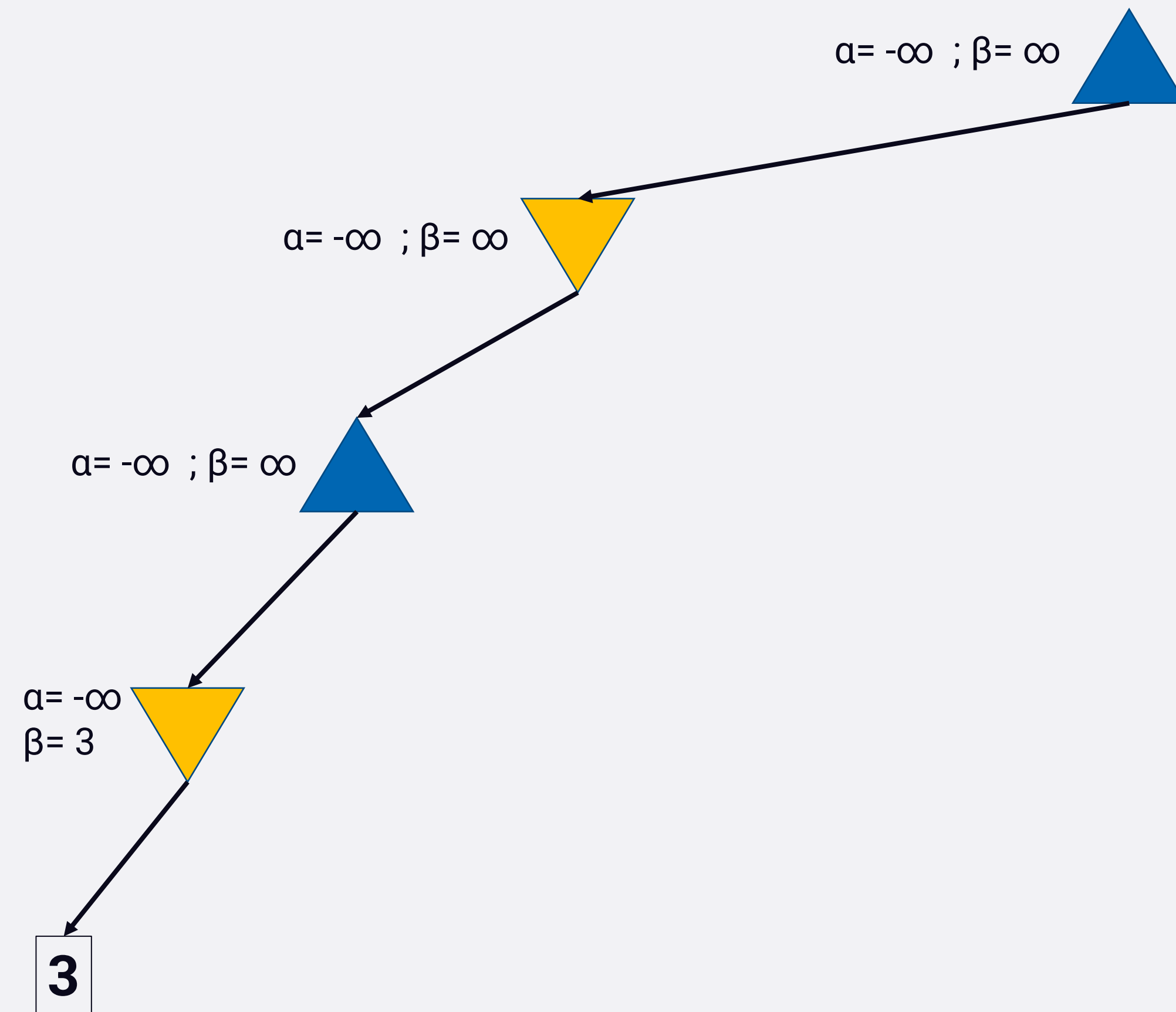
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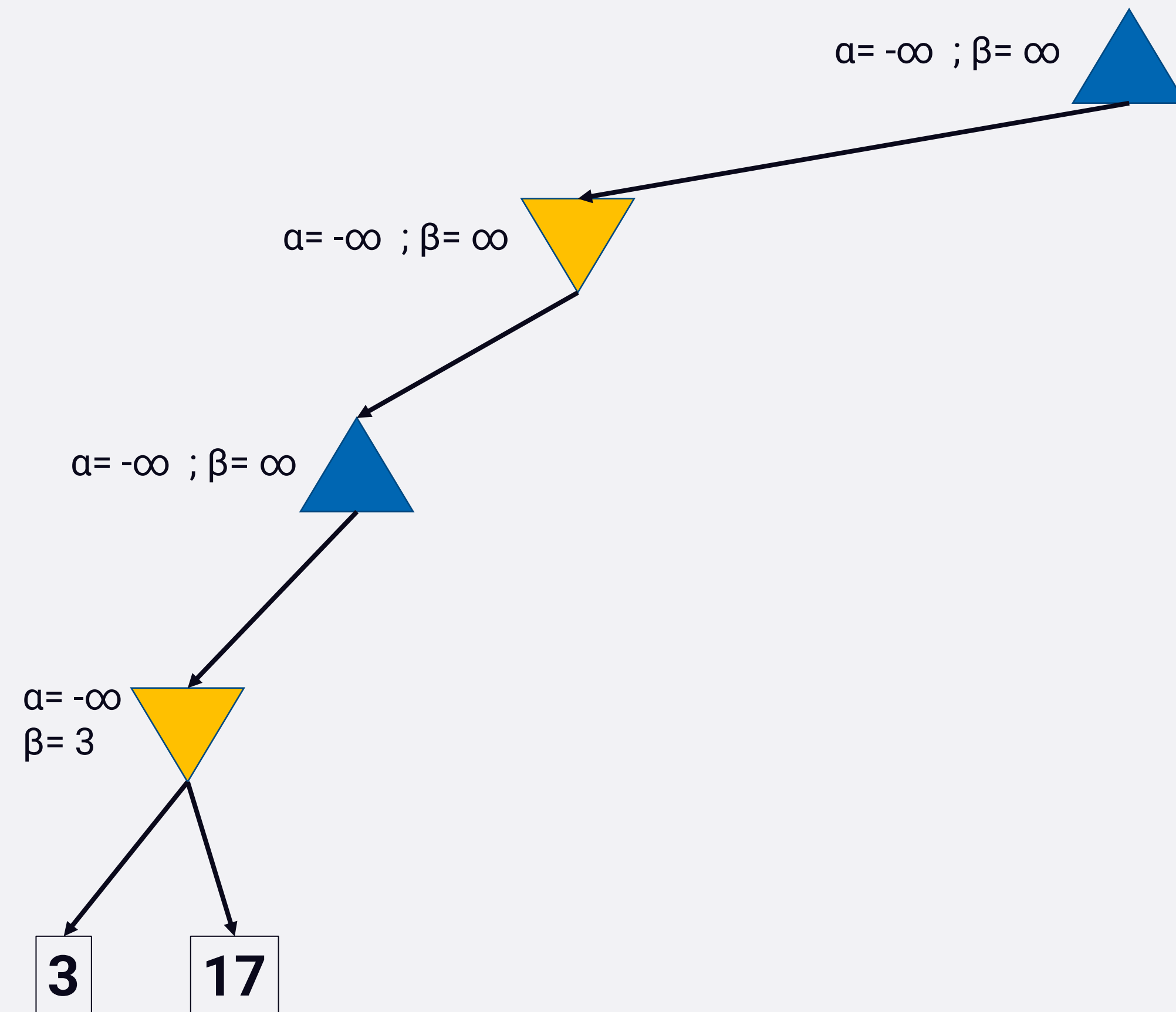
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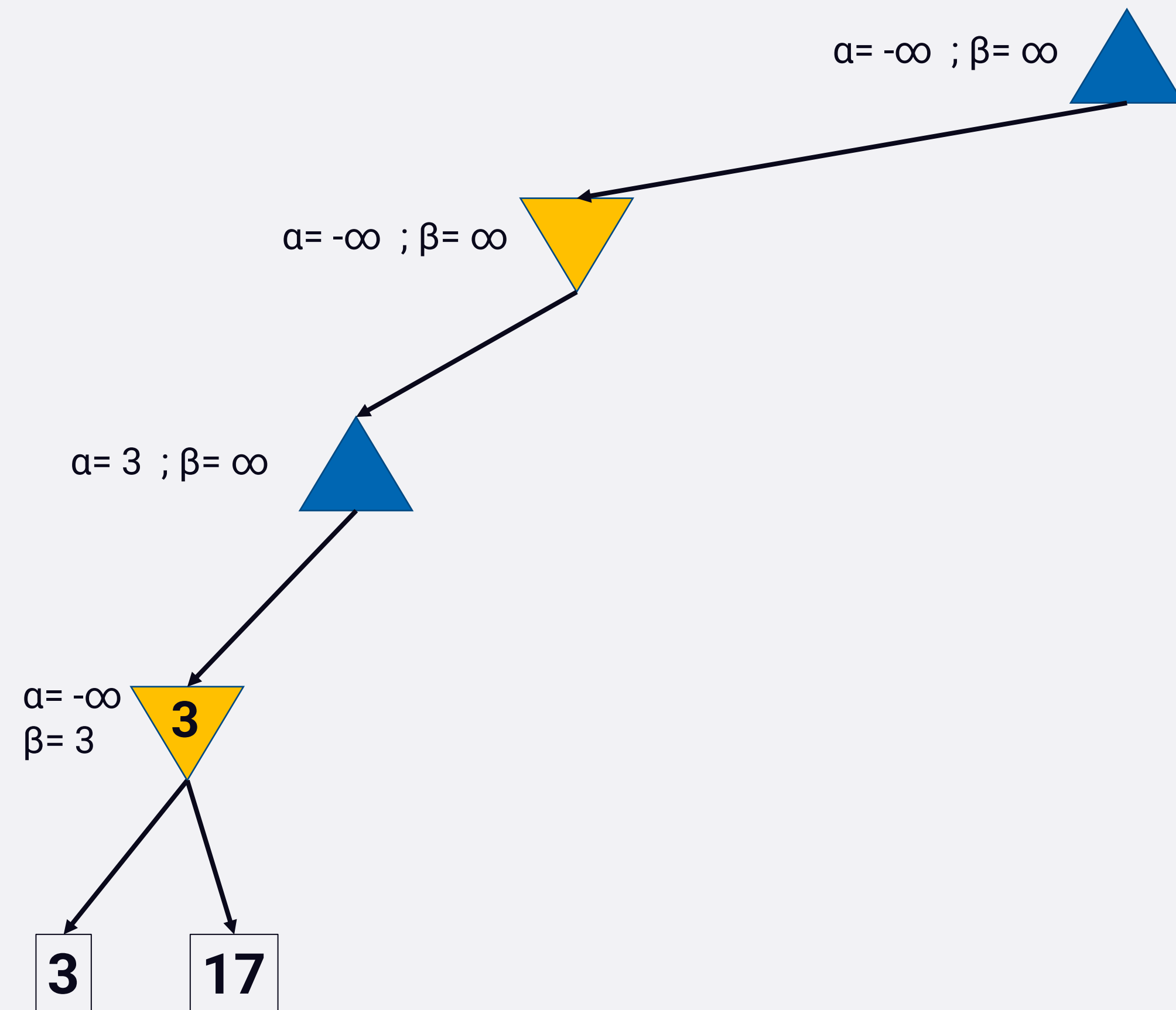
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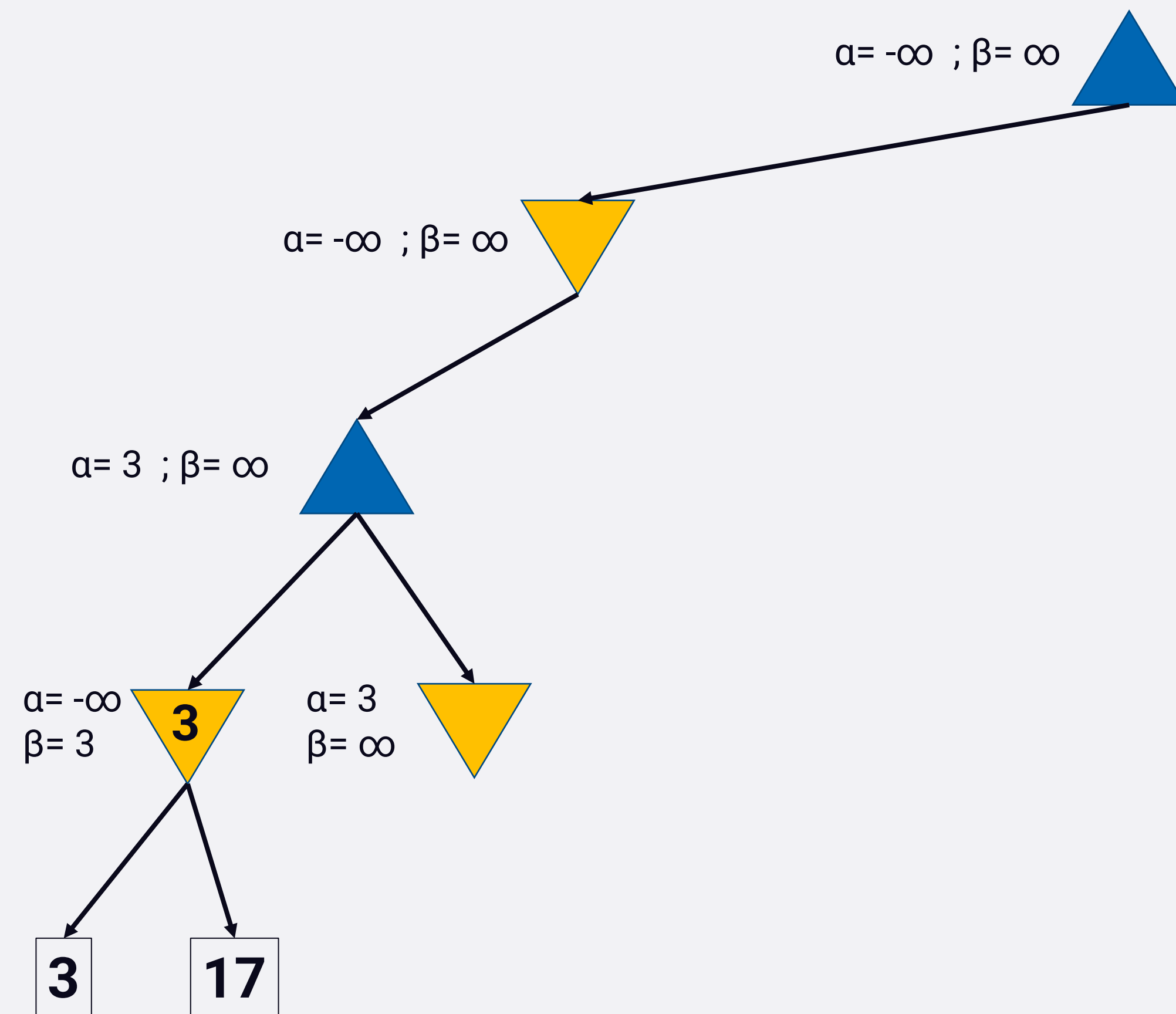
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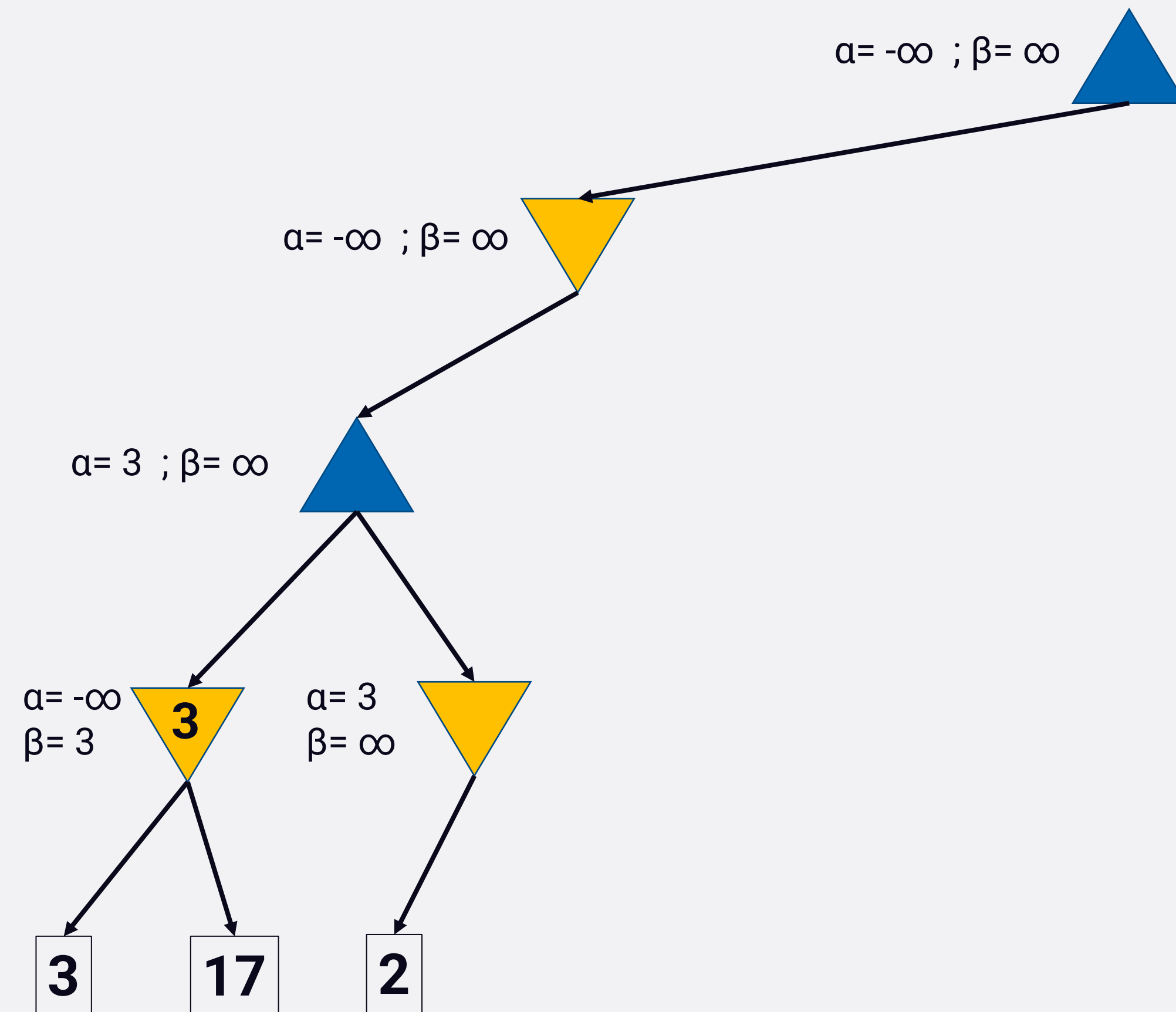
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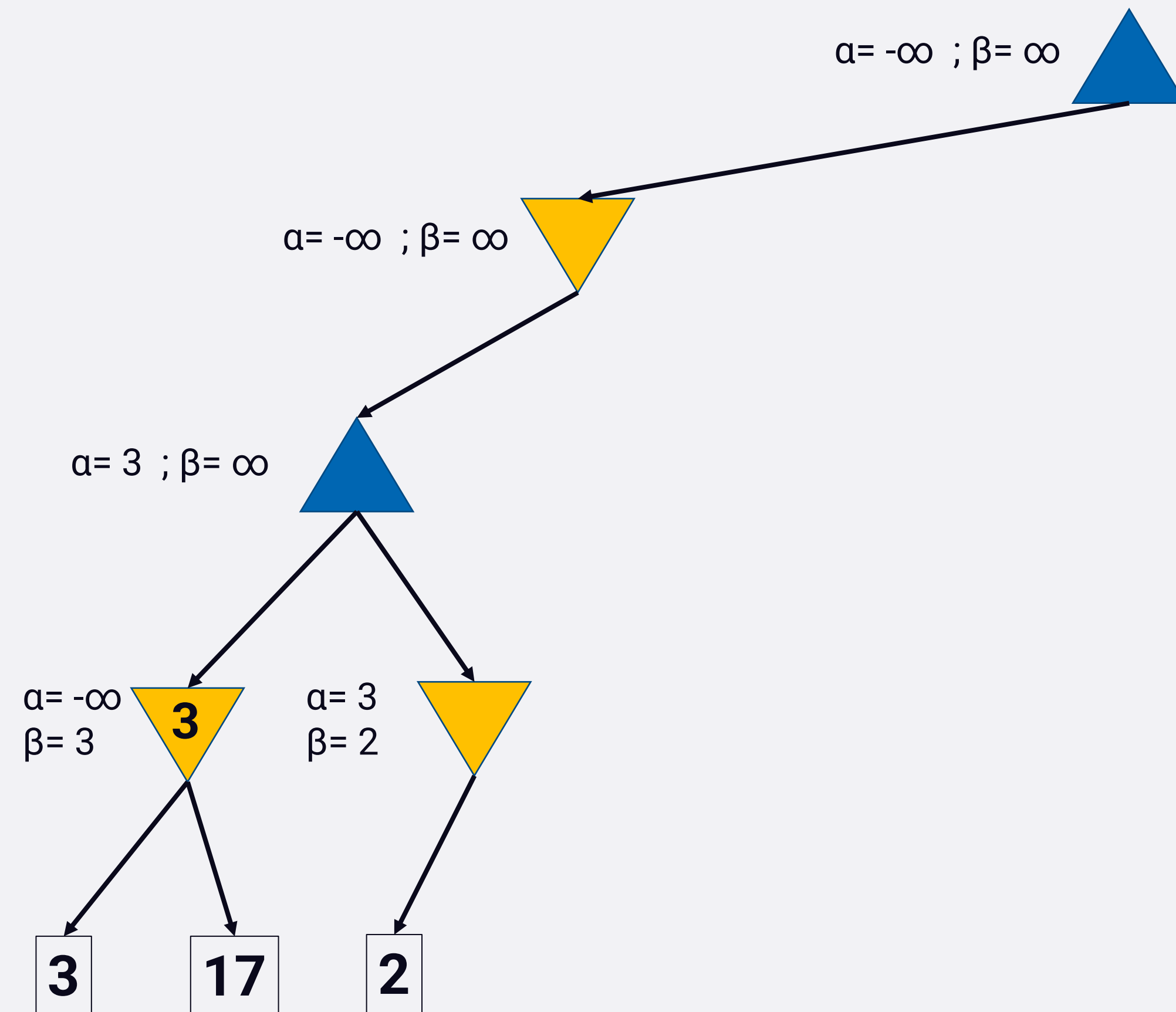
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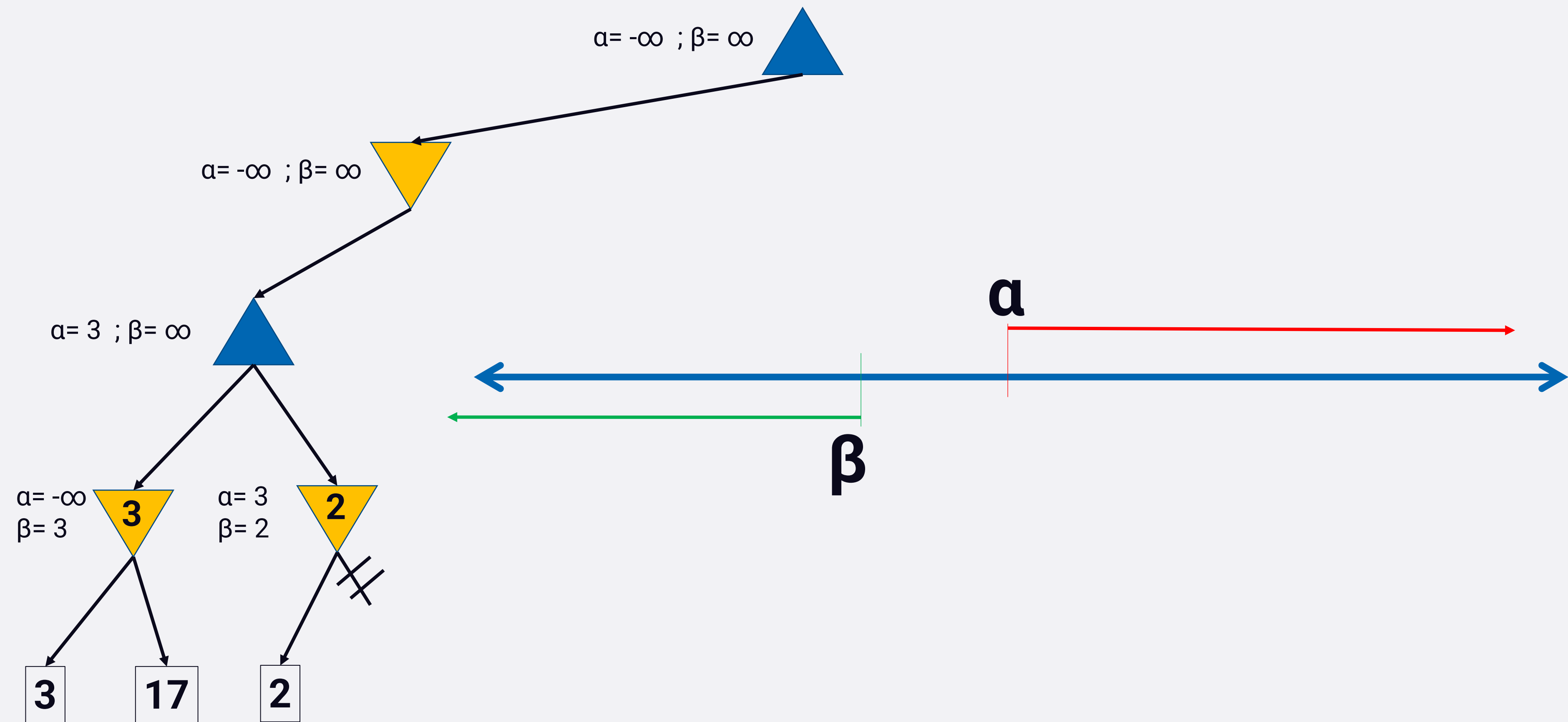
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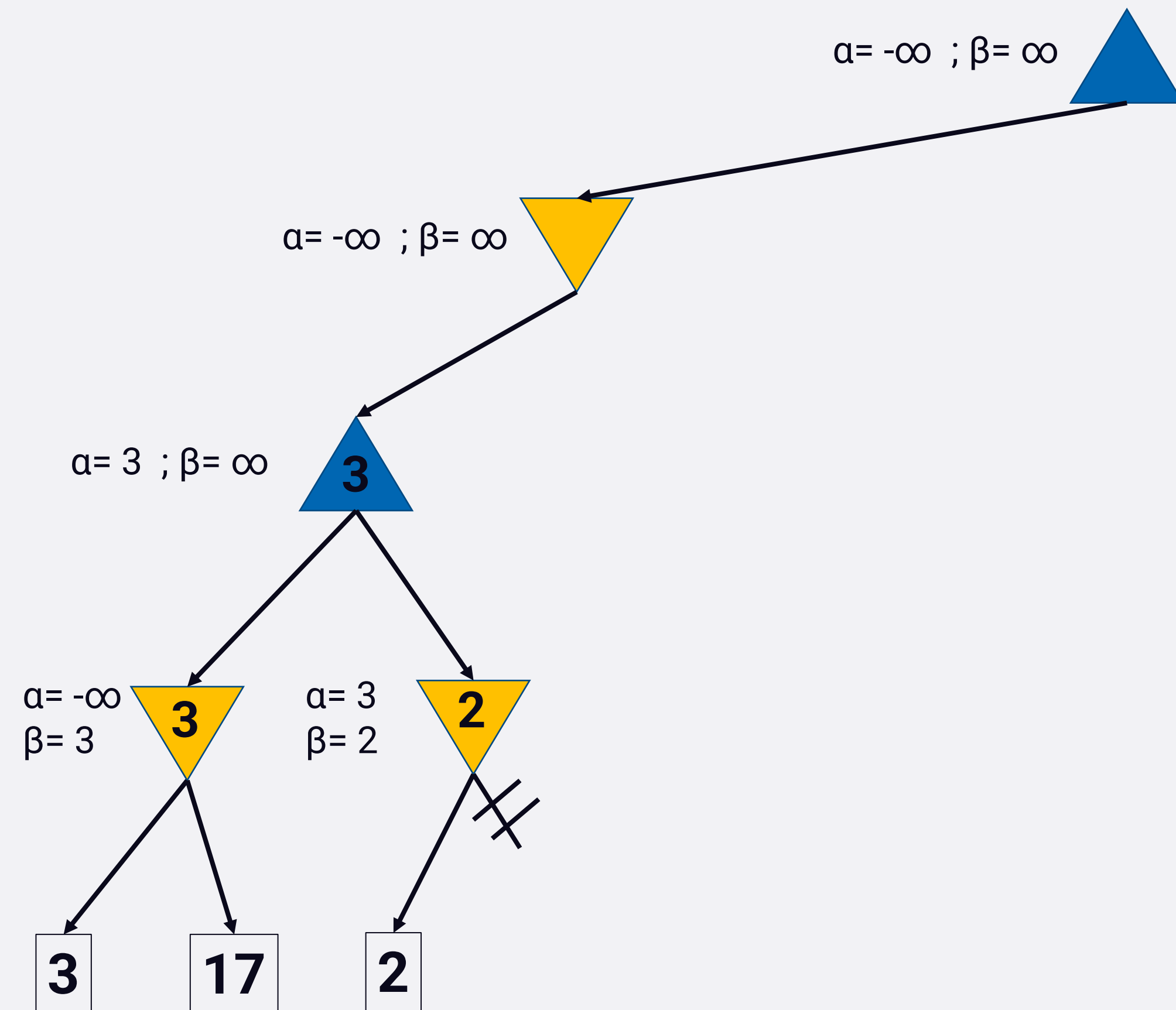
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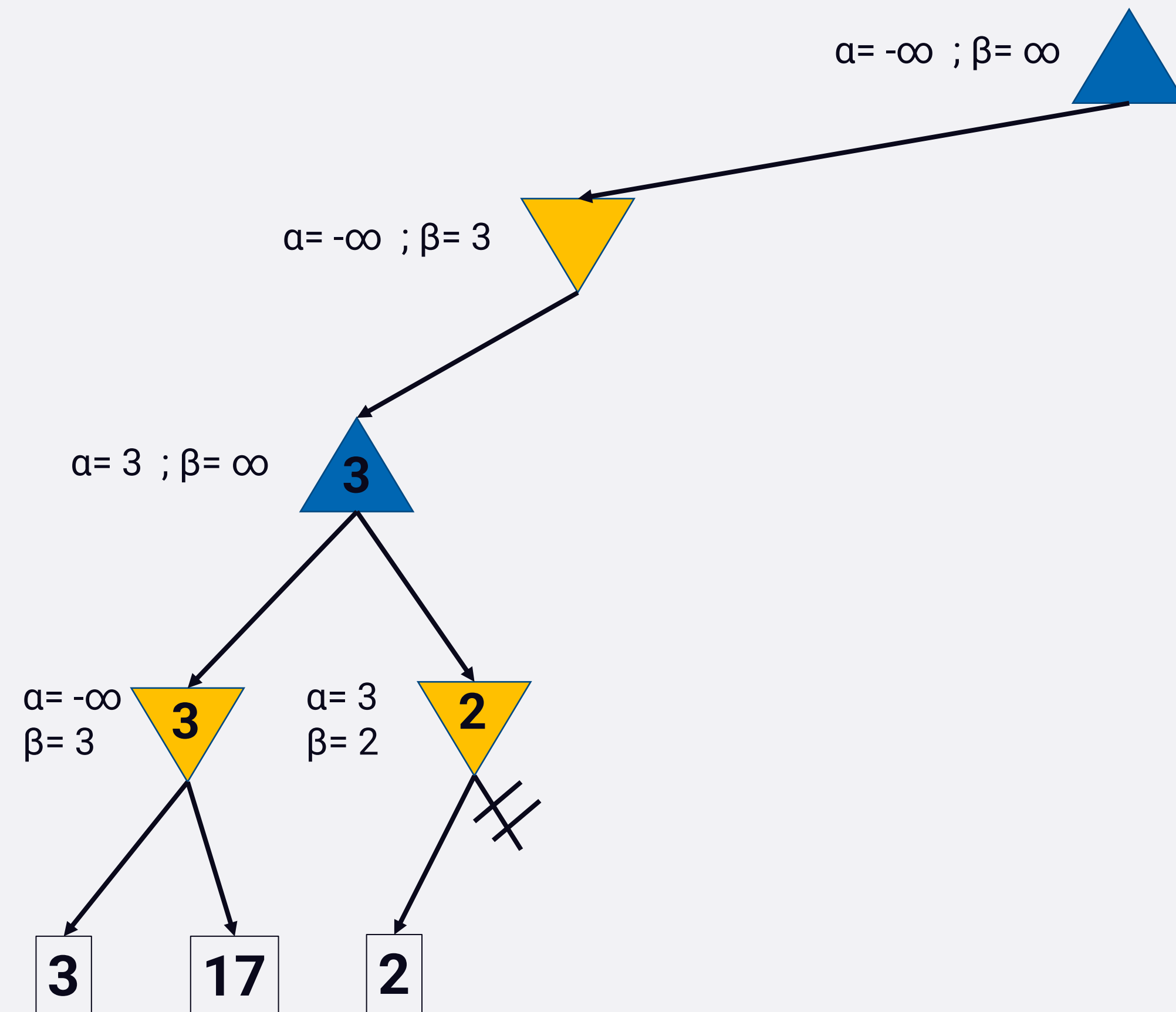
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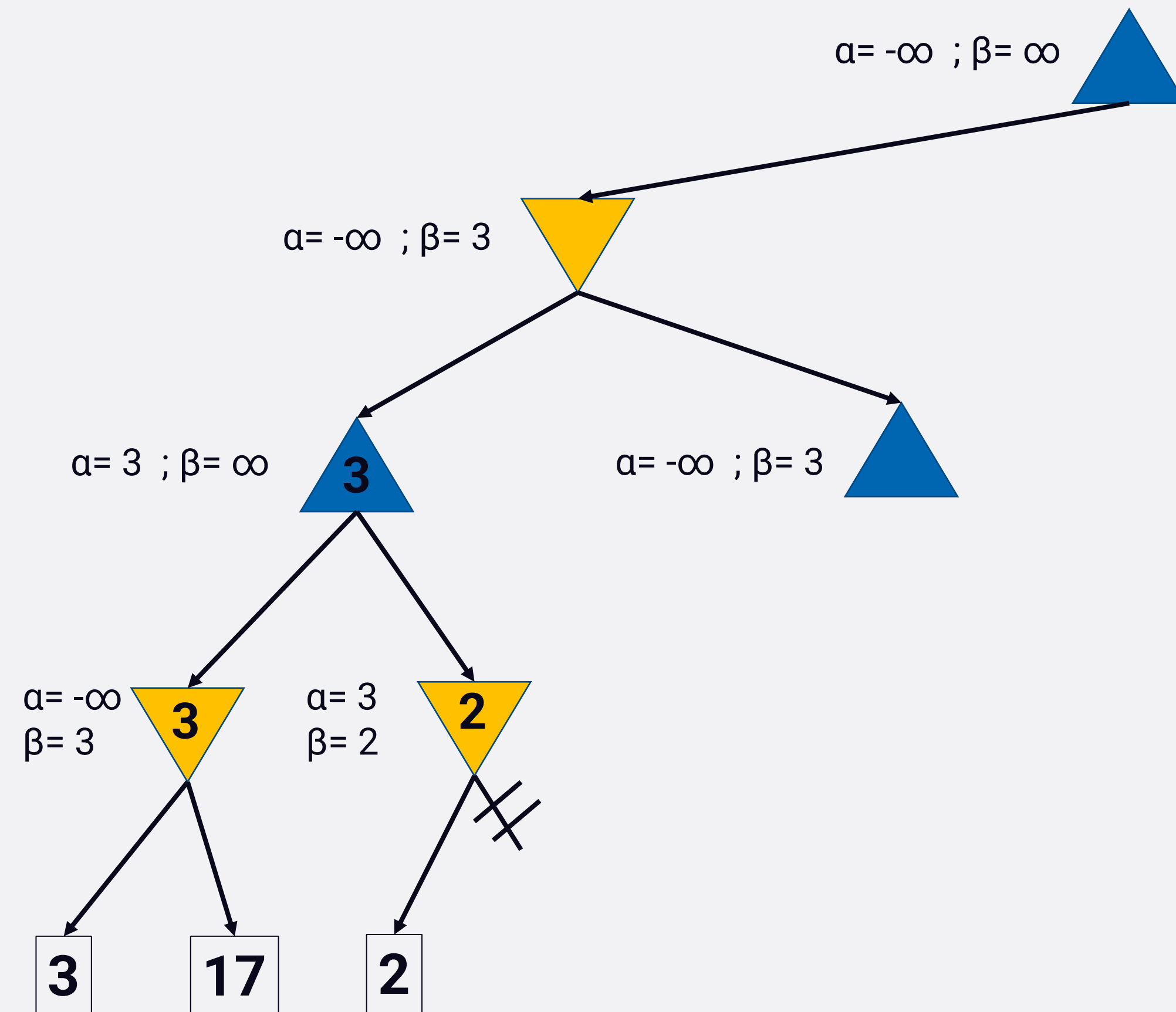
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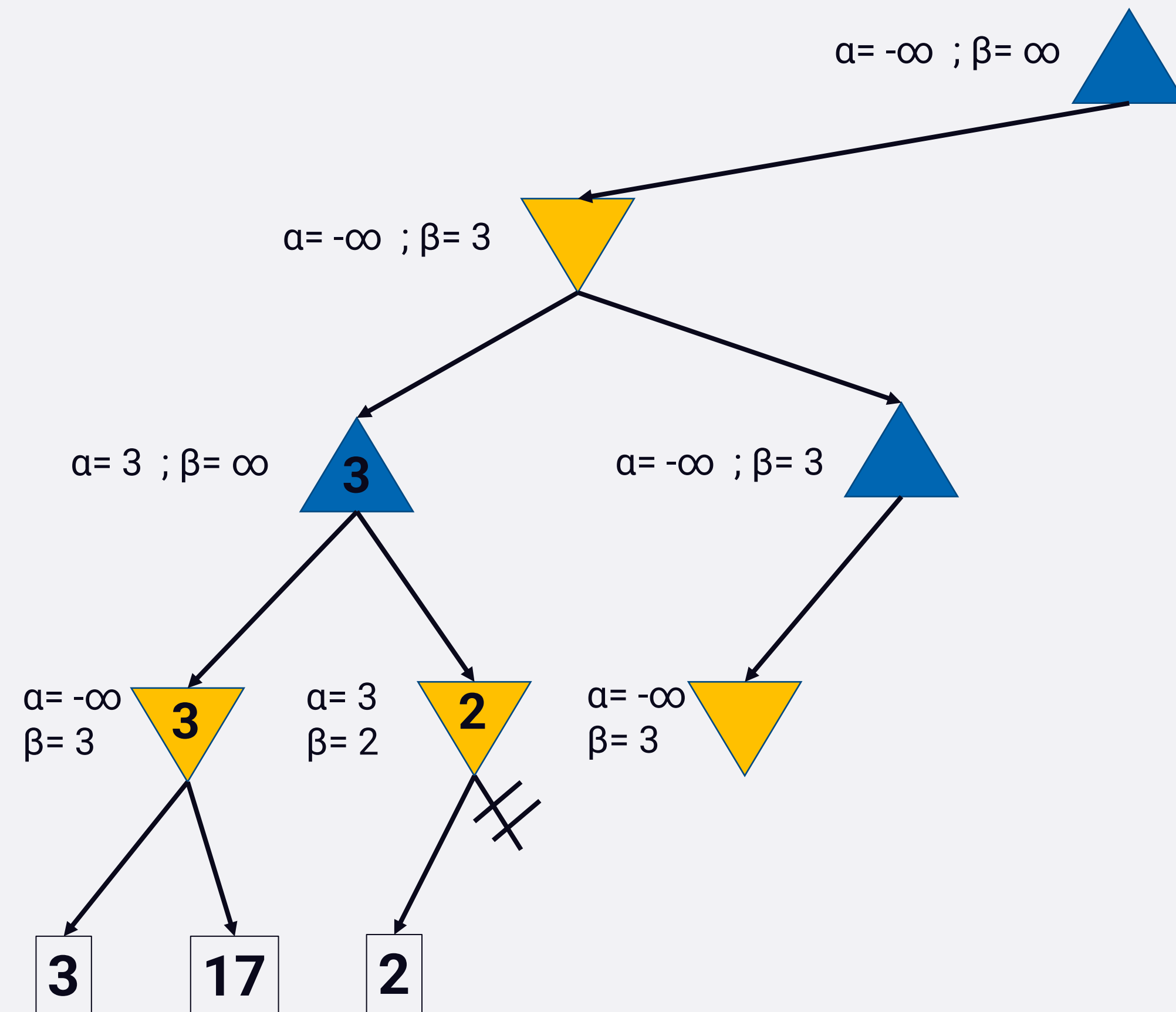
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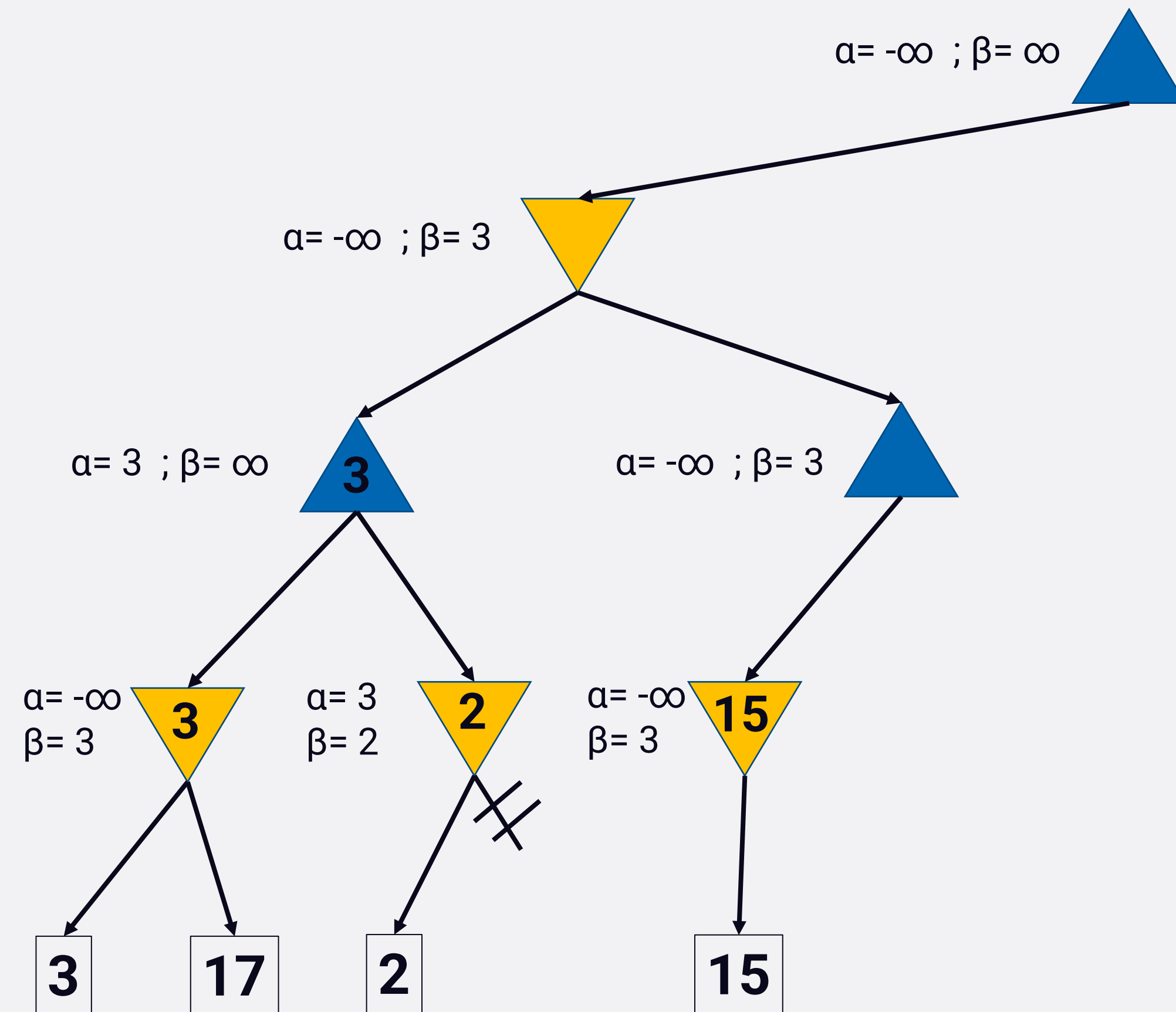
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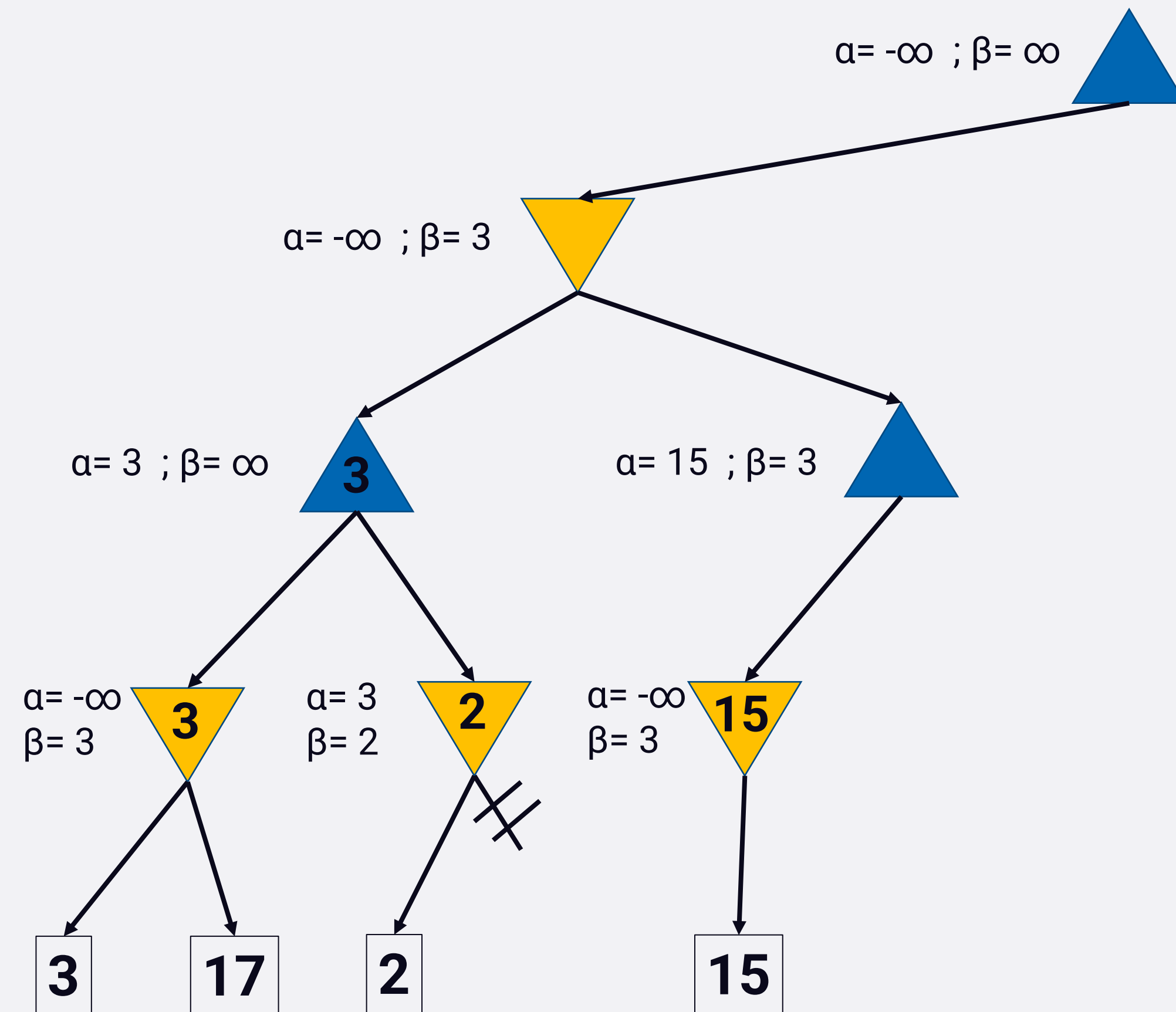
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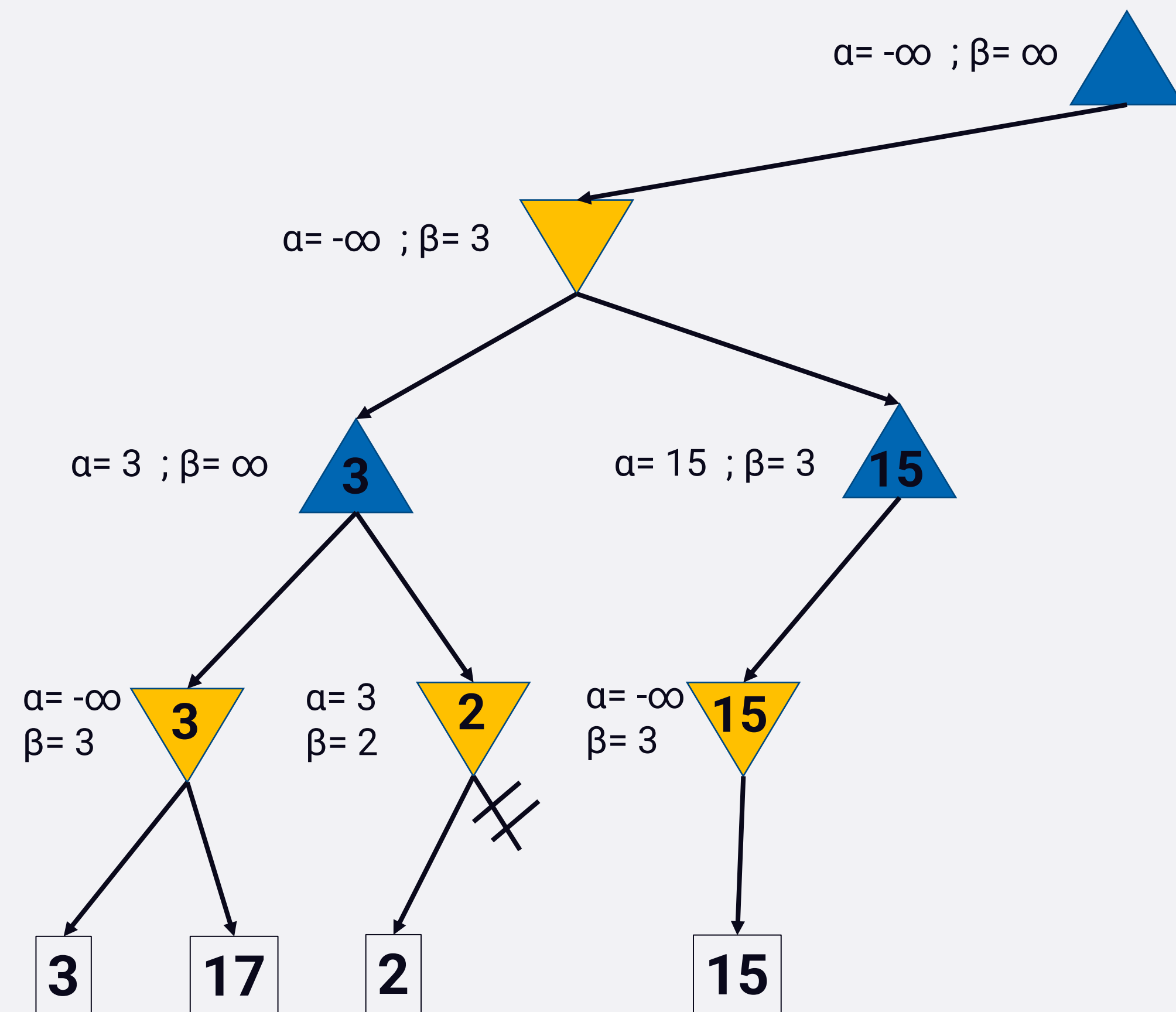
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- Minimax with alpha-beta pruning



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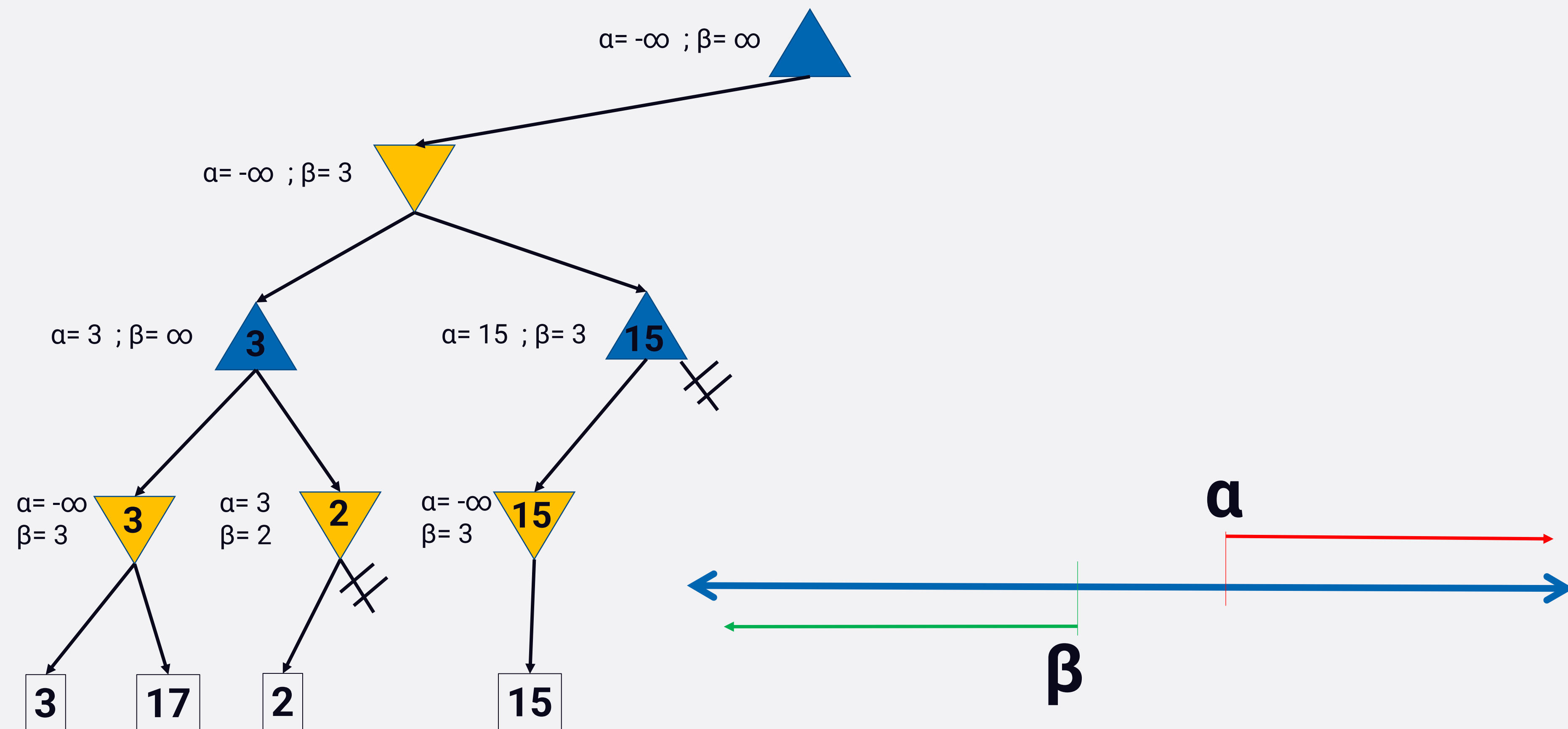
- Minimax with alpha-beta pruning





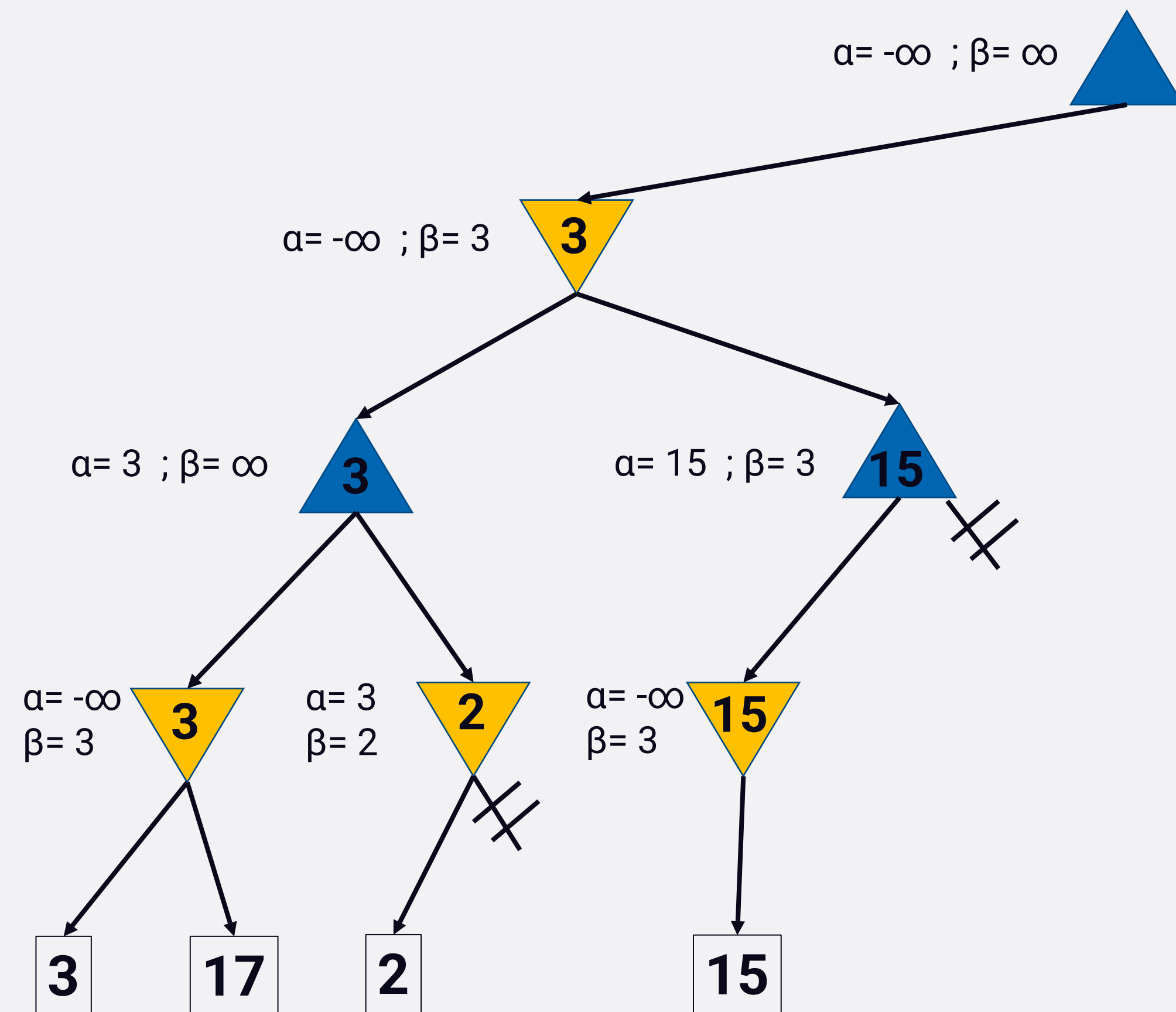
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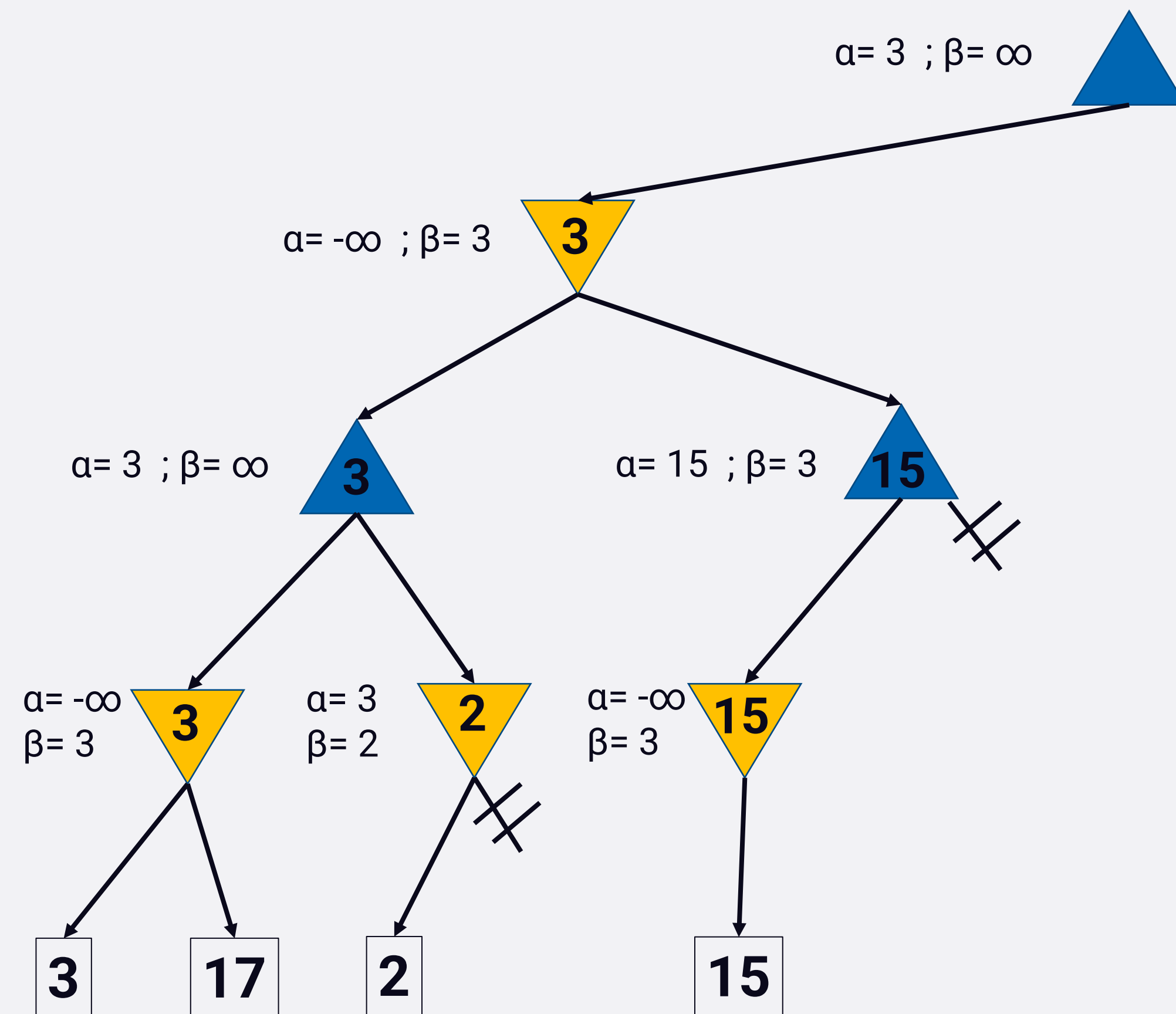
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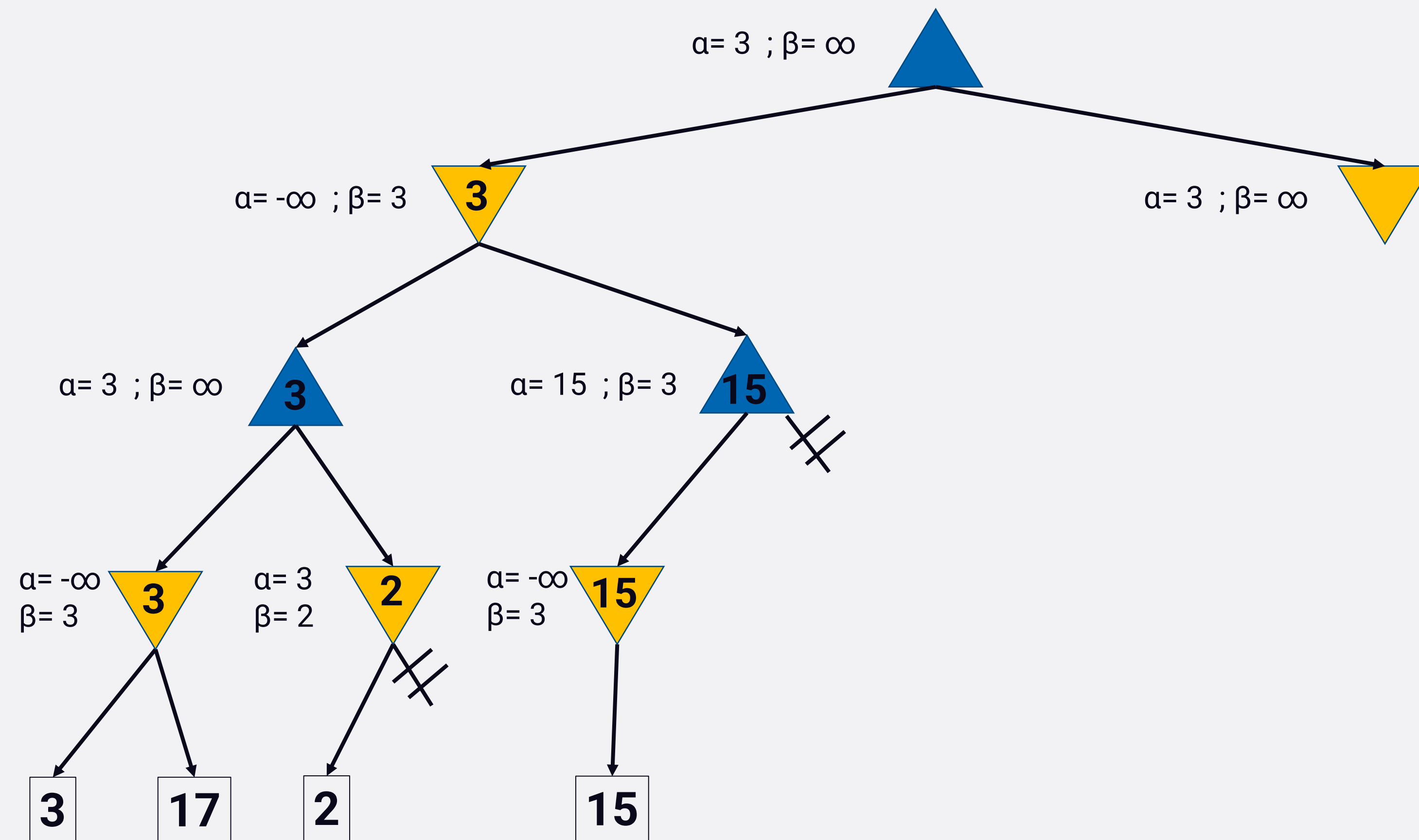
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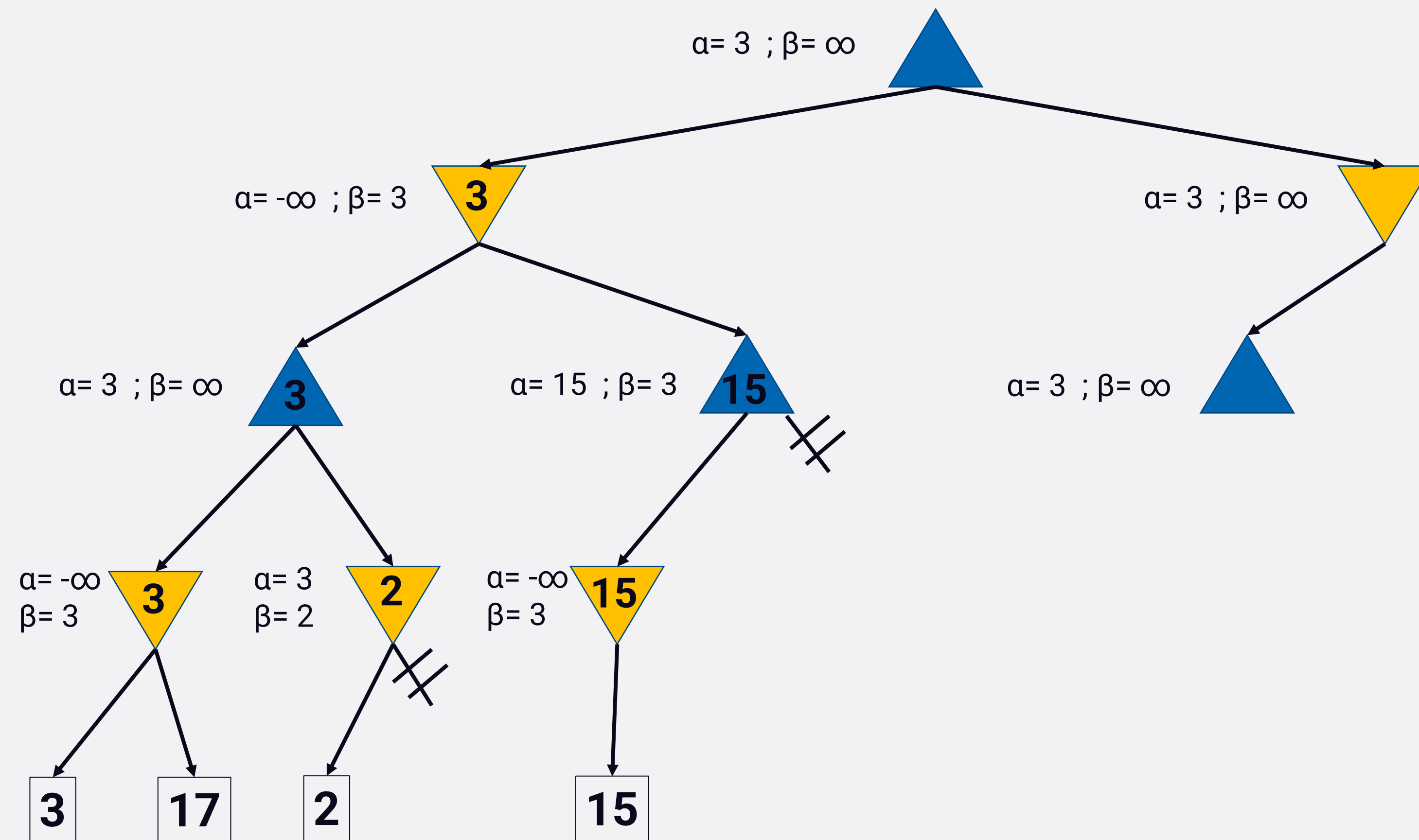
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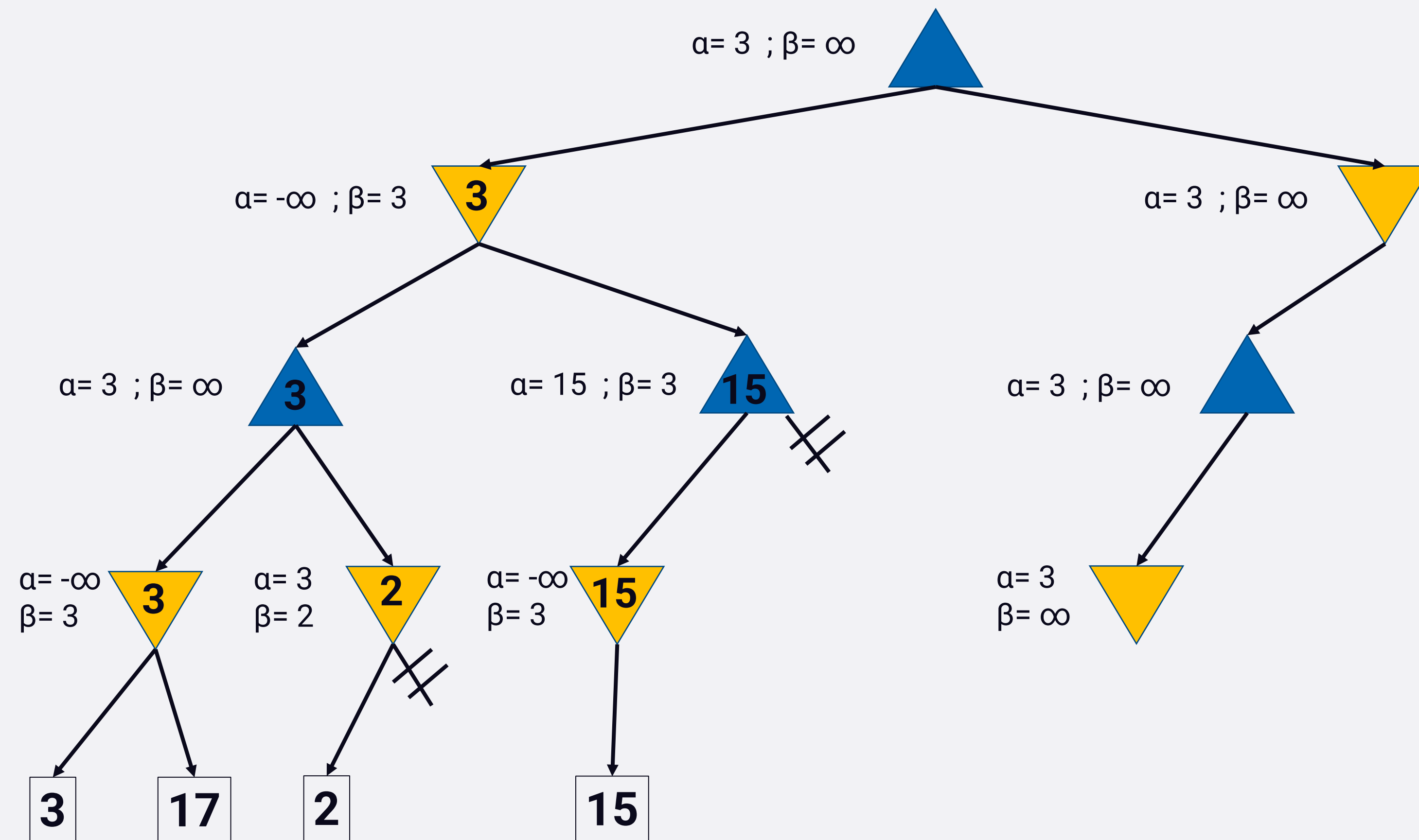
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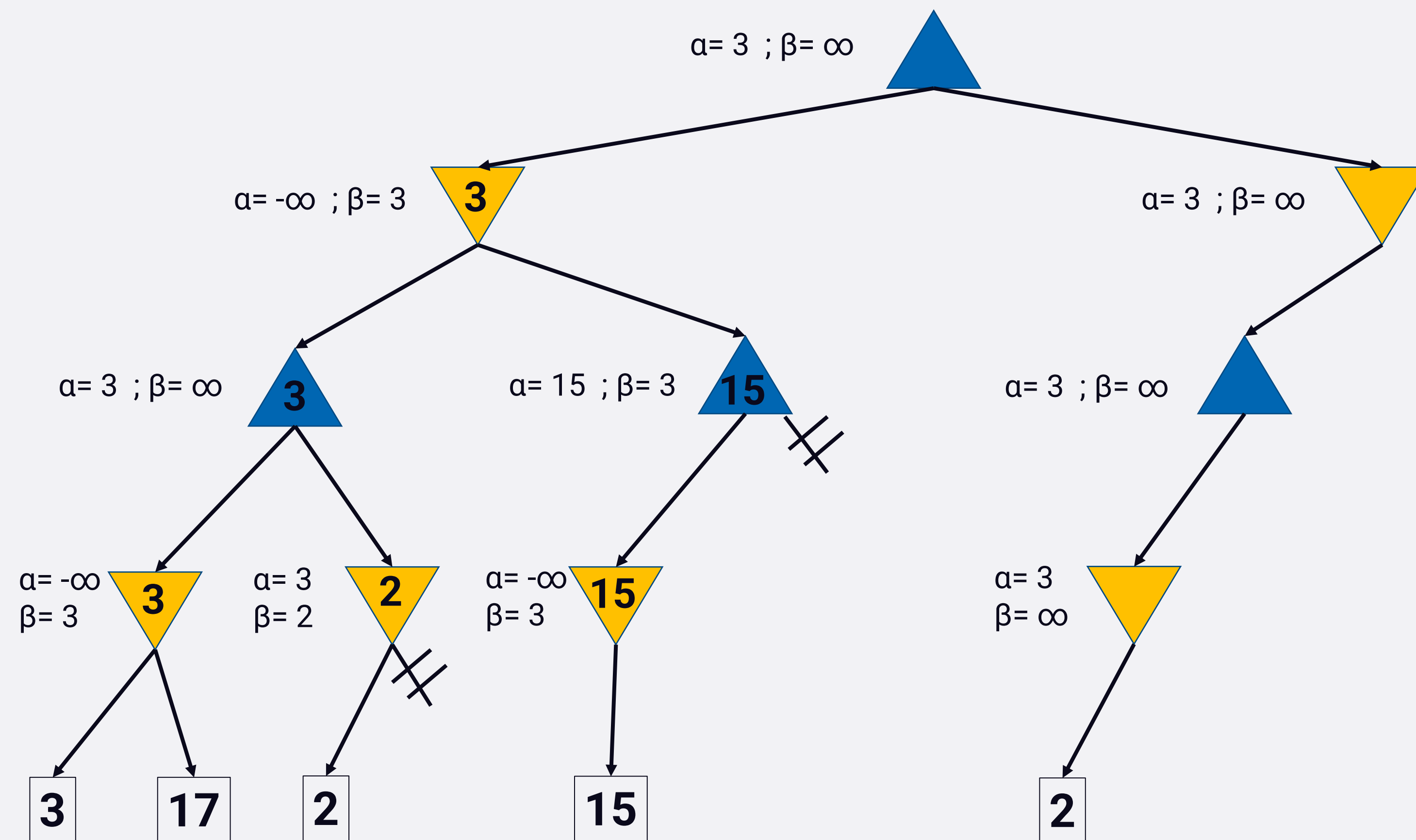
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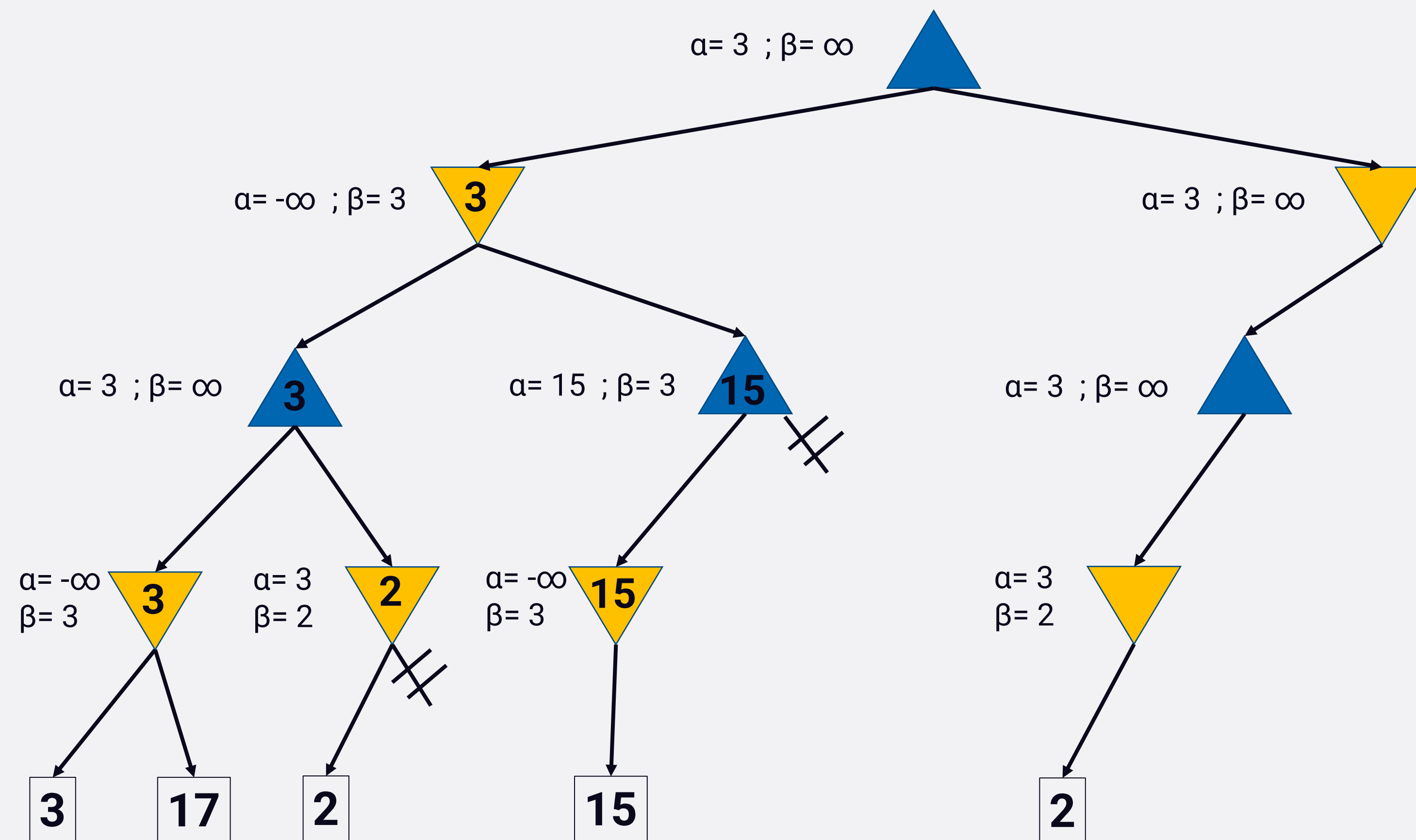
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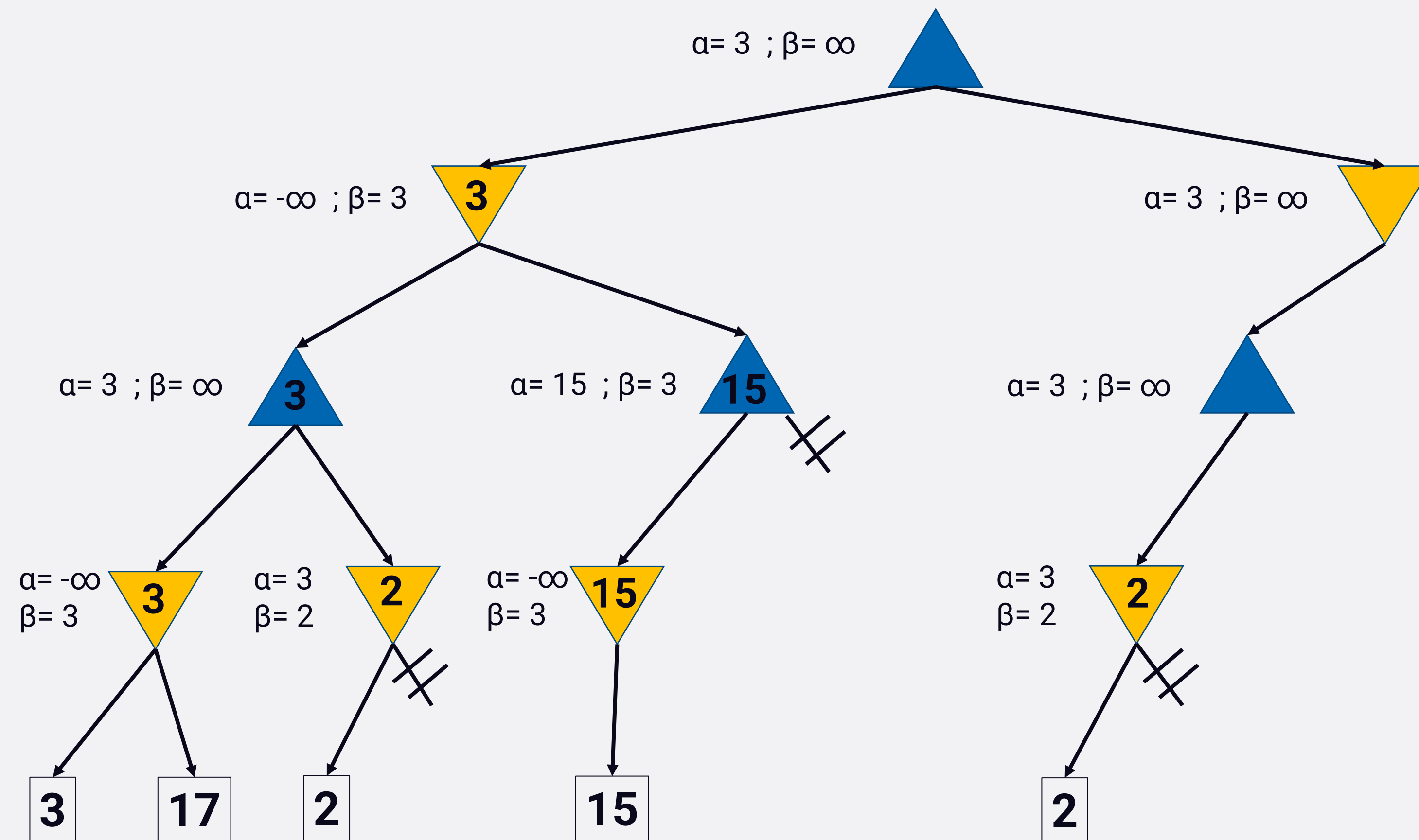
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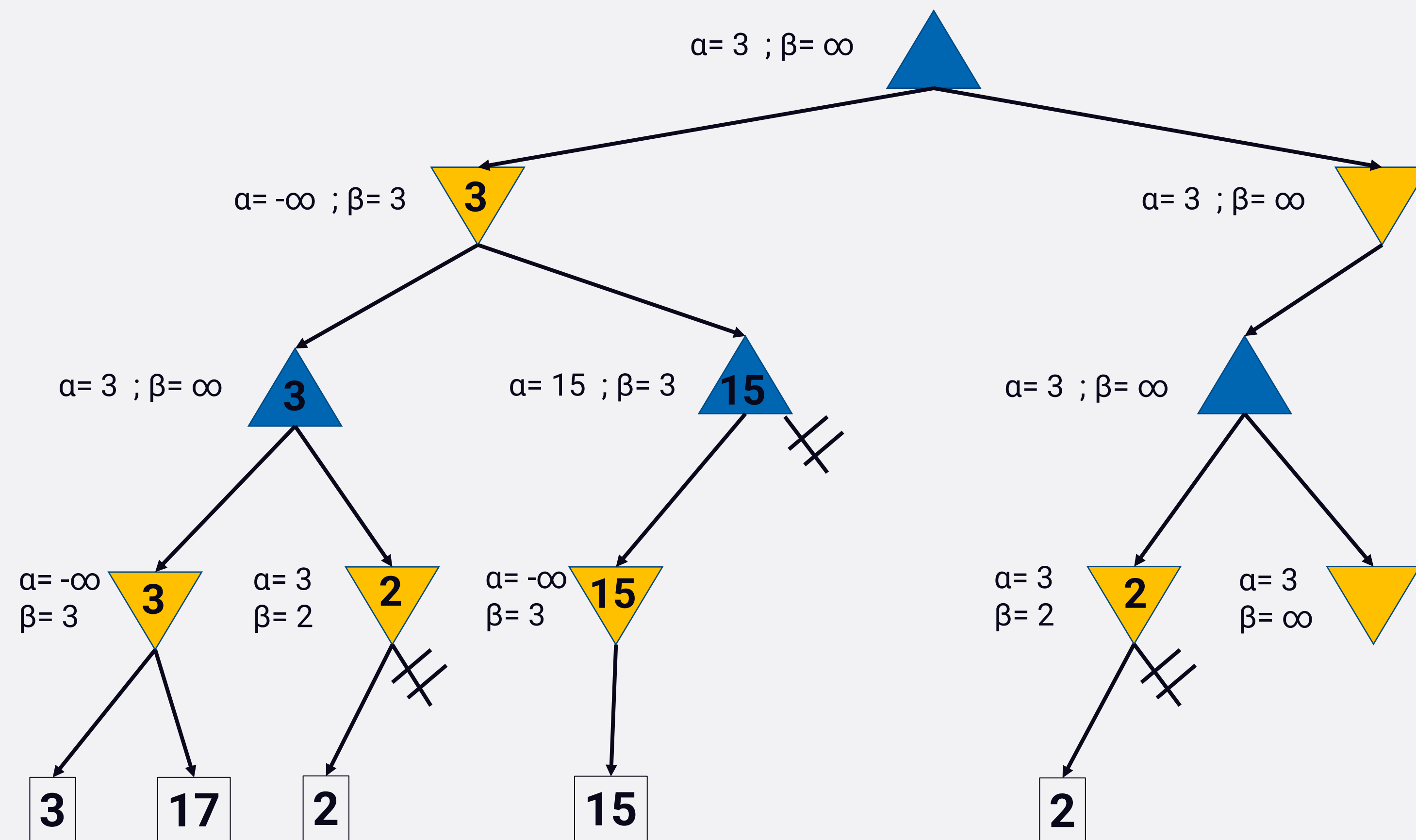
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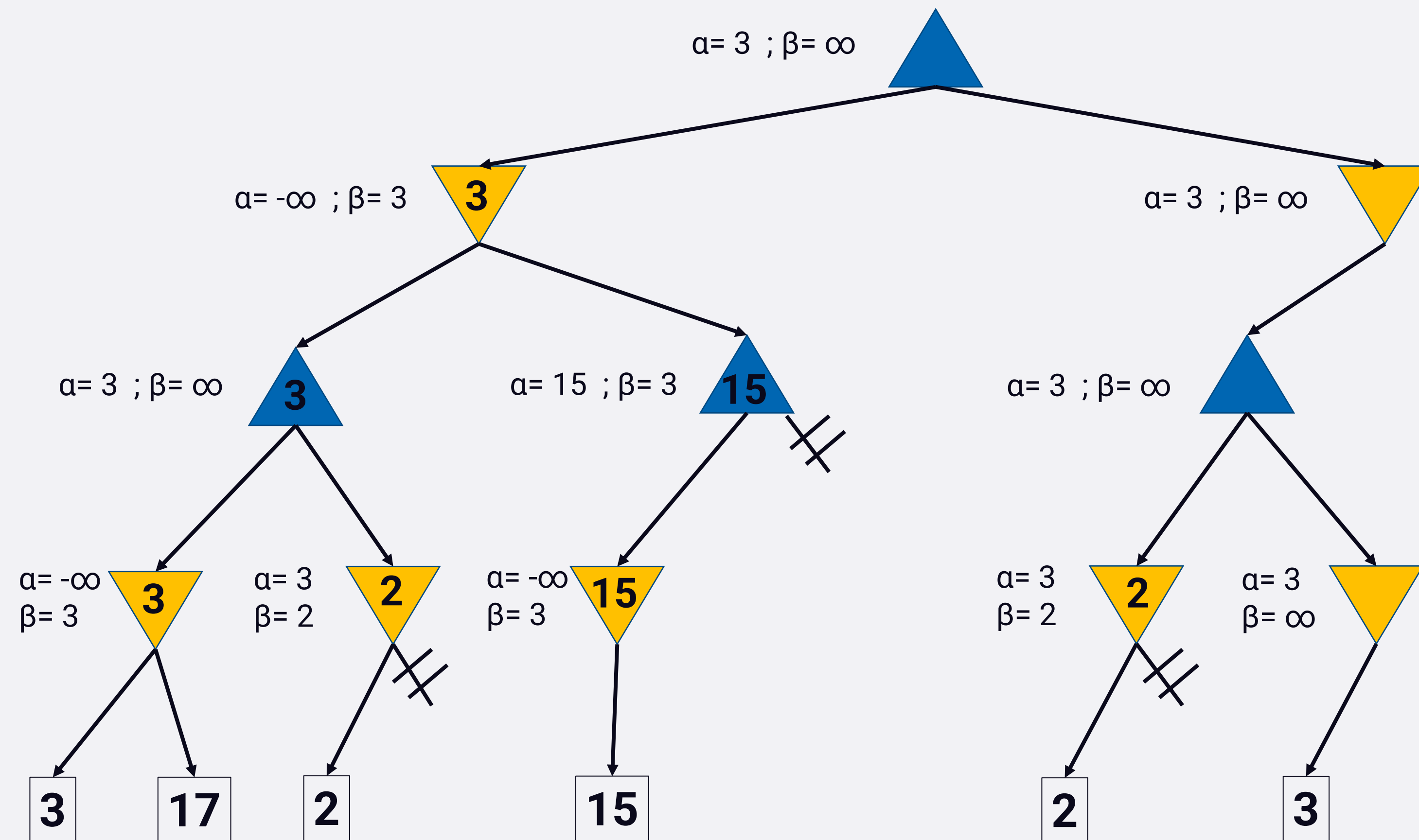
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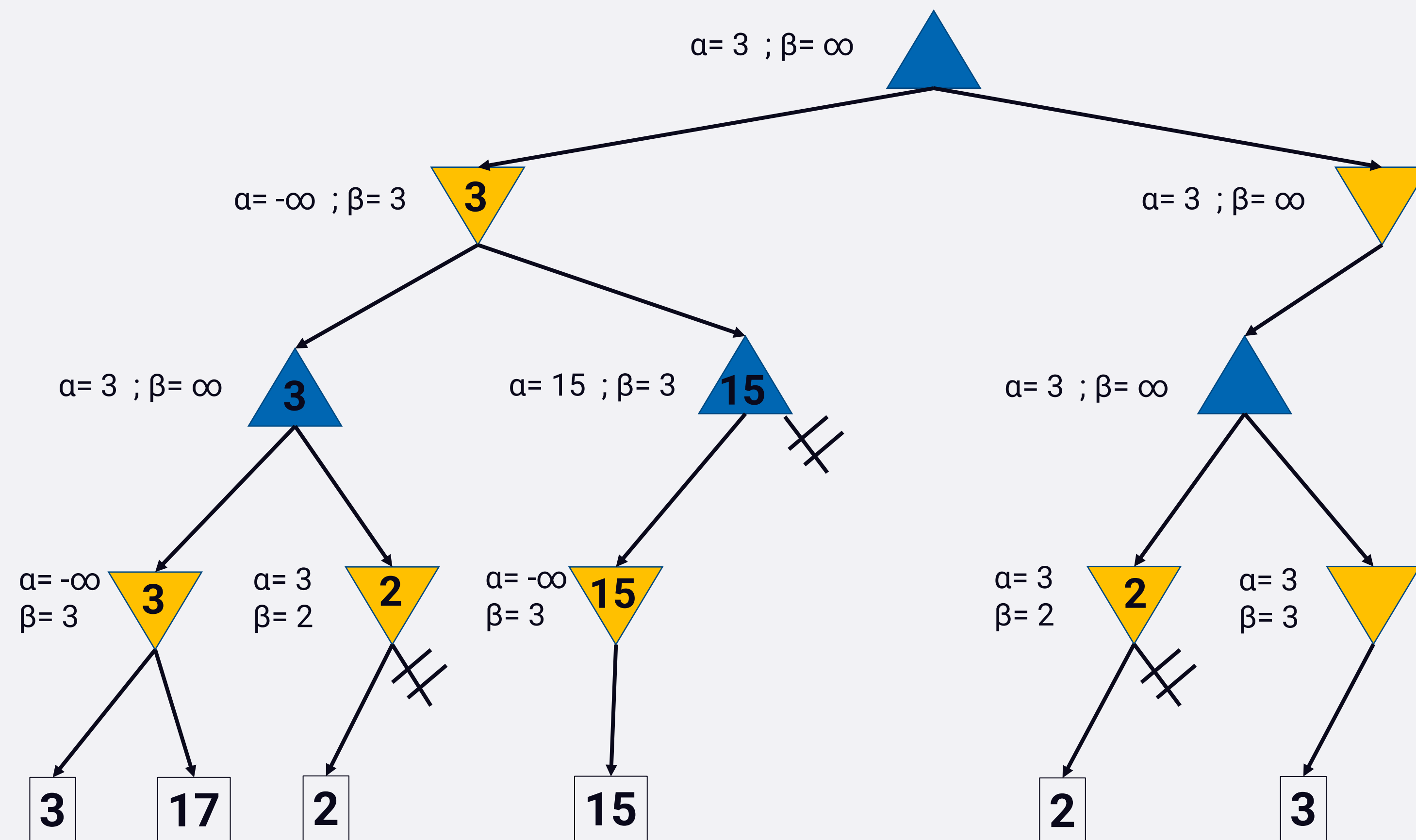
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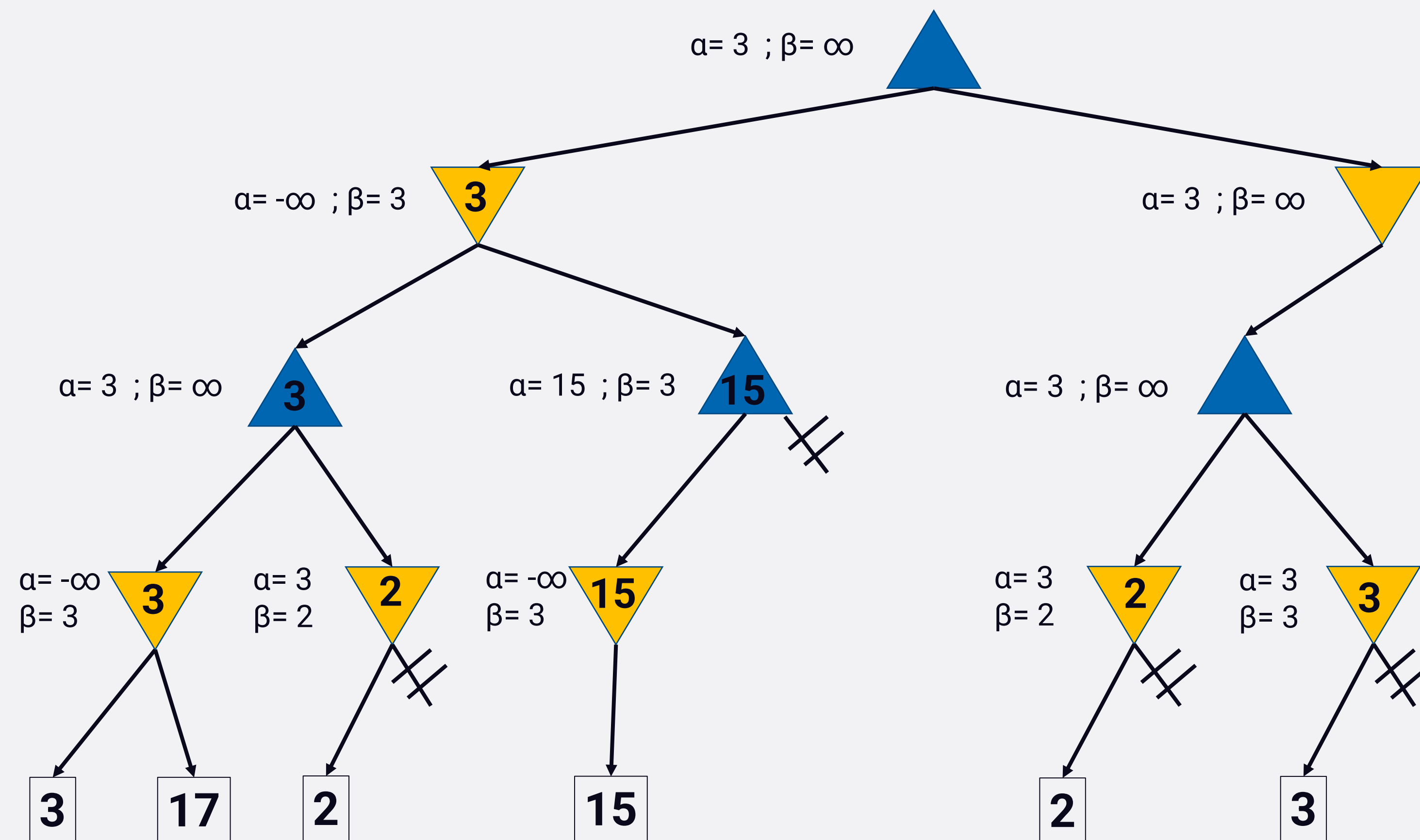
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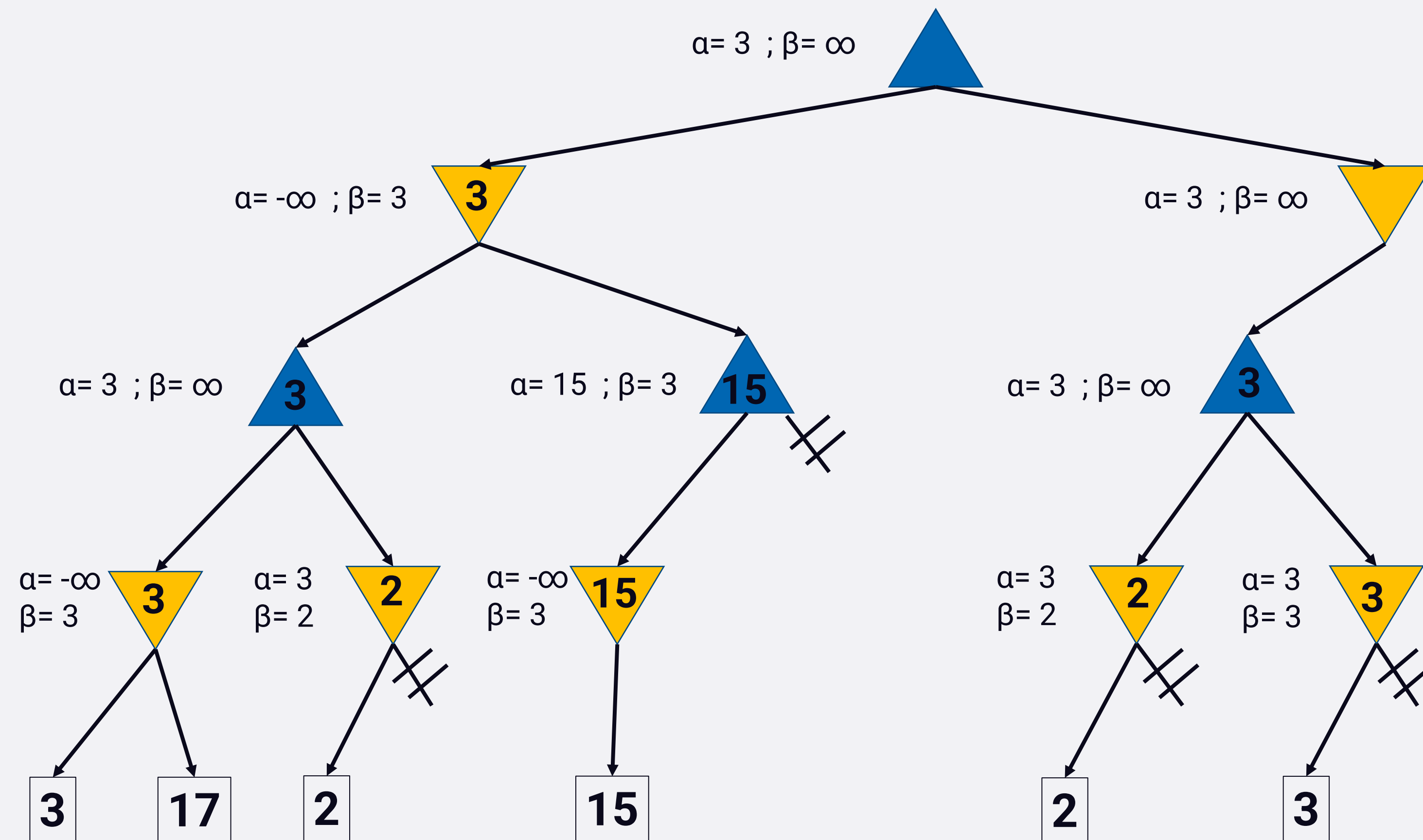
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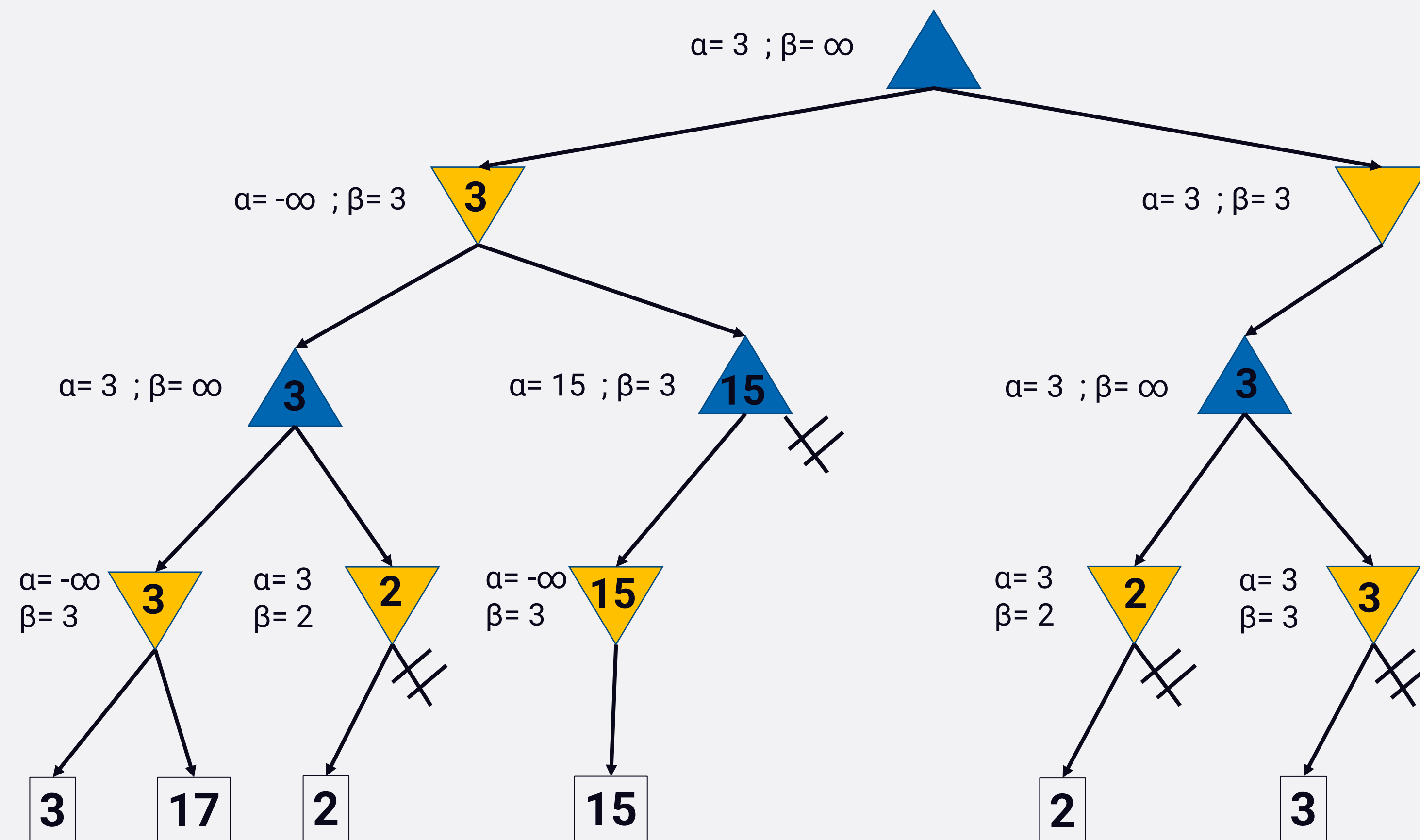
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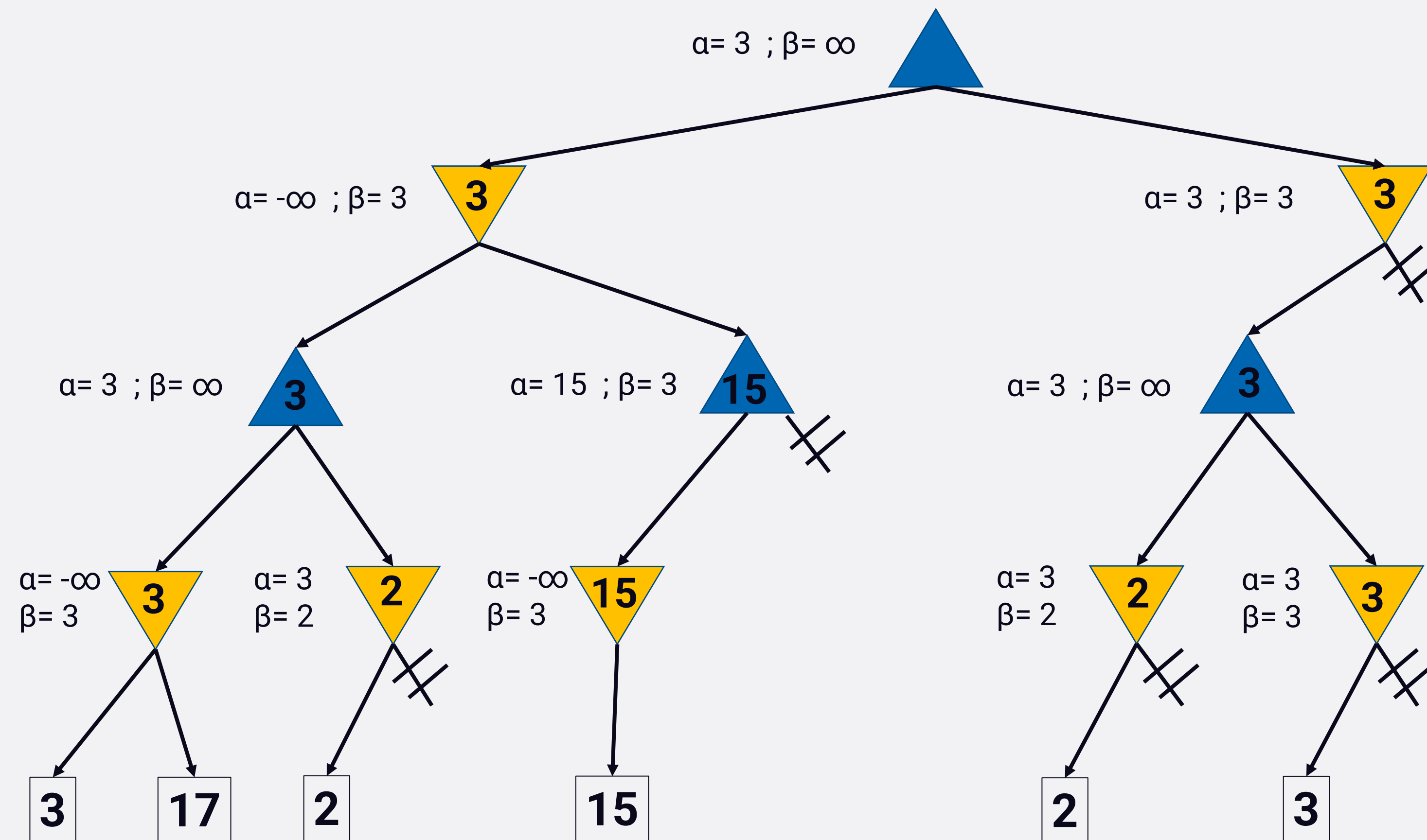
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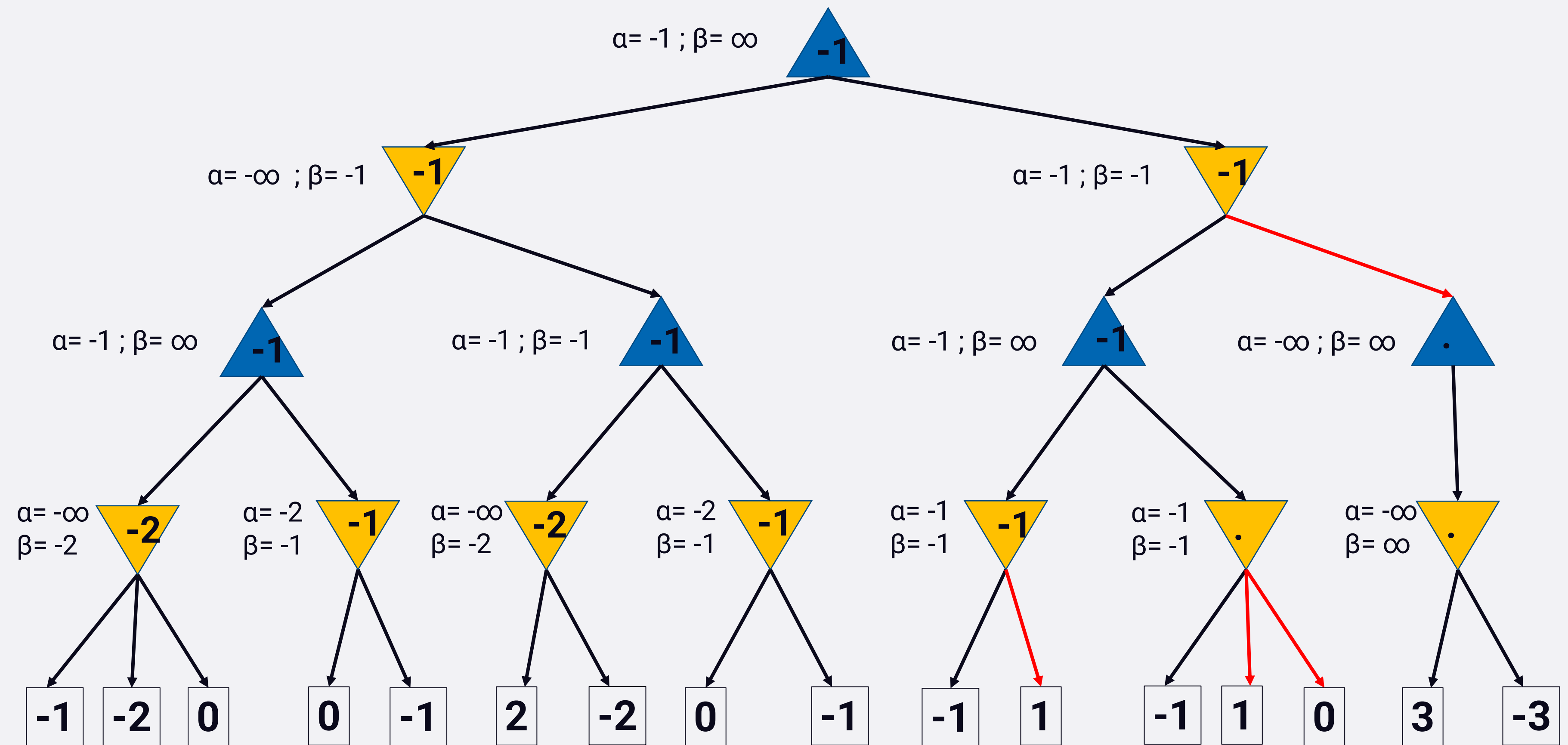
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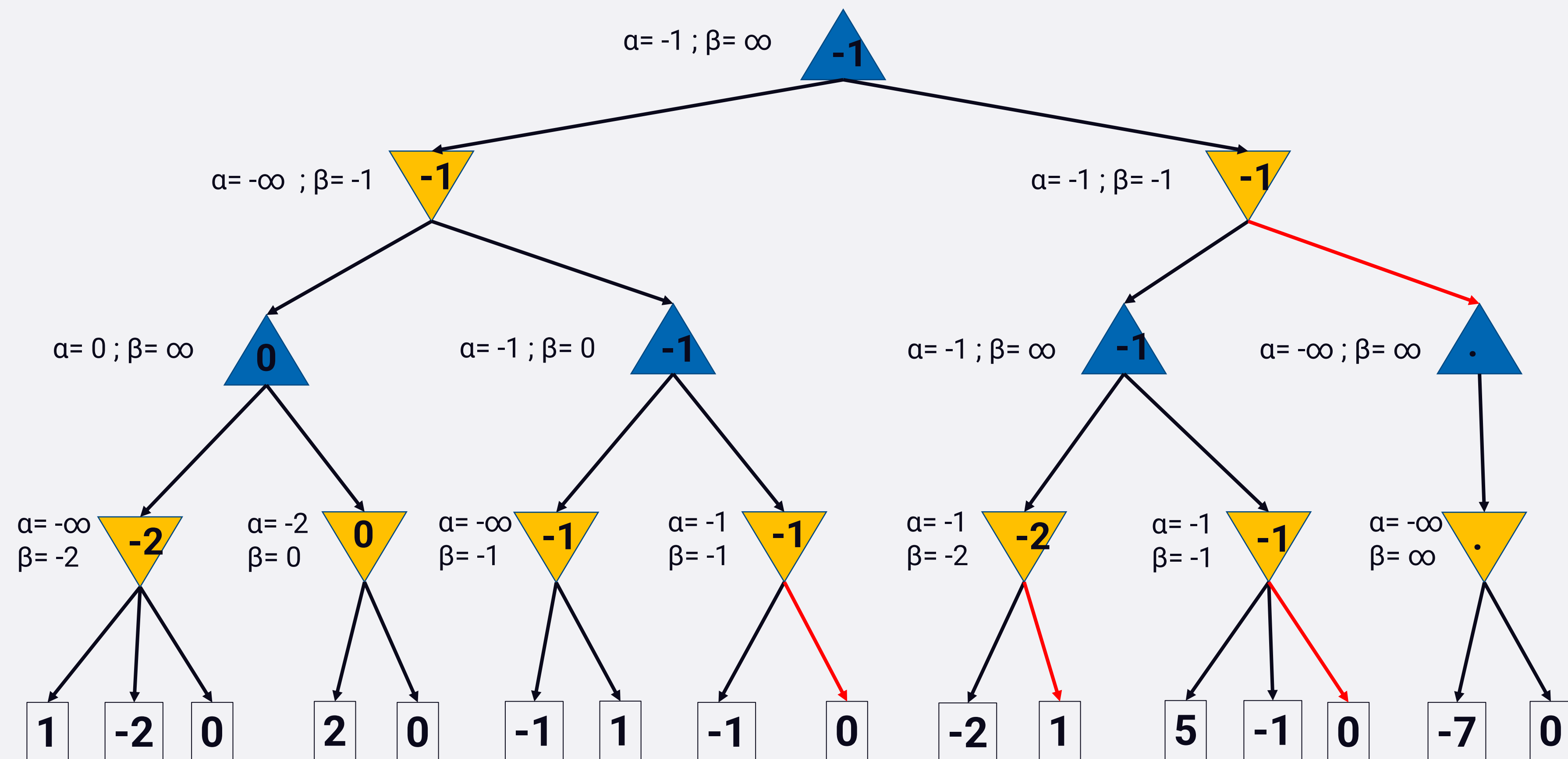




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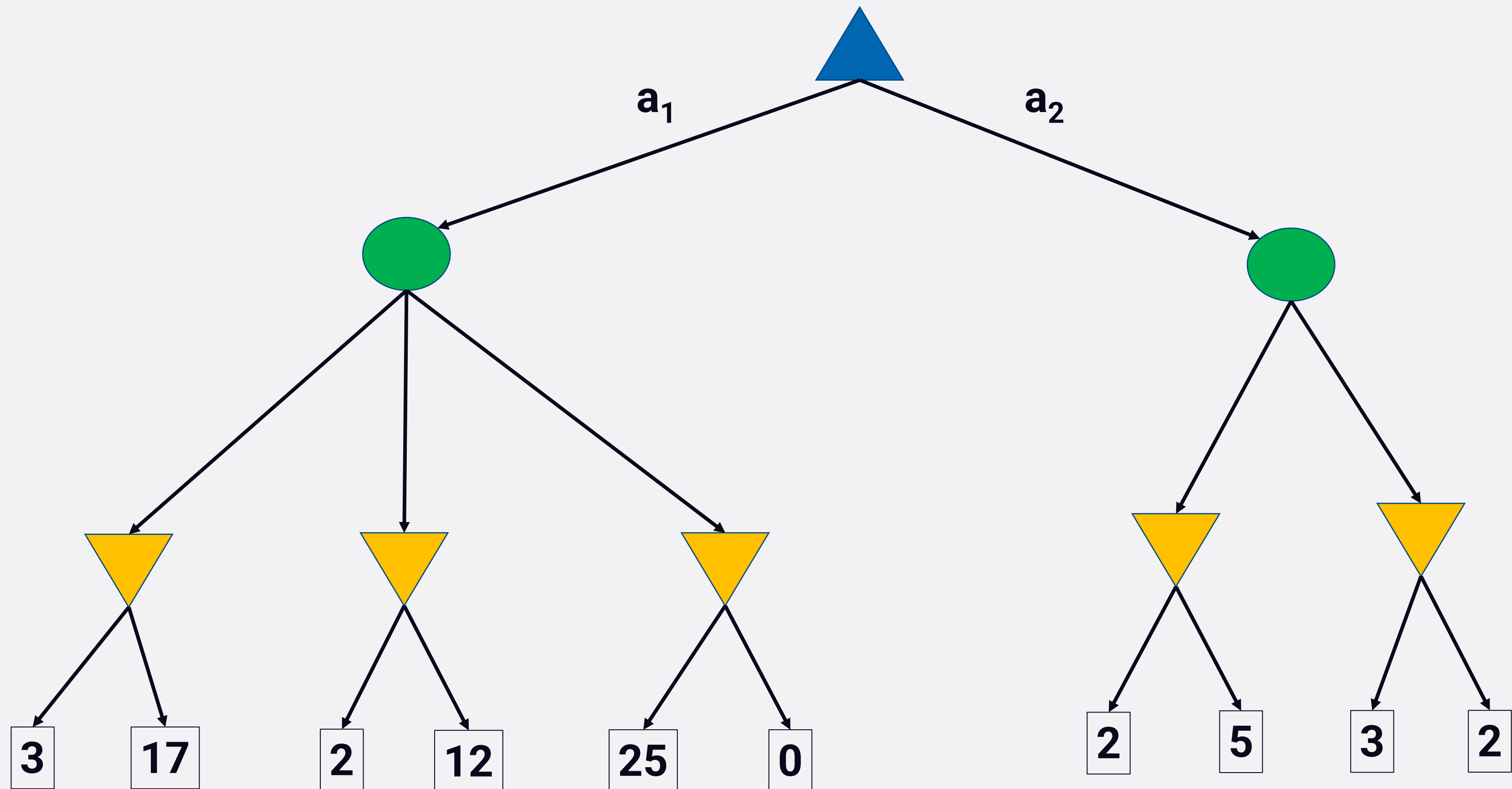


## Exercise 6.3



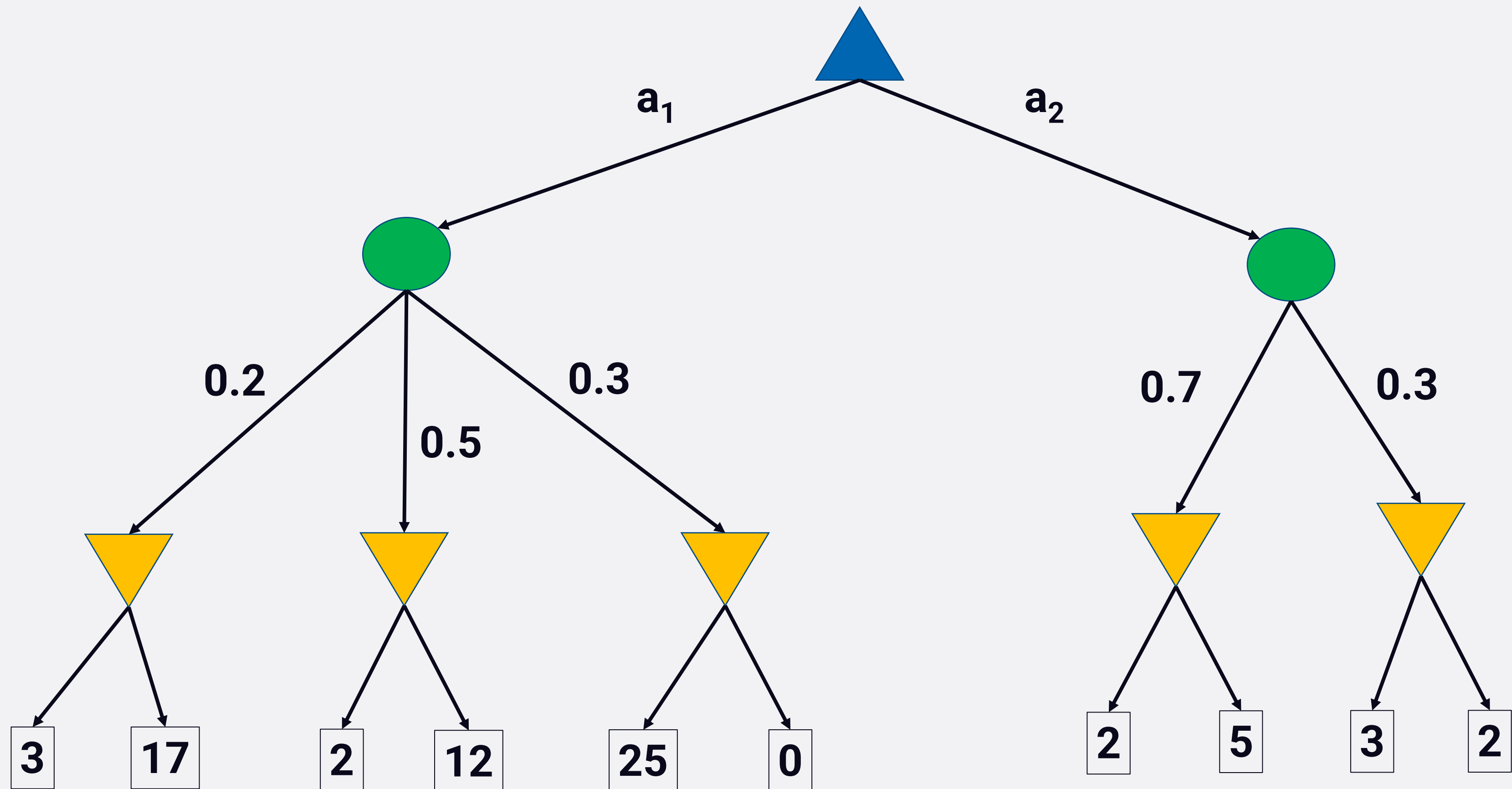
## Exercise 6.3

- Expectiminimax



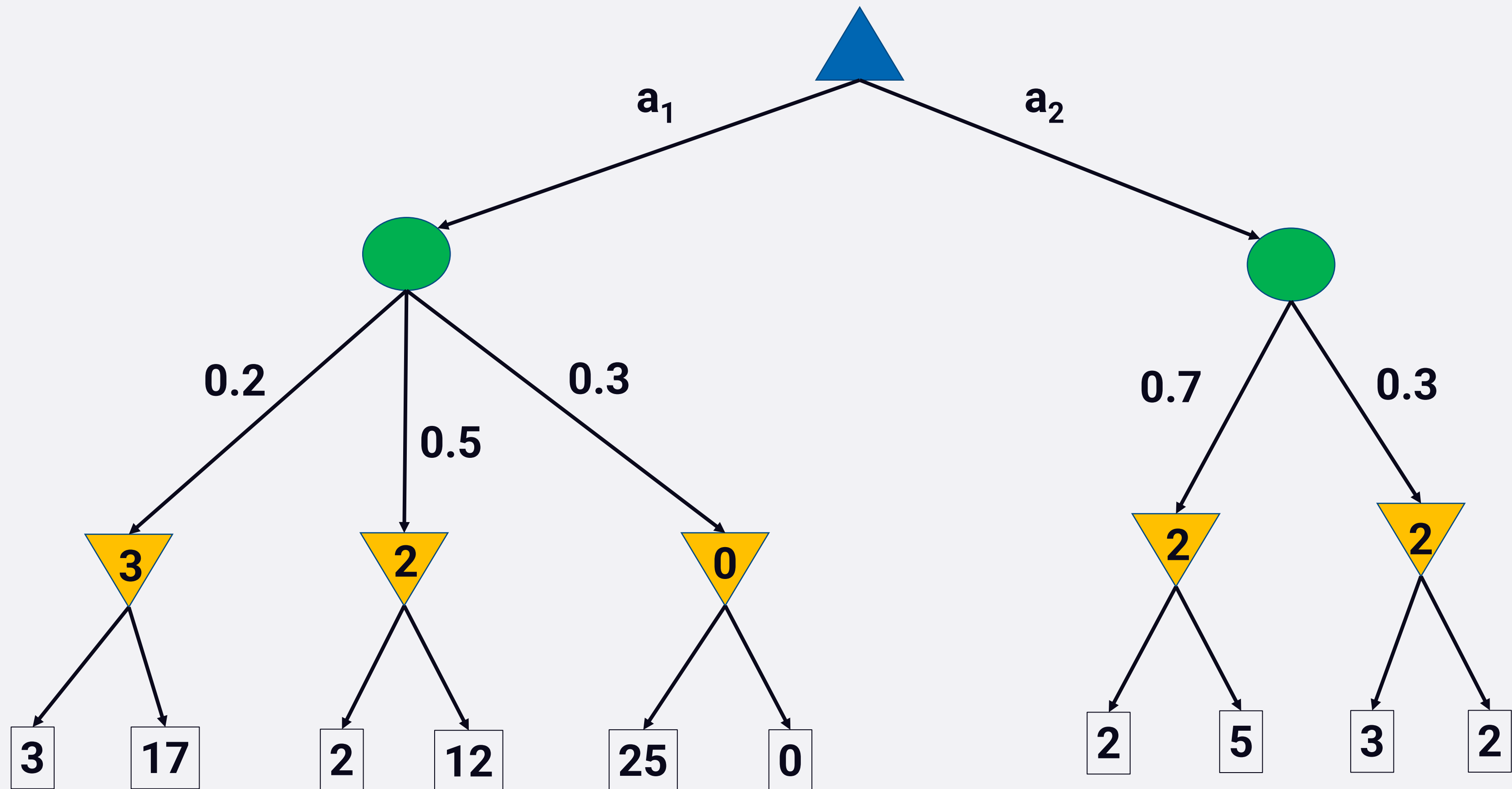
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- Expectiminimax



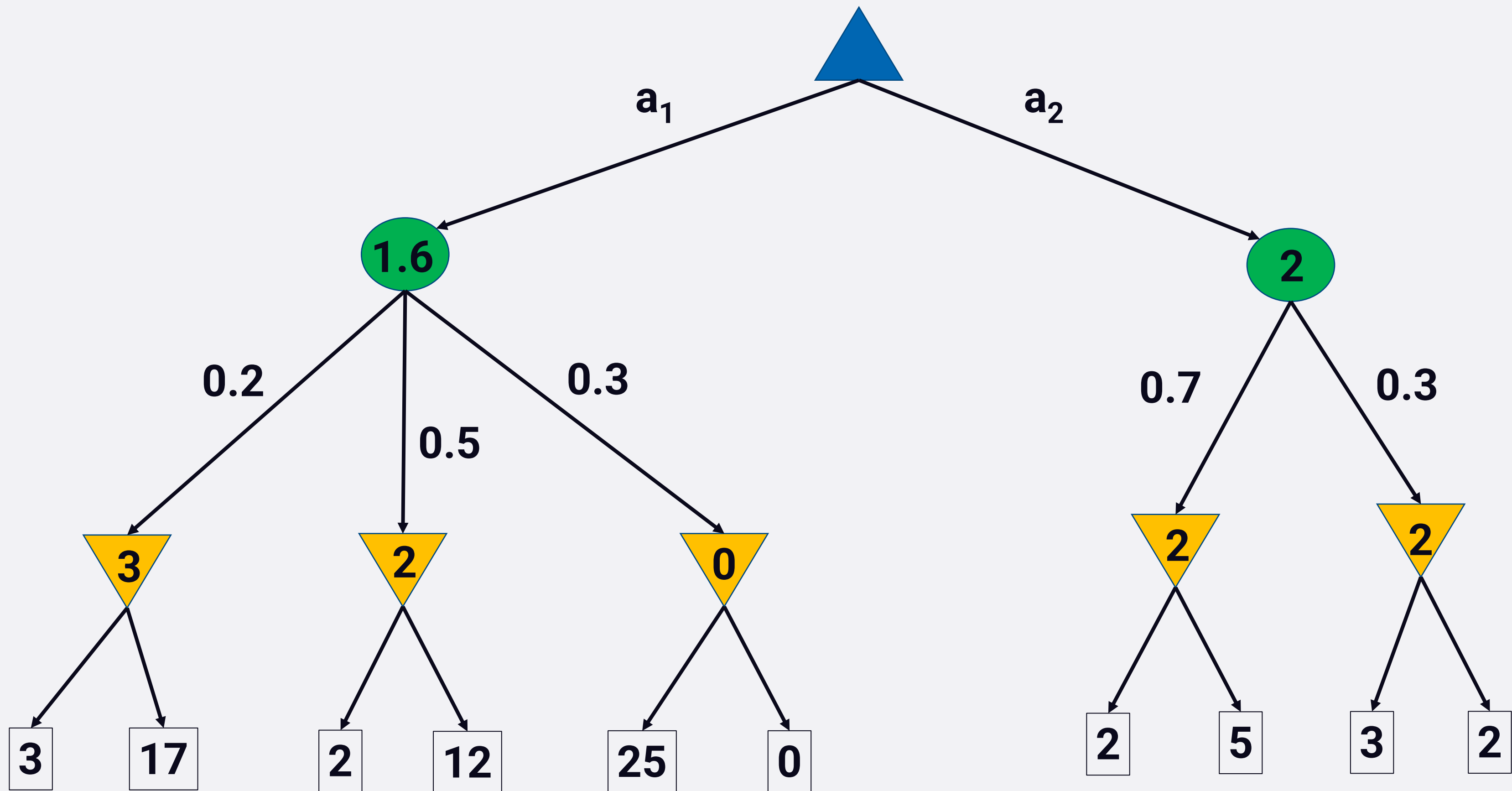
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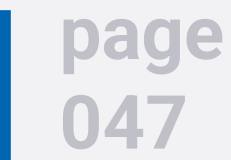
- Expectiminimax



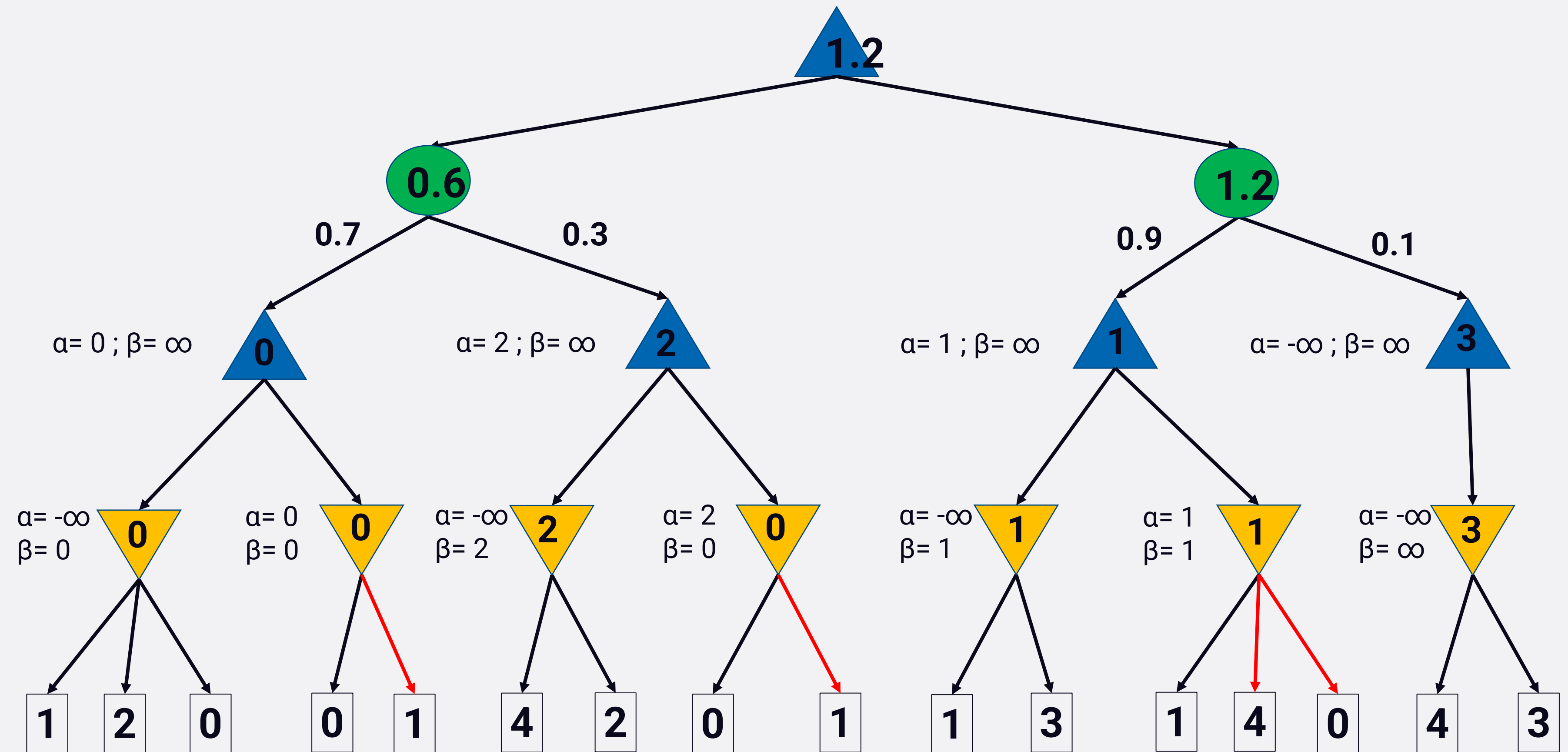
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- Expectiminimax



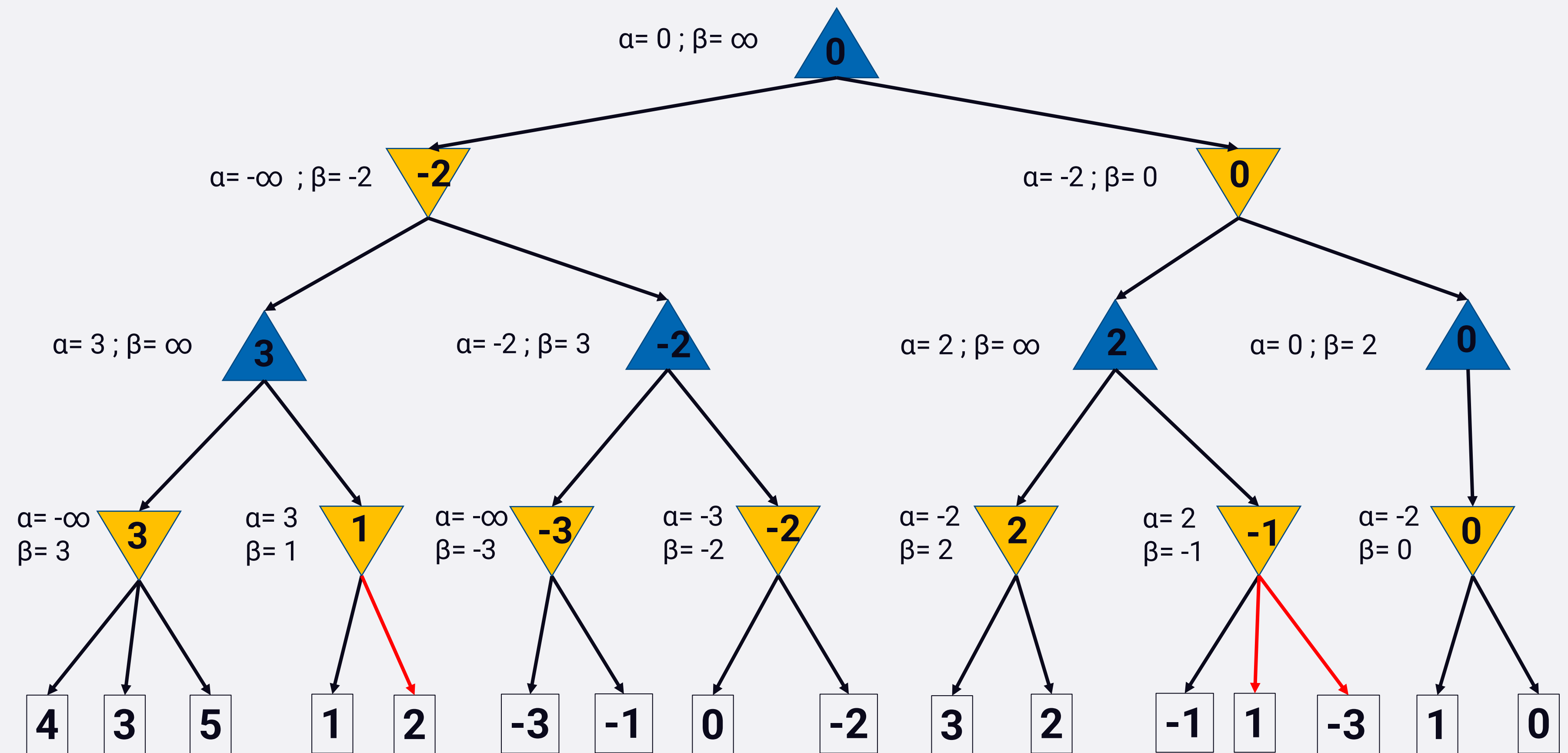


## Exercise 6.5





## Exercise 6.6



## Exercise 6.7

