AOJ
2431 - House Moving

http://judge.u-aizu.ac.jp/onlinejudge/description.jsp?id=2431

Problem

- 1 ~ n の n 個の整数からなる数列
  - e.g. { 2 3 1 5 4 } (n = 5)

- 昇順に並べ替えるための最小コストを計算
  - 整数 x を移動させるコスト : x

2 3 1 5 4

1 2 3 5 4 ➡ コスト 5

1 2 3 4 5

最長増加部分列

- 部分列
  - {２３１５４}の部分列

    {２３４} {２３５} {３４} {３１４} ~~{３２４}~~
- 増加部分列
  - {２３１５４}の増加部分列

    {２３４} {２３５} {３４} ~~{３１４}~~
- 最長増加部分列
  - {２３１５４}の最長増加部分列

    {２３４} {２３５} ~~{３４}~~

最~~系~~重増加部分列

- 最重増加部分列
  - { 2 3 1 5 4 } の最重増加部分列

    ~~{ 2 3 4 }~~　{ 2 3 5 }　~~{ 3 4 }~~　~~{ 3 1 4 }~~

解法

最重増加部分列に含まれない要素を移動

(数列の総和) - (最重増加部分列の総和)

- { 2 3 1 5 4 }
  - 数列の総和 : 5 * (5 + 1) / 2 = 15
  - 最重増加部分列の総和 : 2 + 3 + 5 = 10
  - コスト : 15 - 10 = 5

最長増加部分列の長さ

dp[i] := i 番目までの最長増加部分列の長さ

x	2	3	1	5	4
dp	1	2	1	3	3

最重増加部分列の重さ

dp[i] := i 番目までの最重増加部分列の重さ

x	2	3	1	5	4
dp	2	5	1	10	9

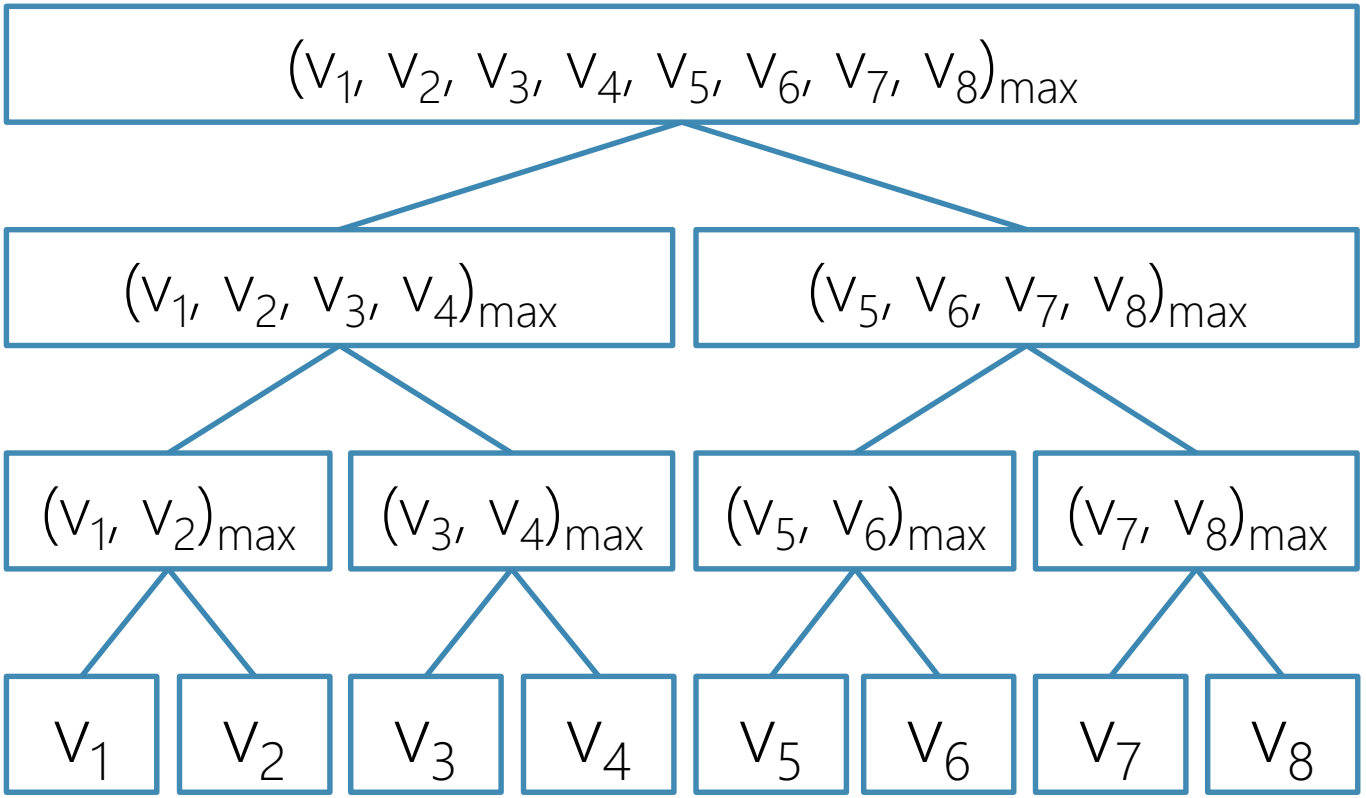
動的計画法 (最長増加部分列)

- $O(n^2)$

ソースコード

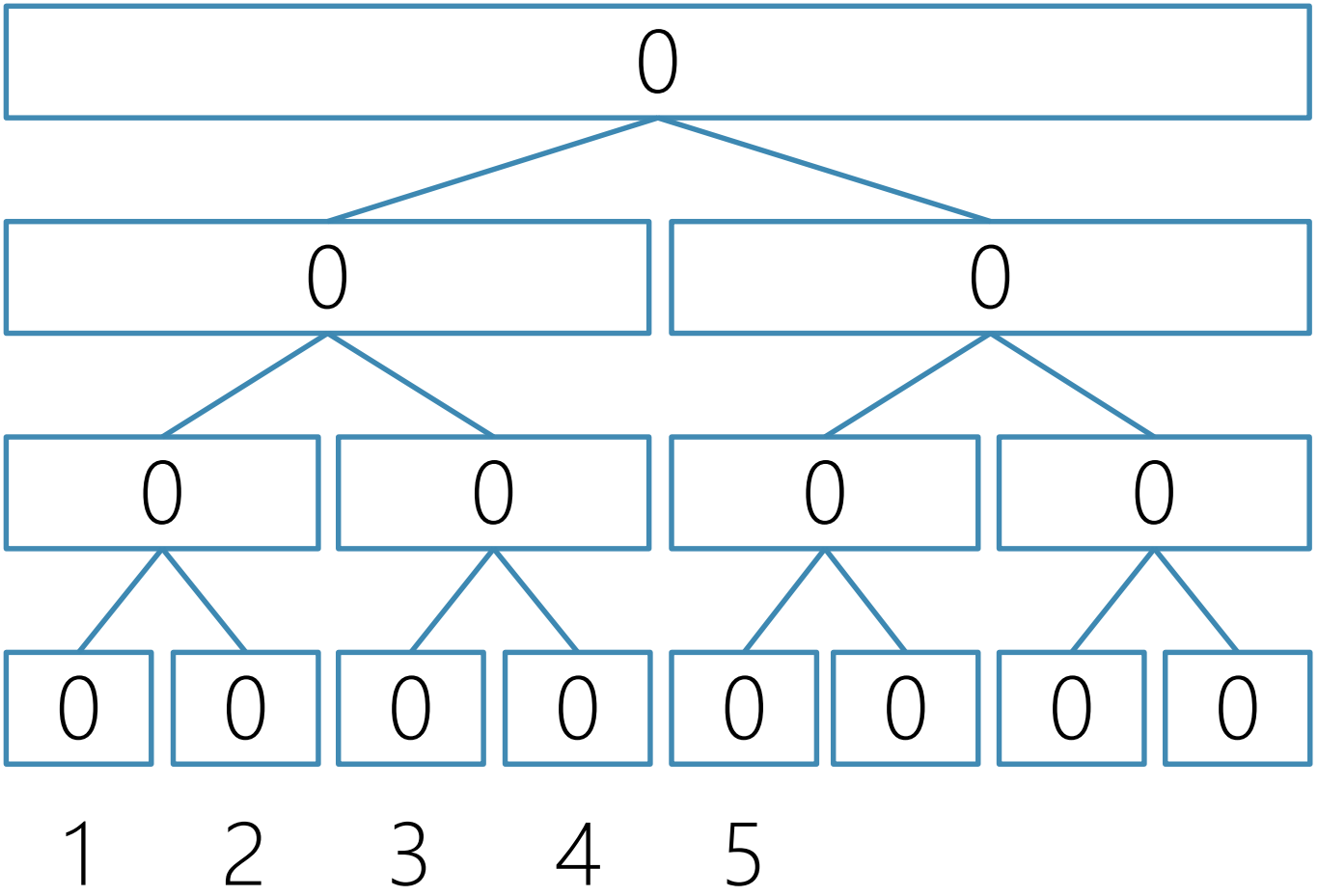
- 2431 tle.cpp

セグメント木


$(V_1, V_2, V_3, V_4, V_5, V_6, V_7, V_8)_{max}$
$(V_1, V_2, V_3, V_4)_{max}$
$(V_5, V_6, V_7, V_8)_{max}$
$(V_1, V_2)_{max}$
$(V_3, V_4)_{max}$
$(V_5, V_6)_{max}$
$(V_7, V_8)_{max}$
V_1
V_2
V_3
V_4
V_5
V_6
V_7
V_8

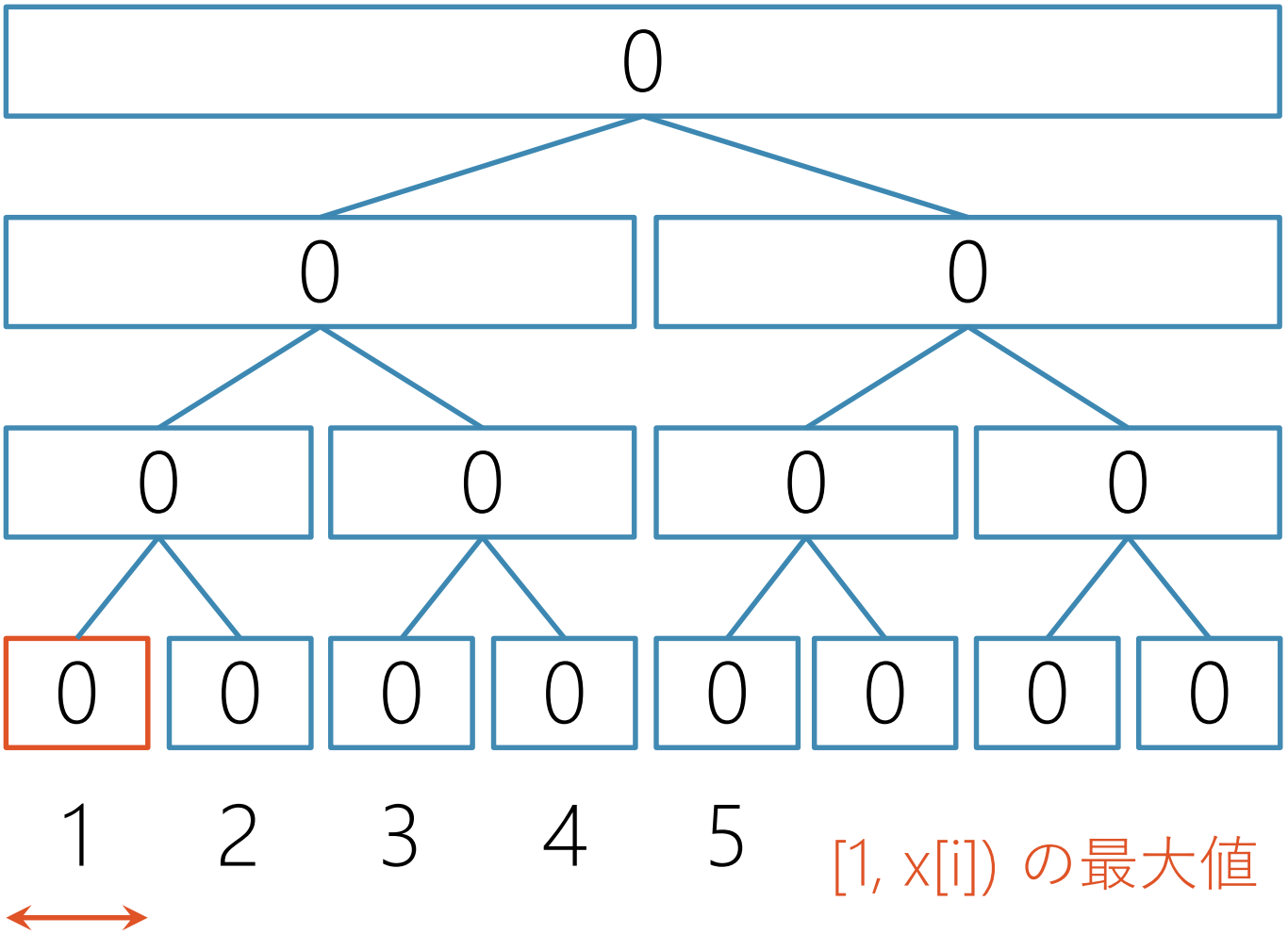
セグメント木

x = { 2, 3, 1, 5, 4 }



セグメント木

x = { 2, 3, 1, 5, 4 }



セグメント木

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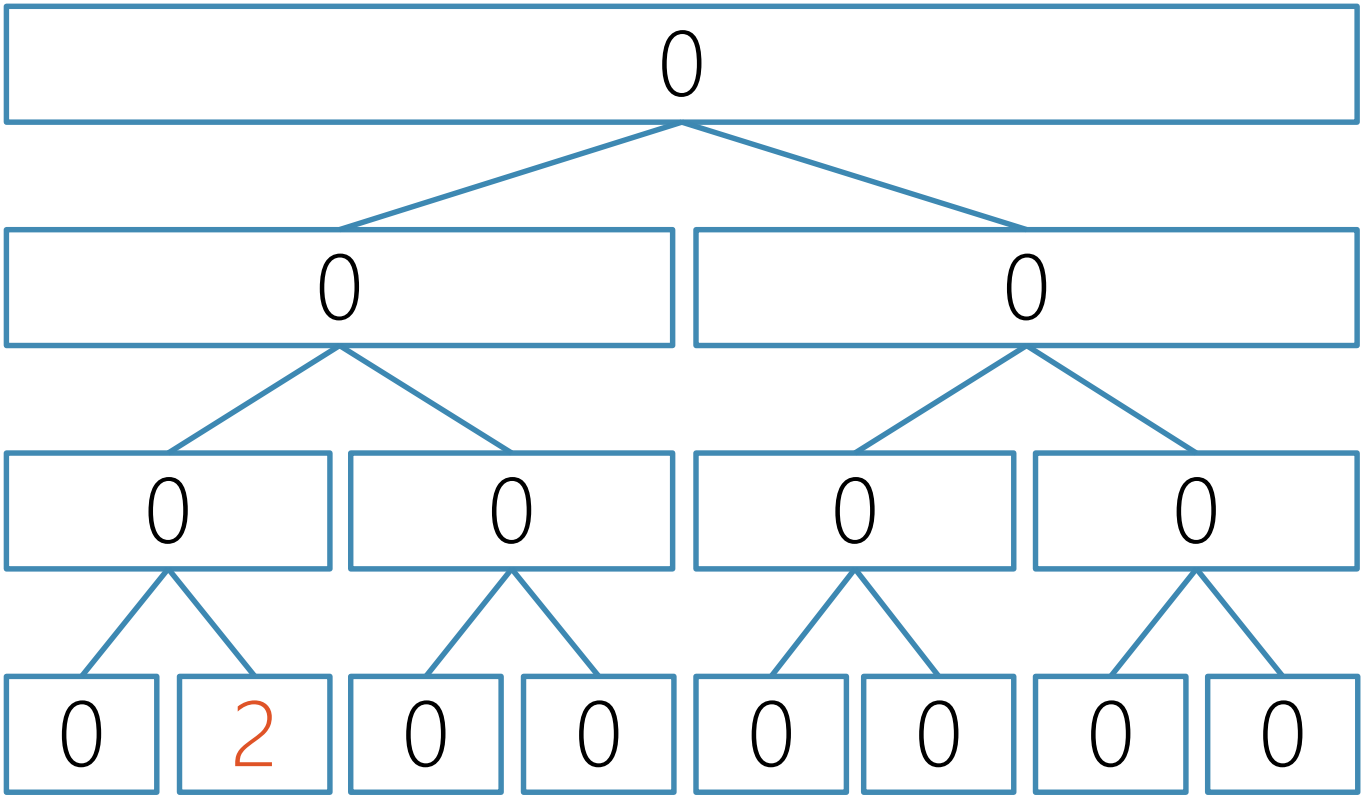
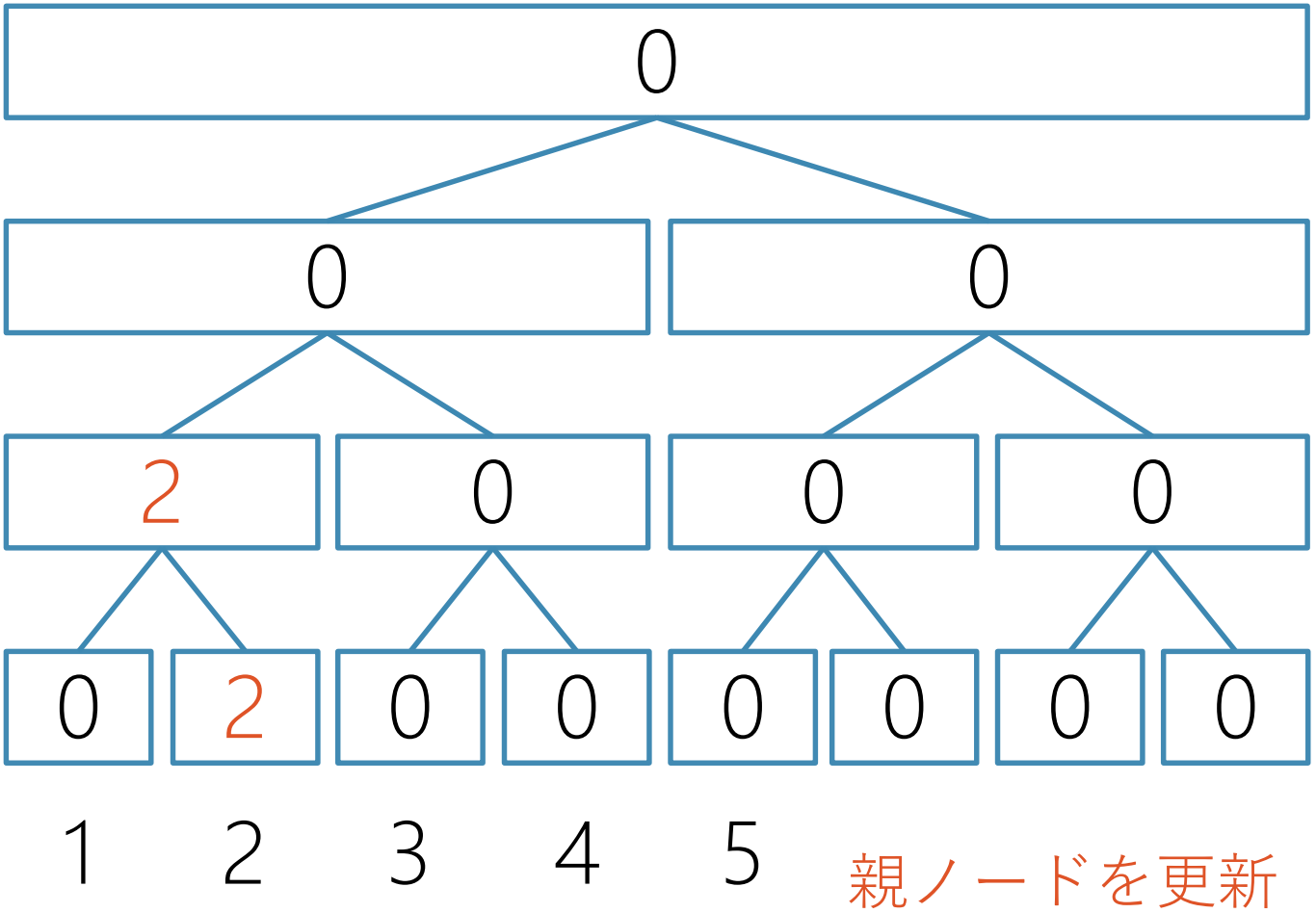


[1, x[i]) の最大値 + x[i]

セグメント木

x = { 2, 3, 1, 5, 4 }



セグメント木

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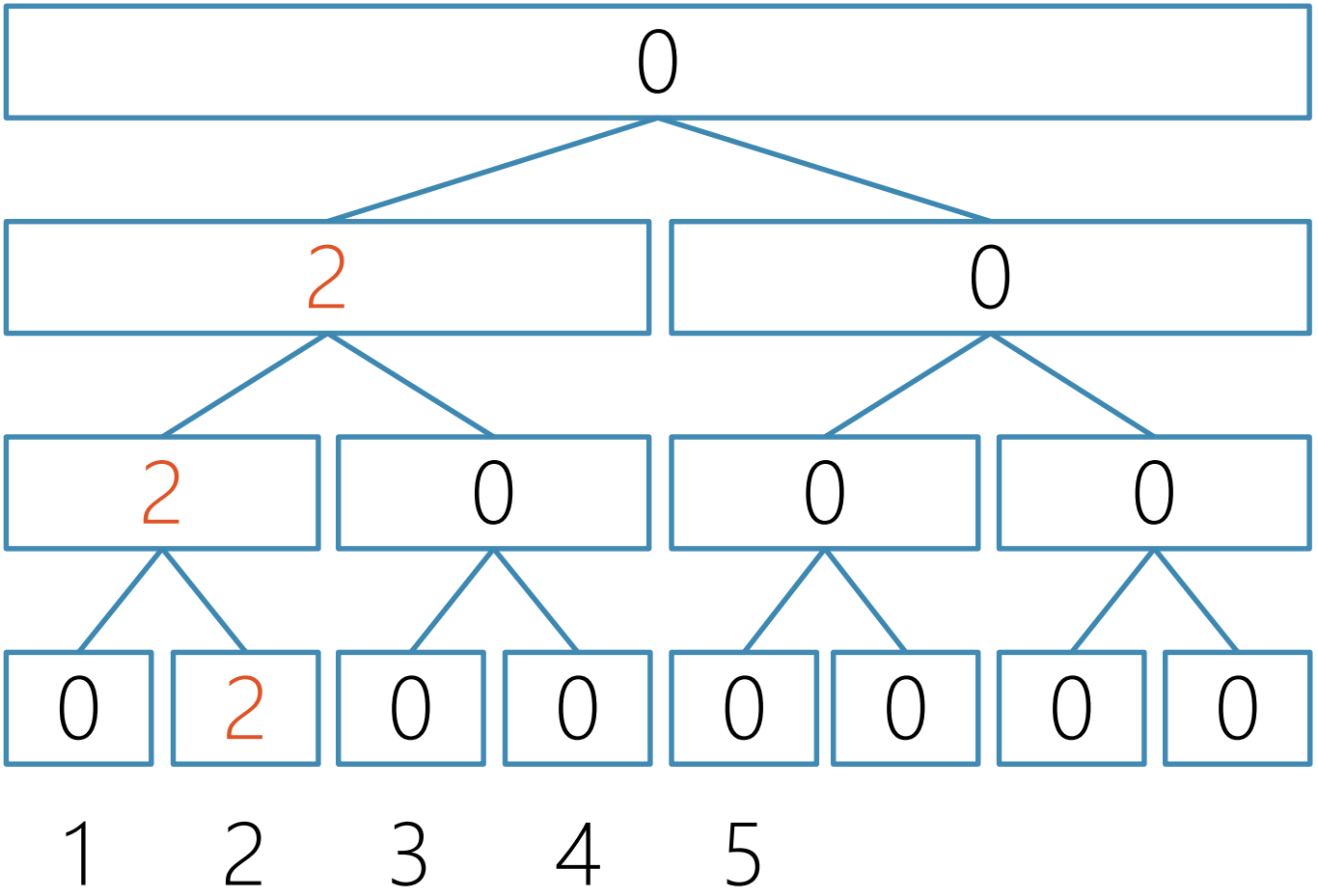

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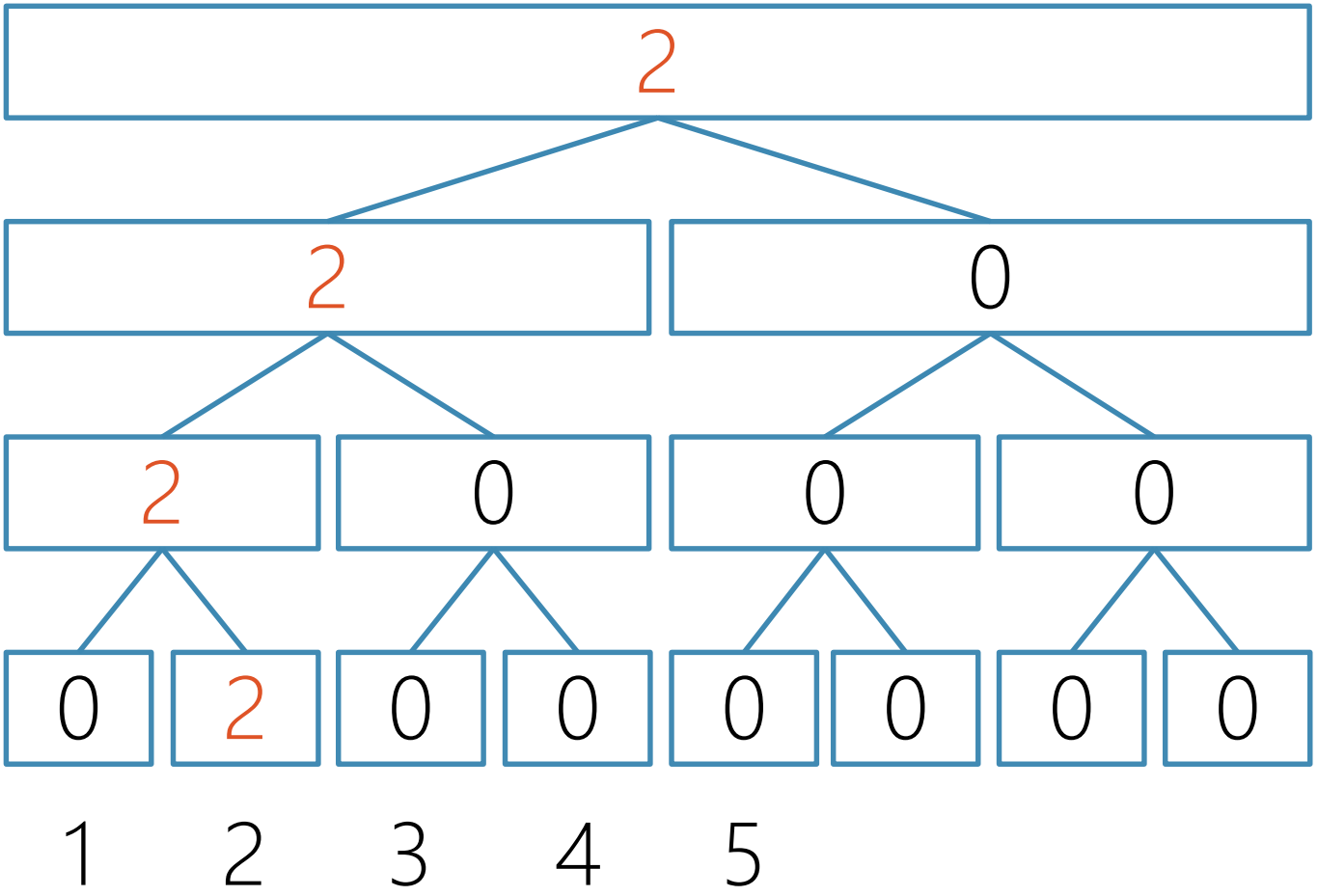

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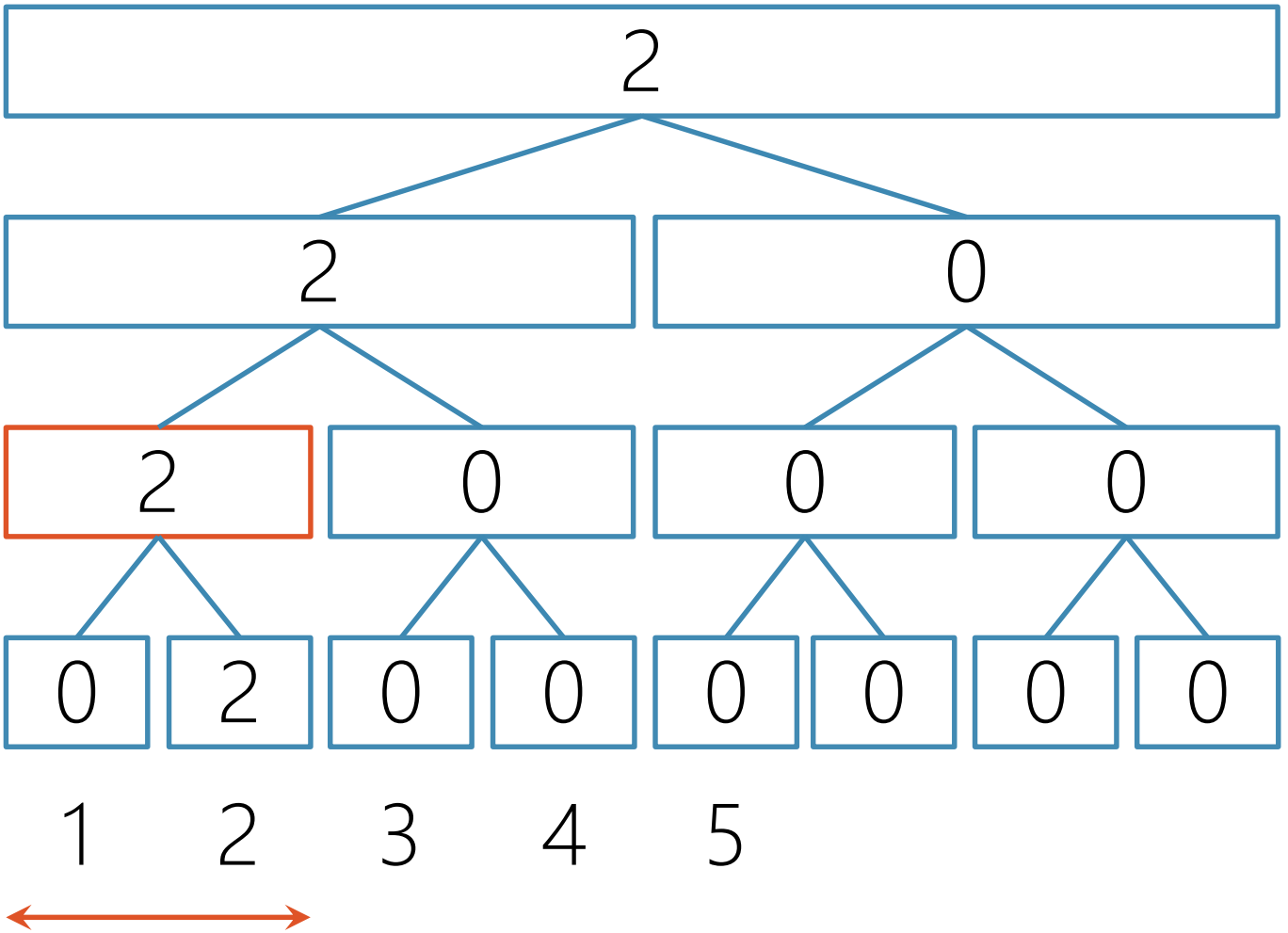

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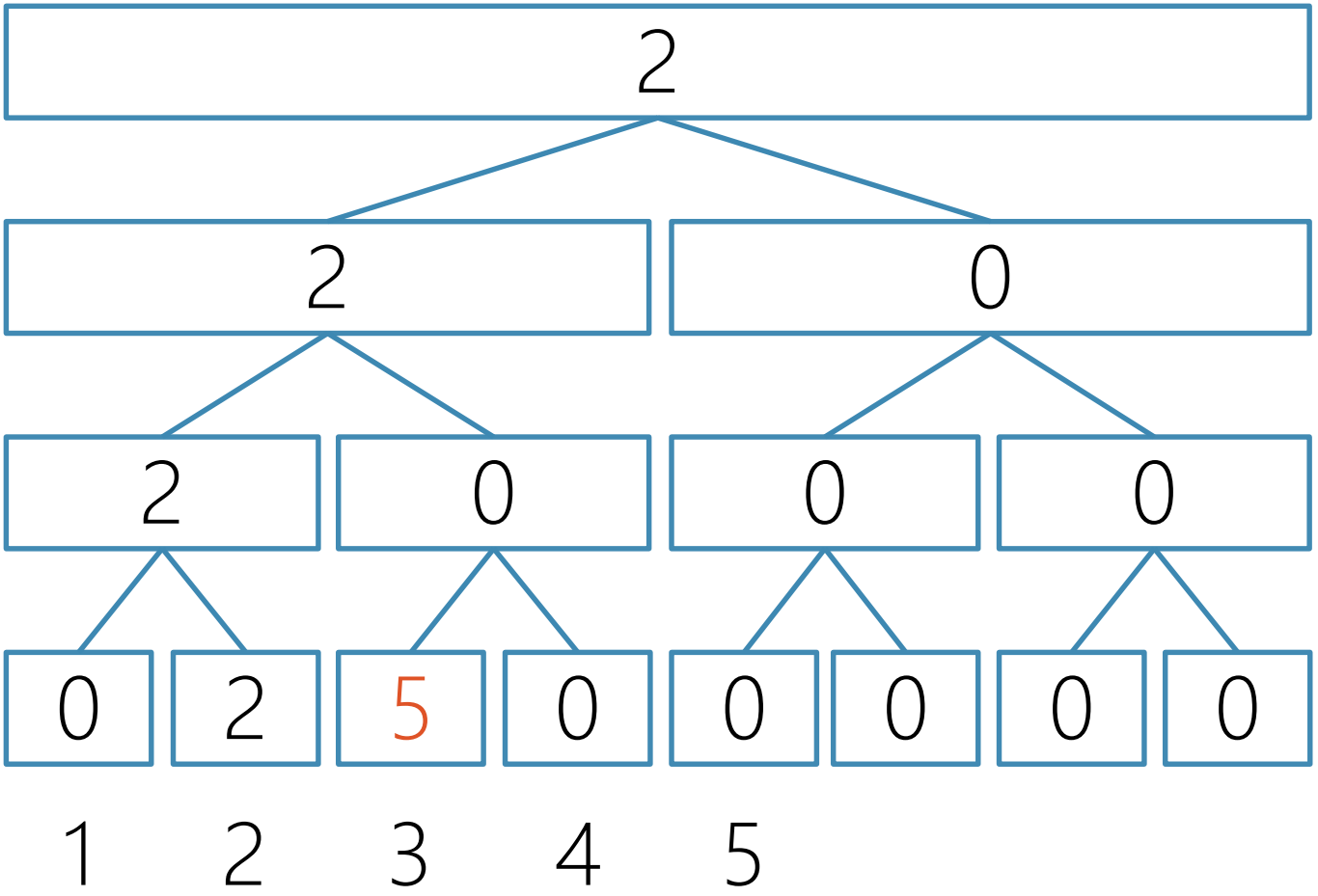

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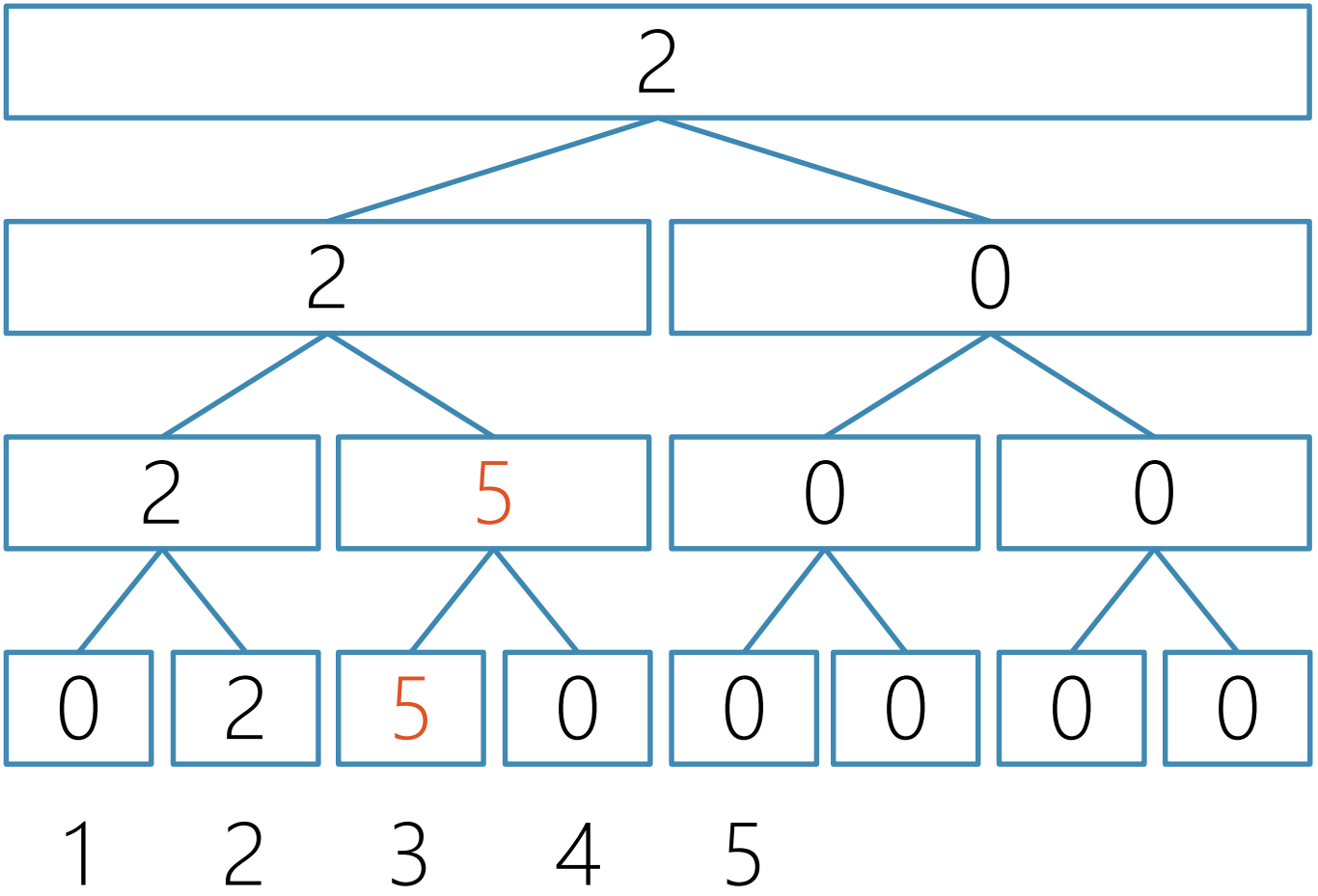

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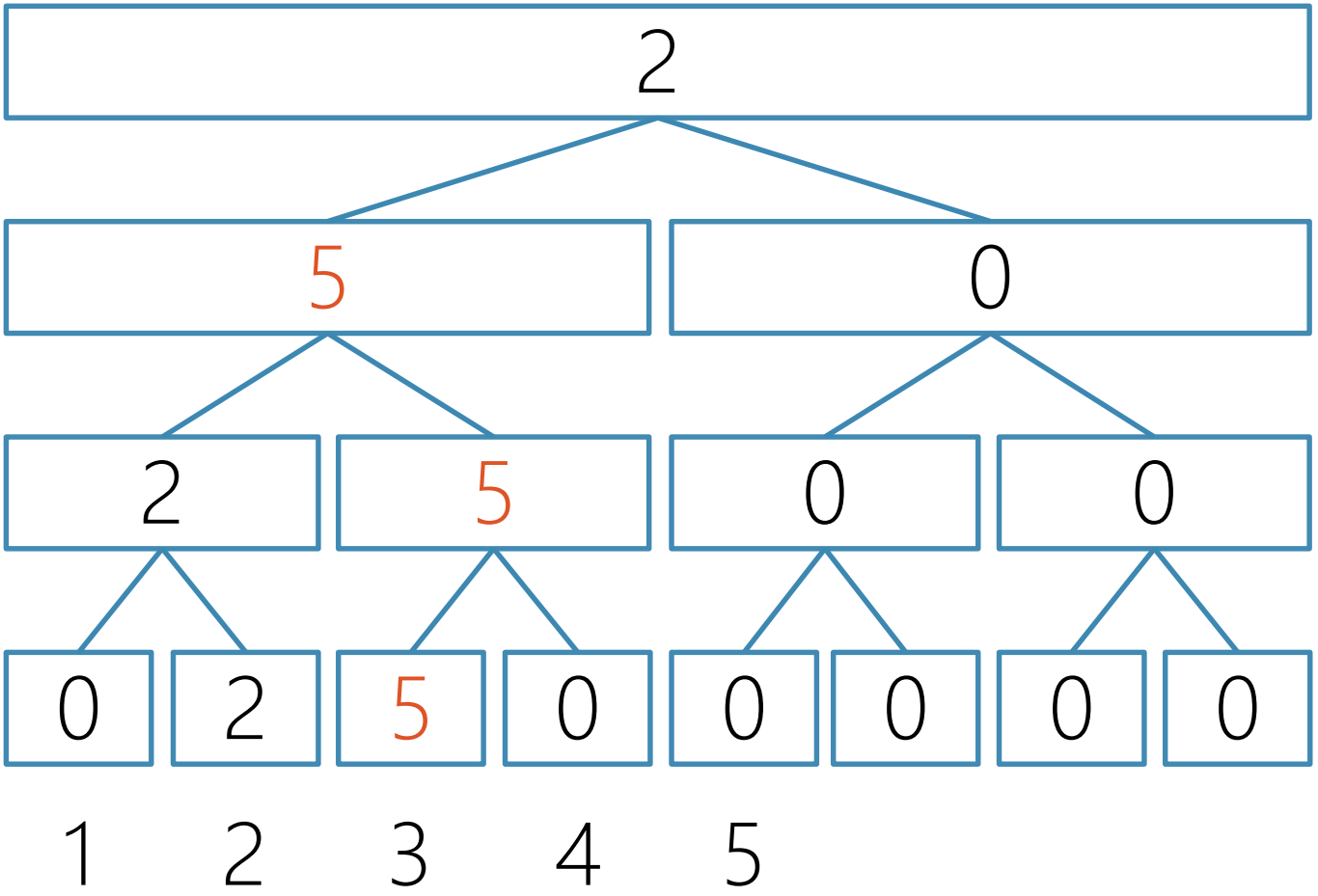

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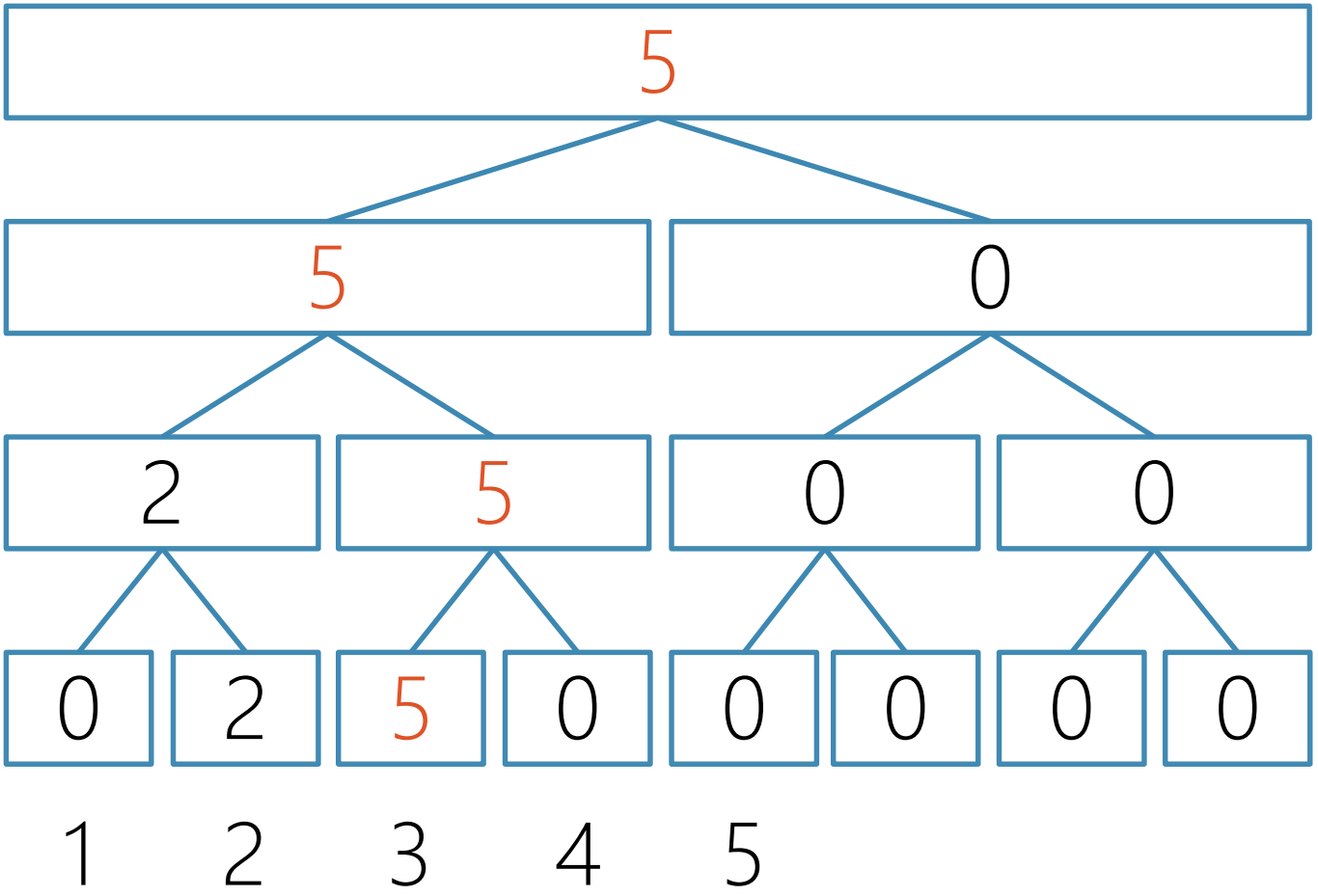

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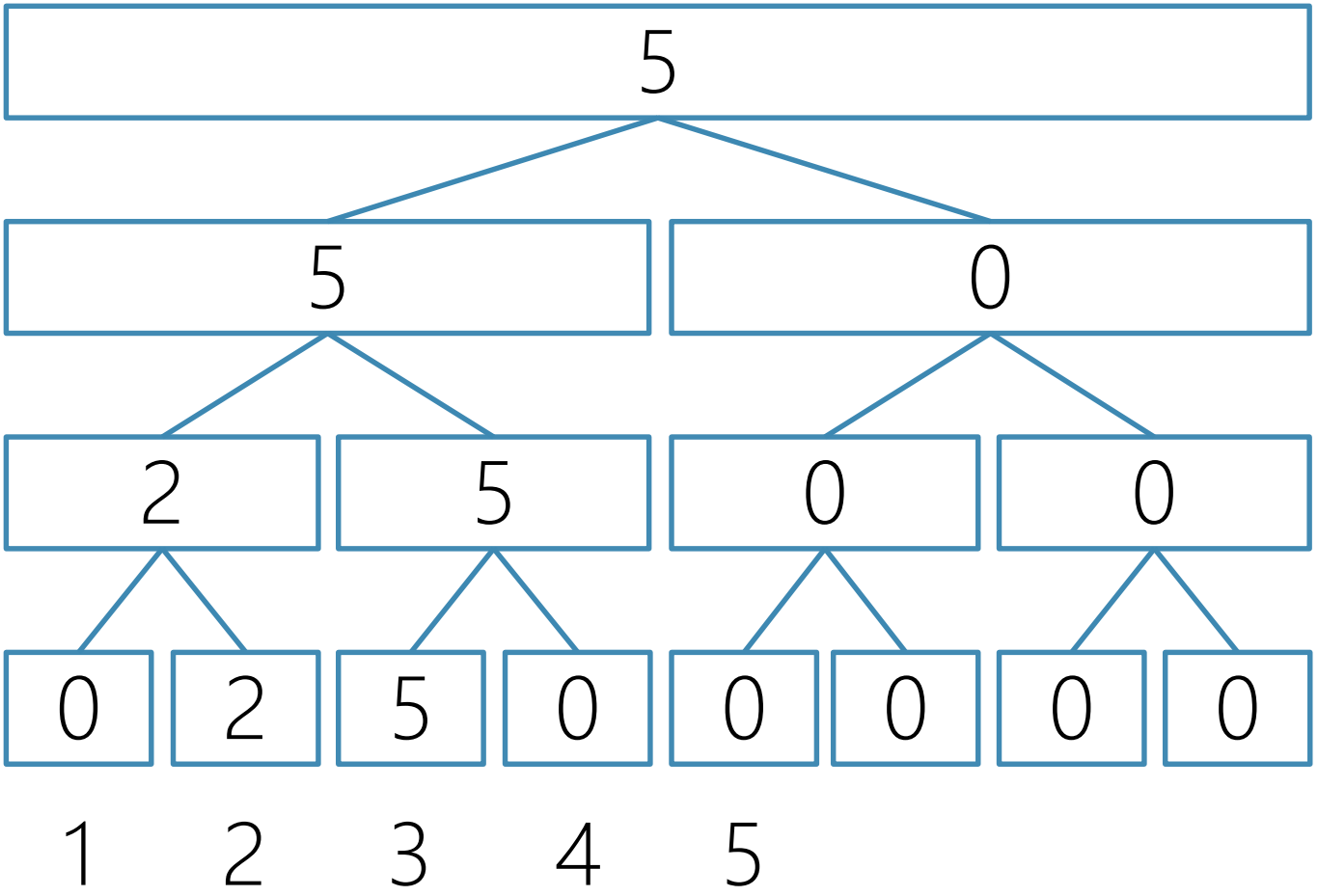

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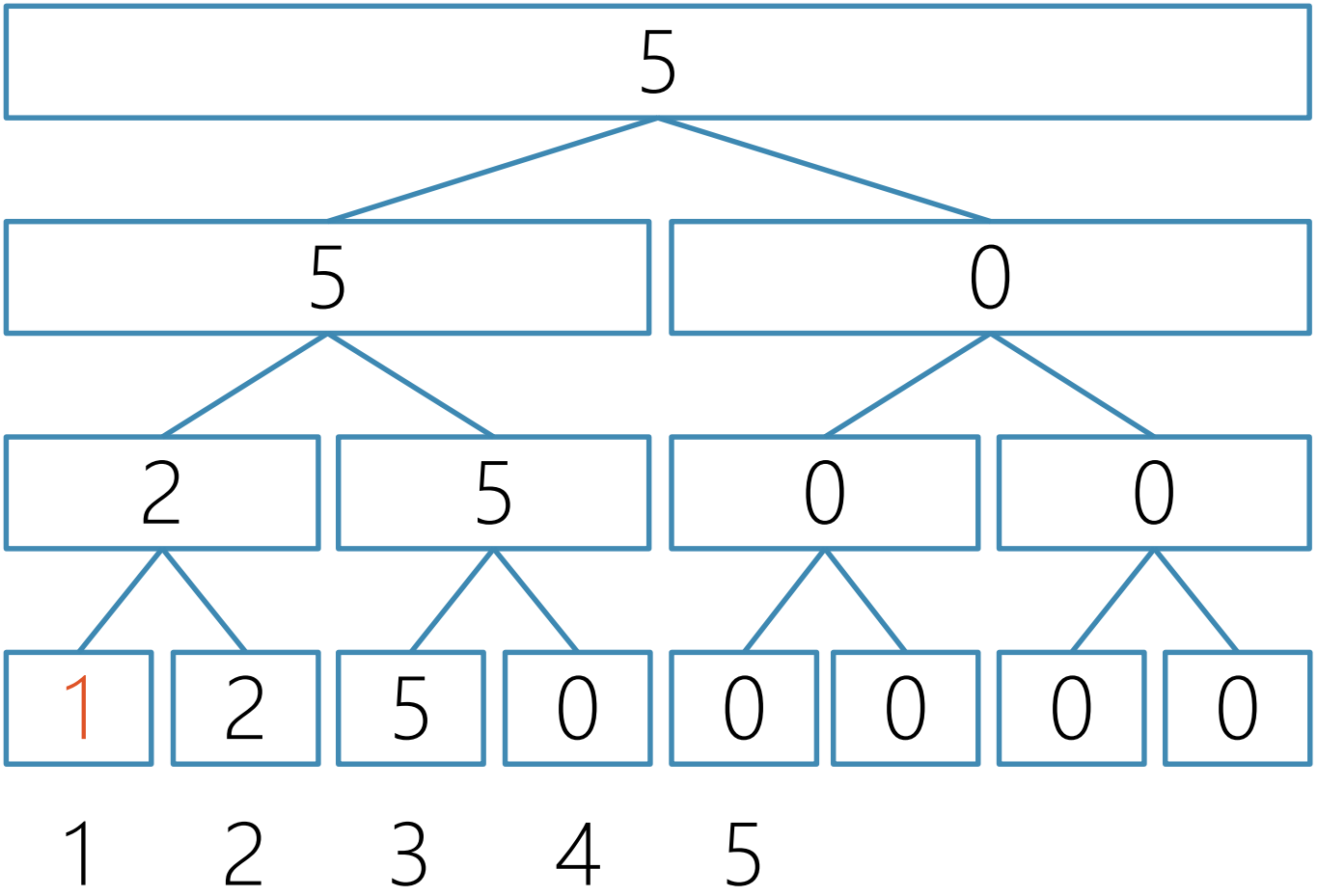

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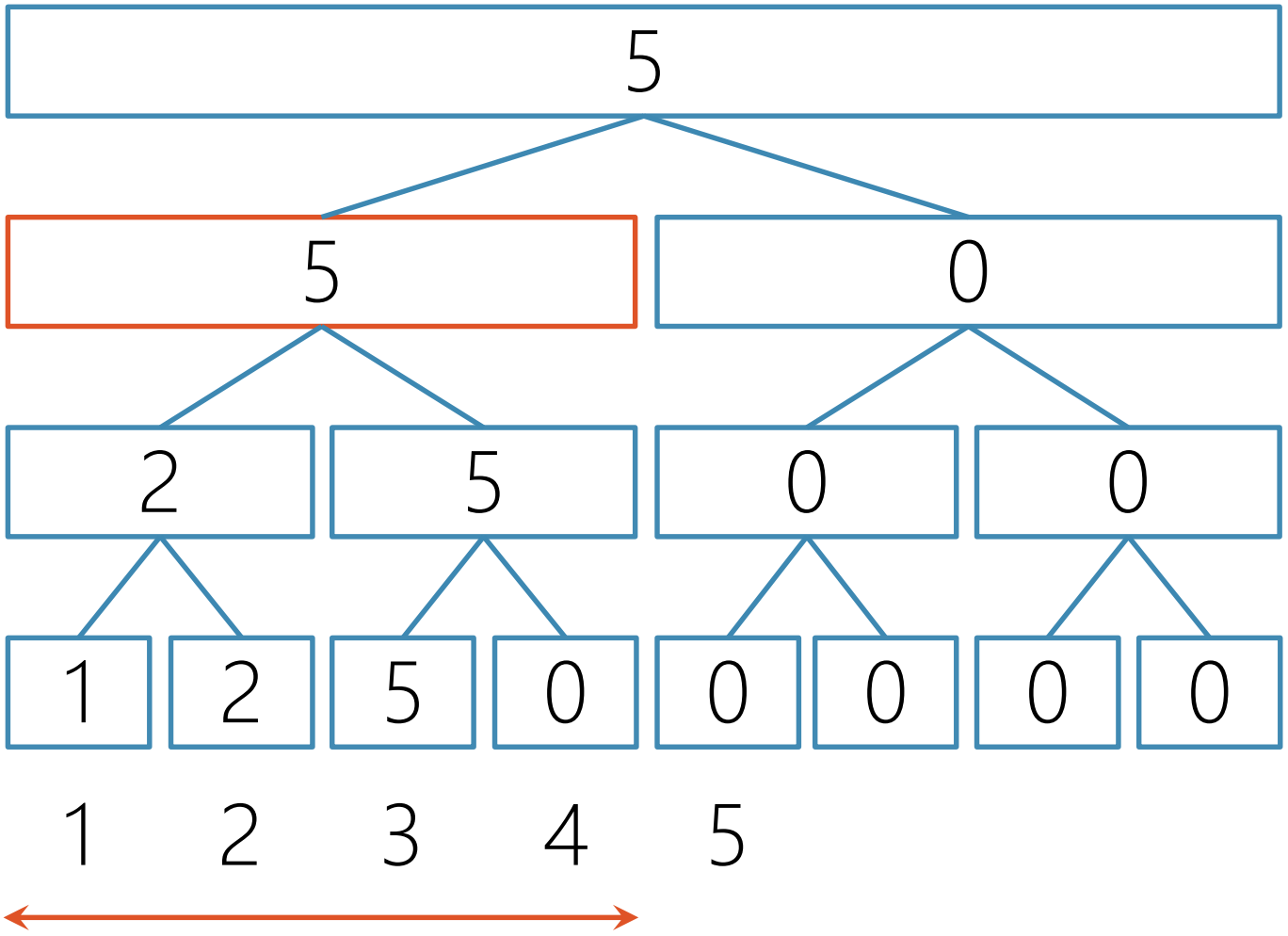

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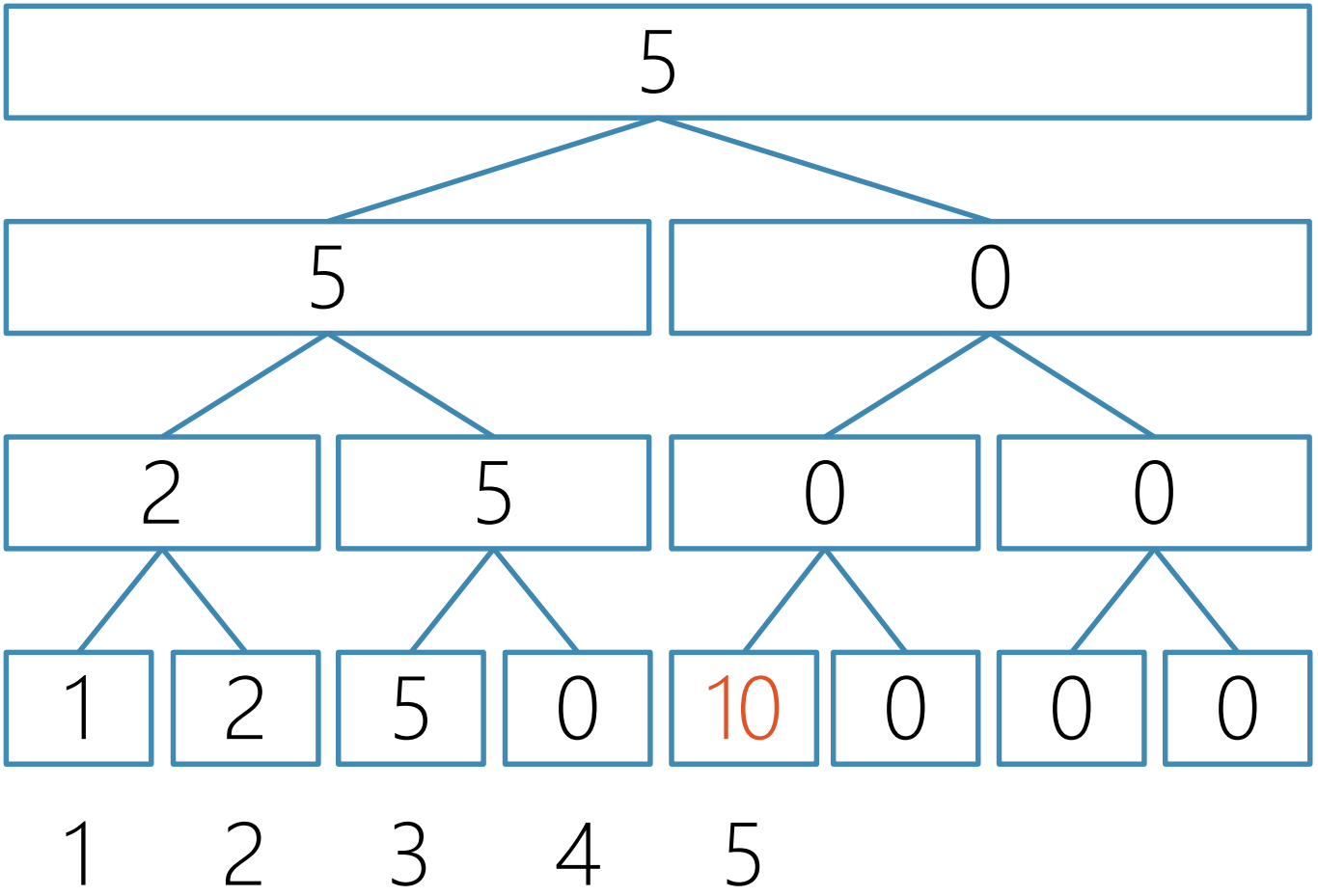

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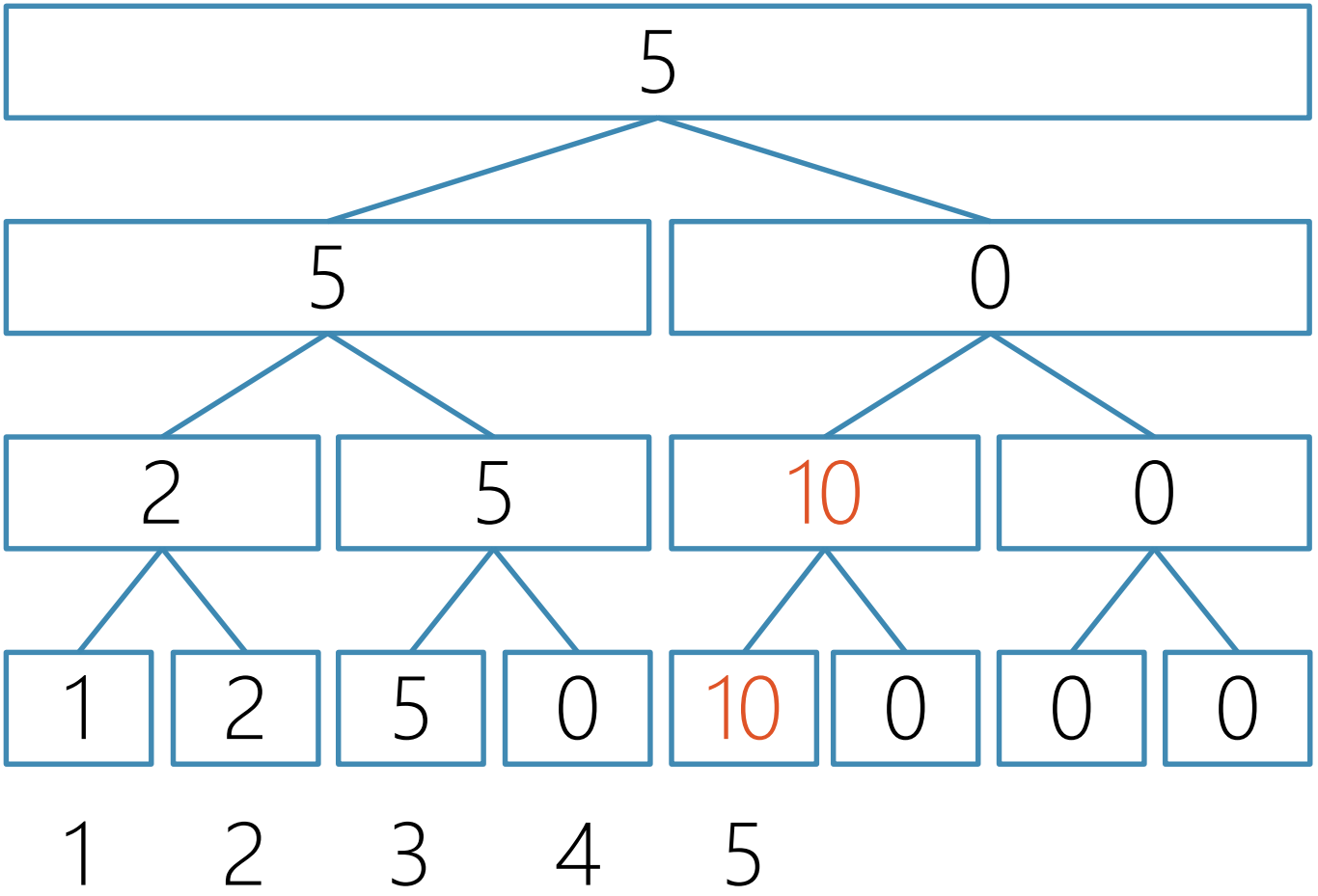

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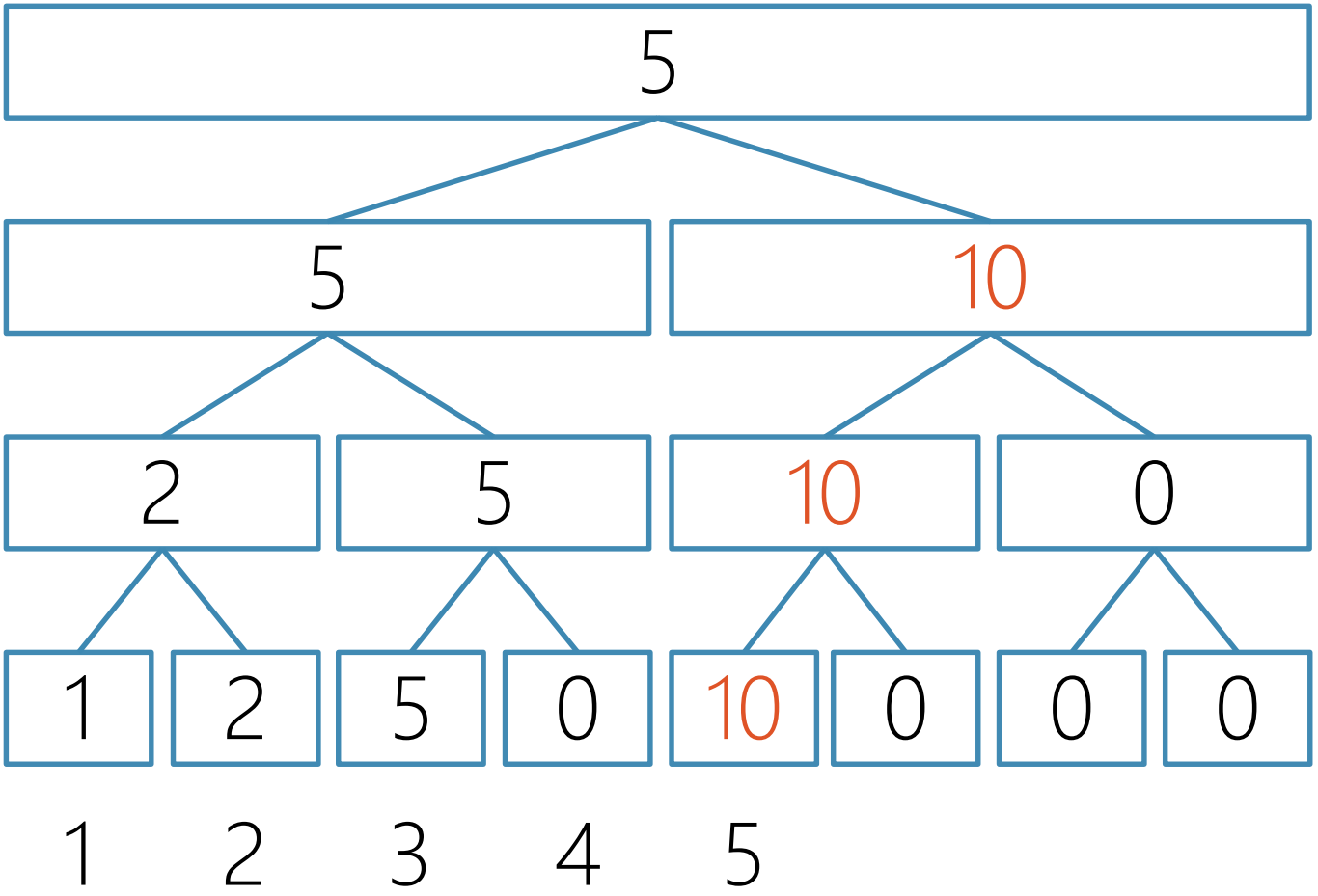

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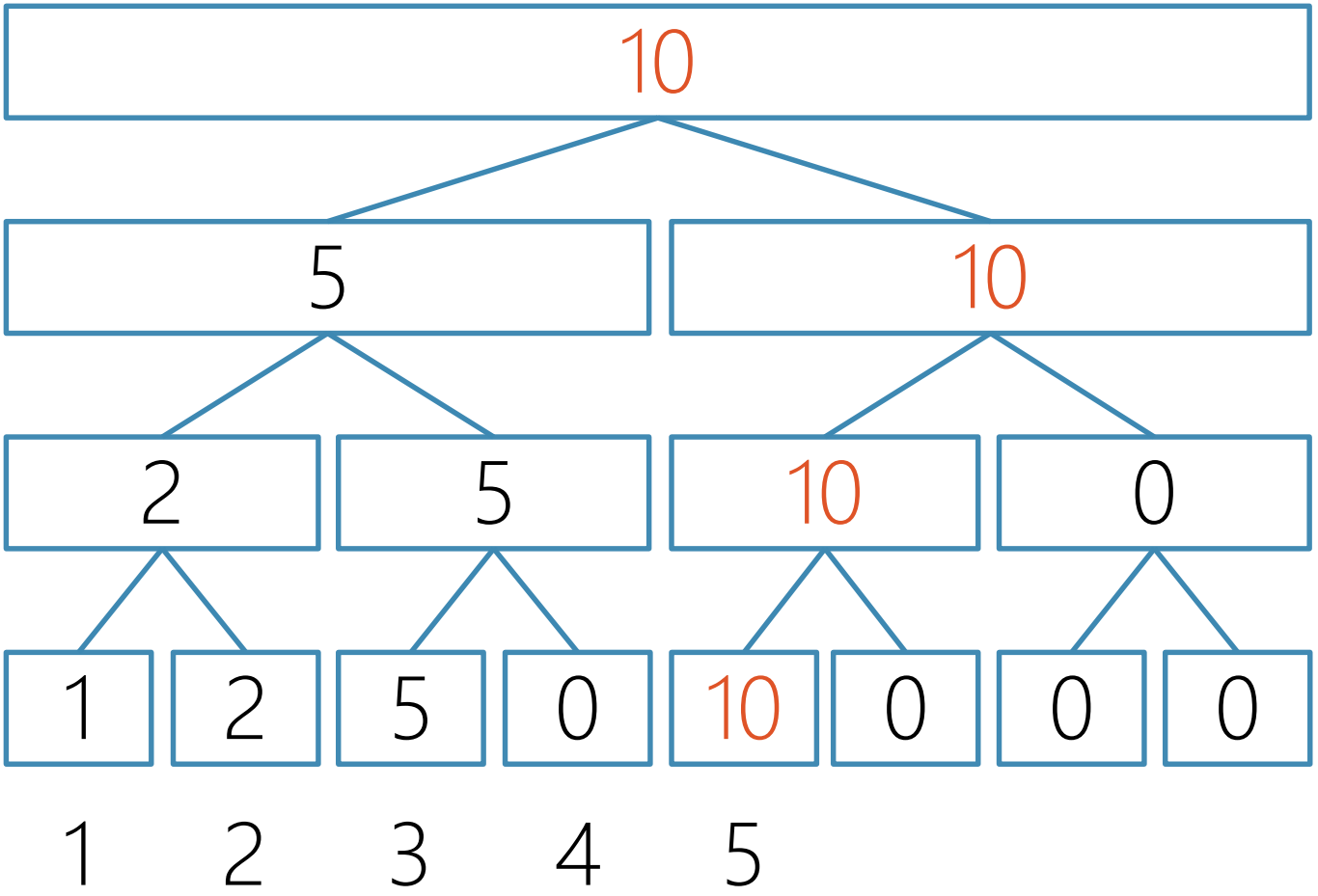

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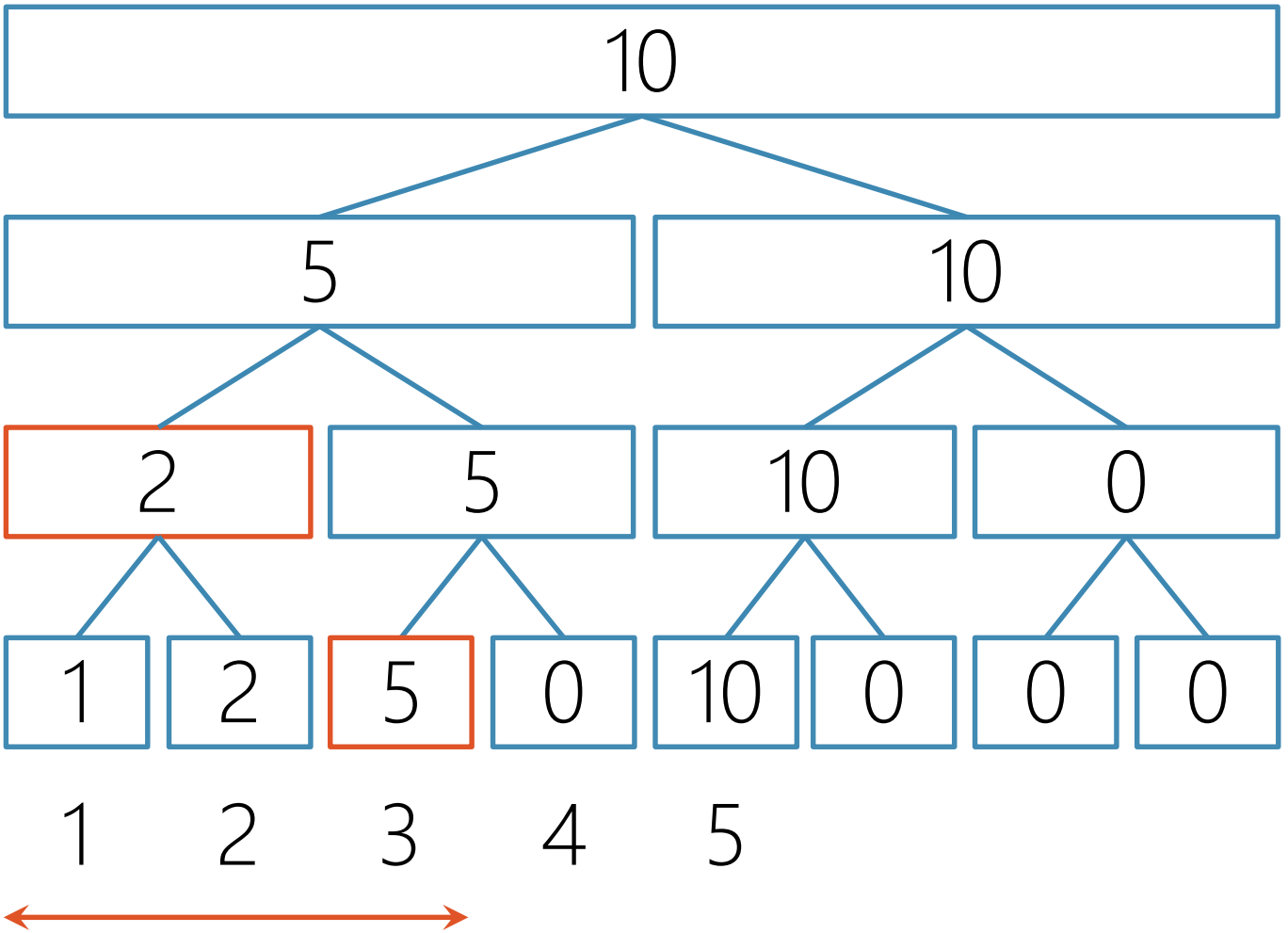

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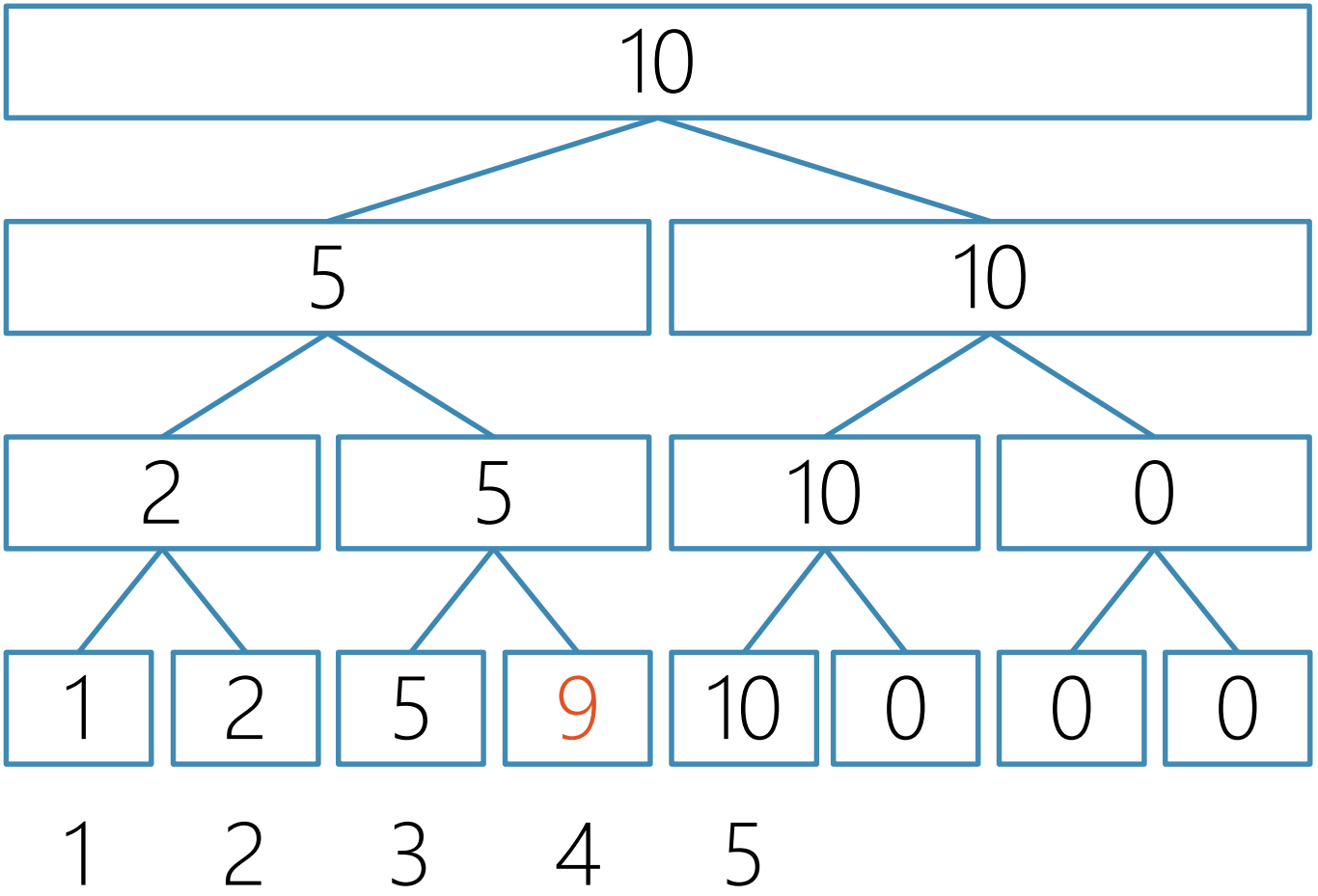

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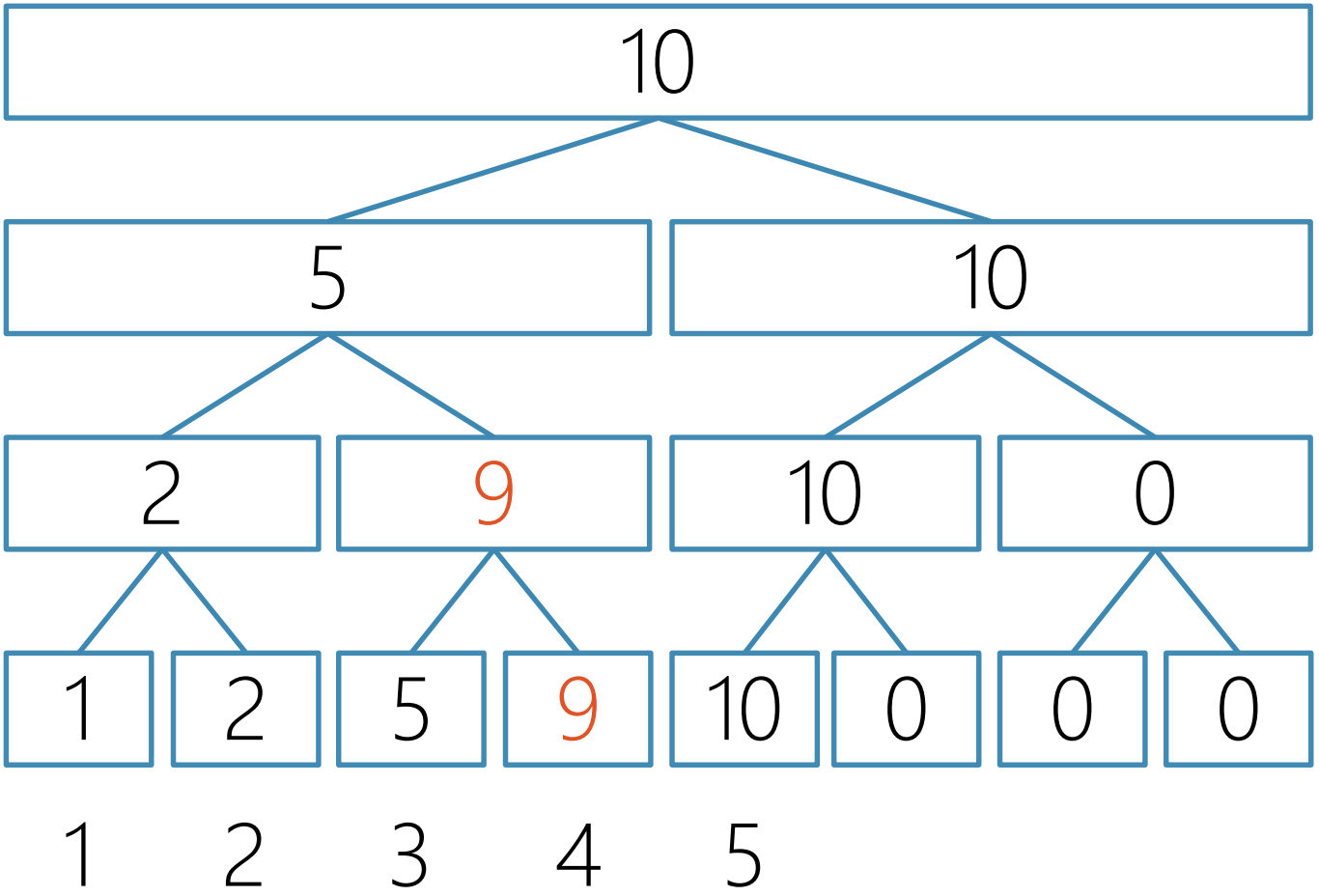

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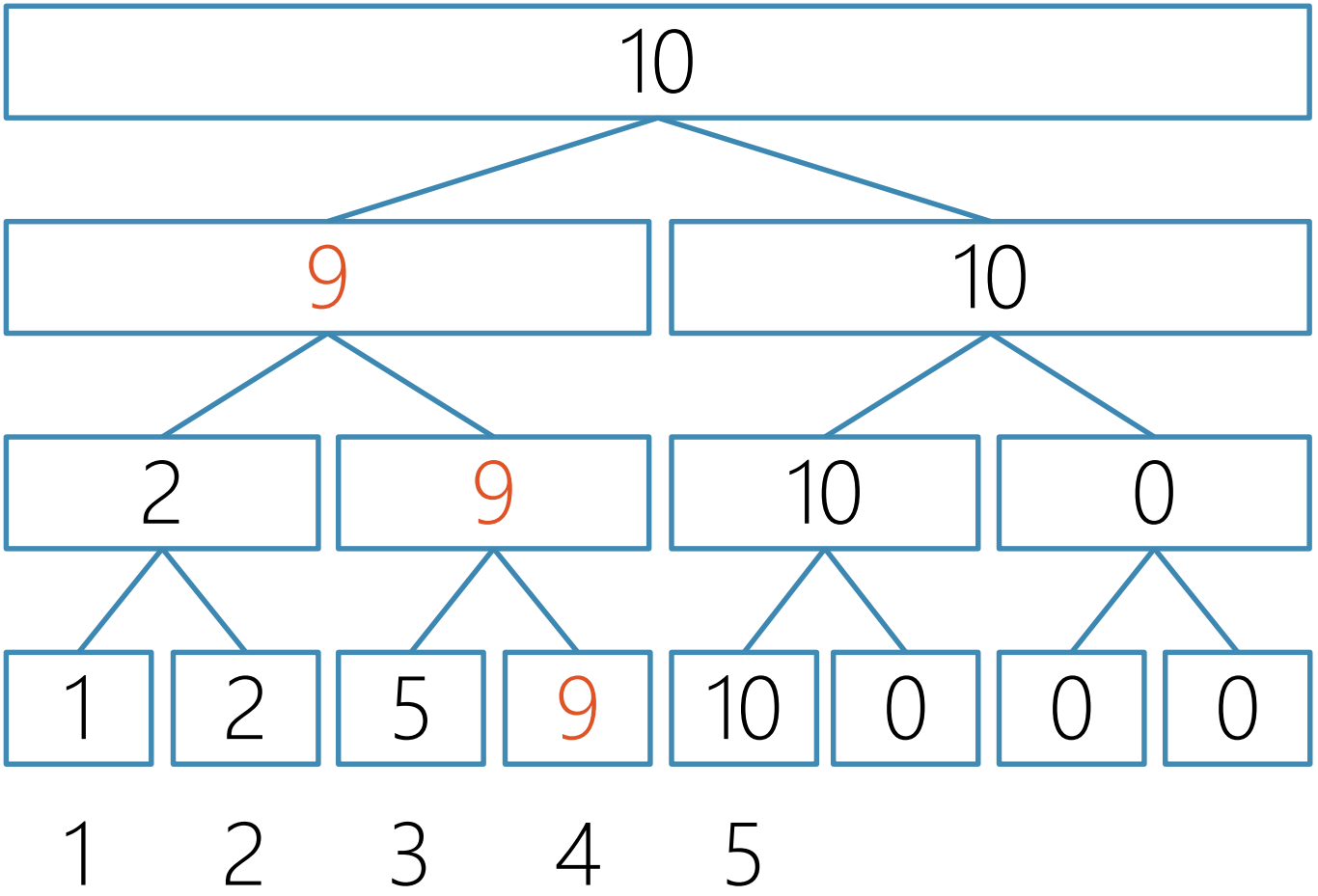

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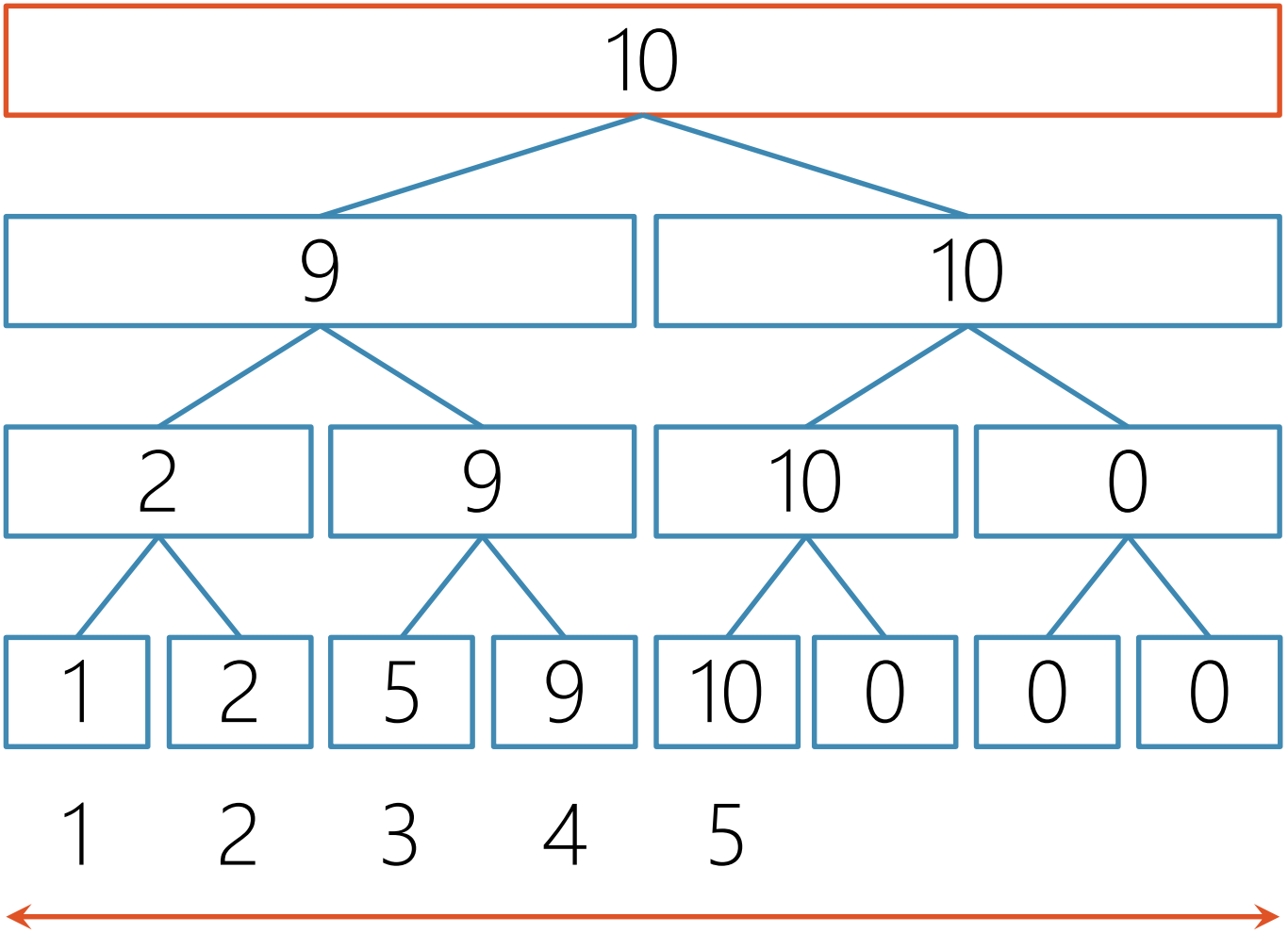
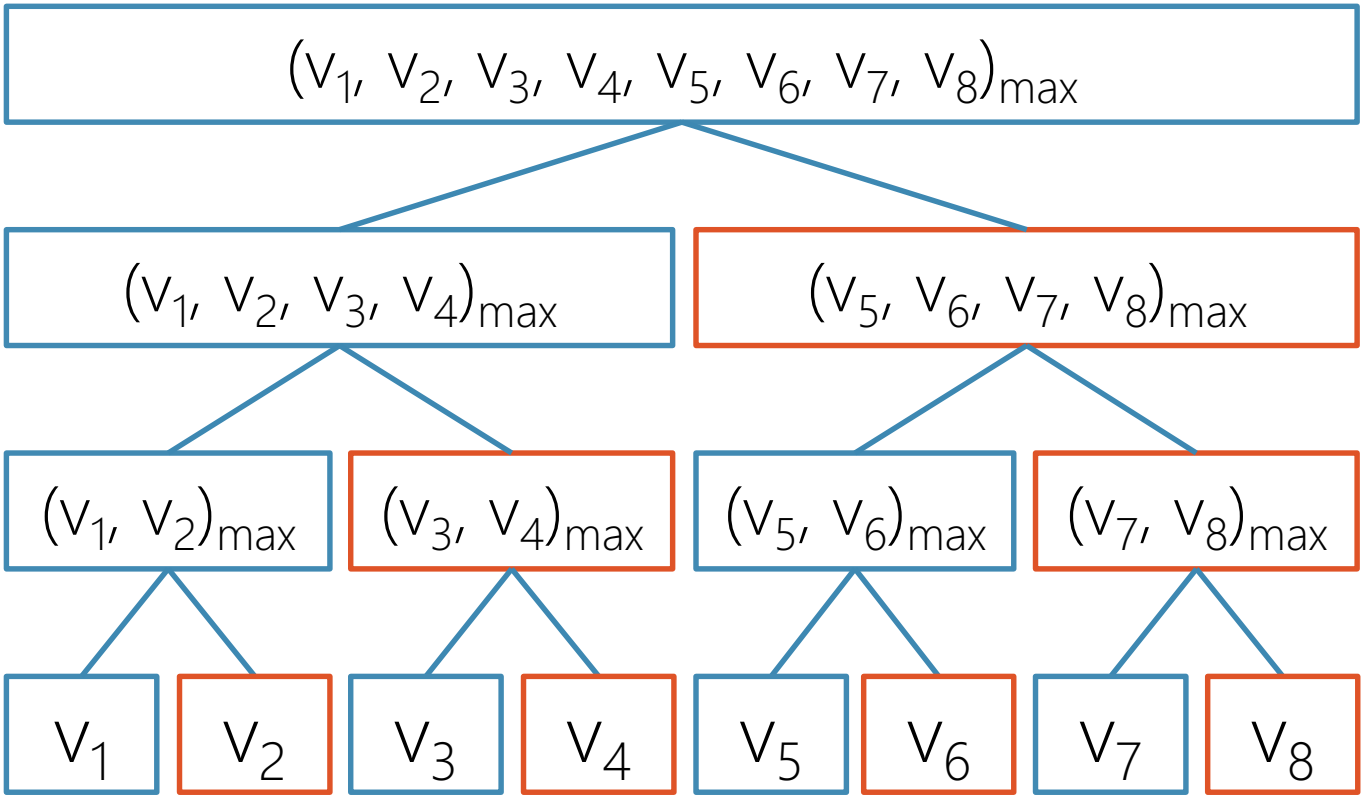


セグメント木

- O(n log(n))

Binary Indexed Tree (BIT)



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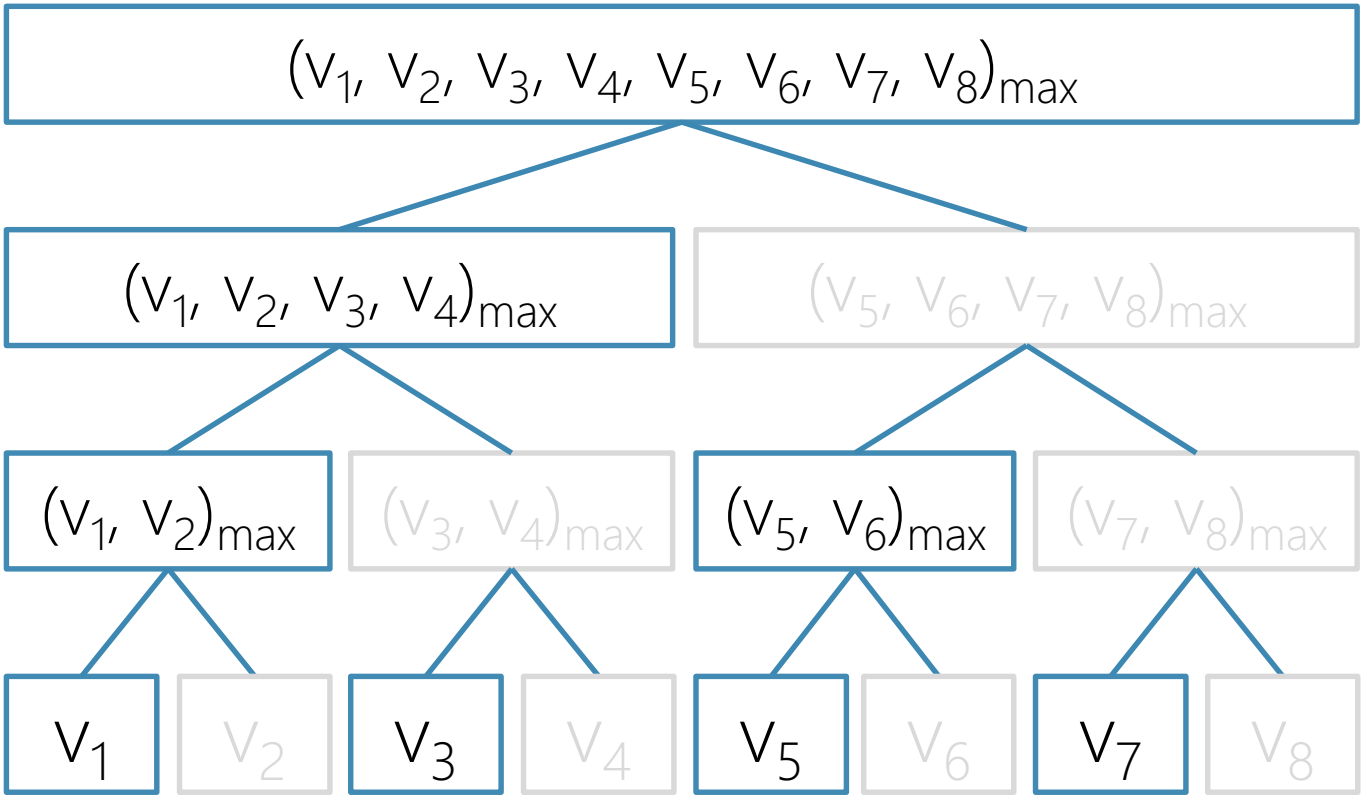

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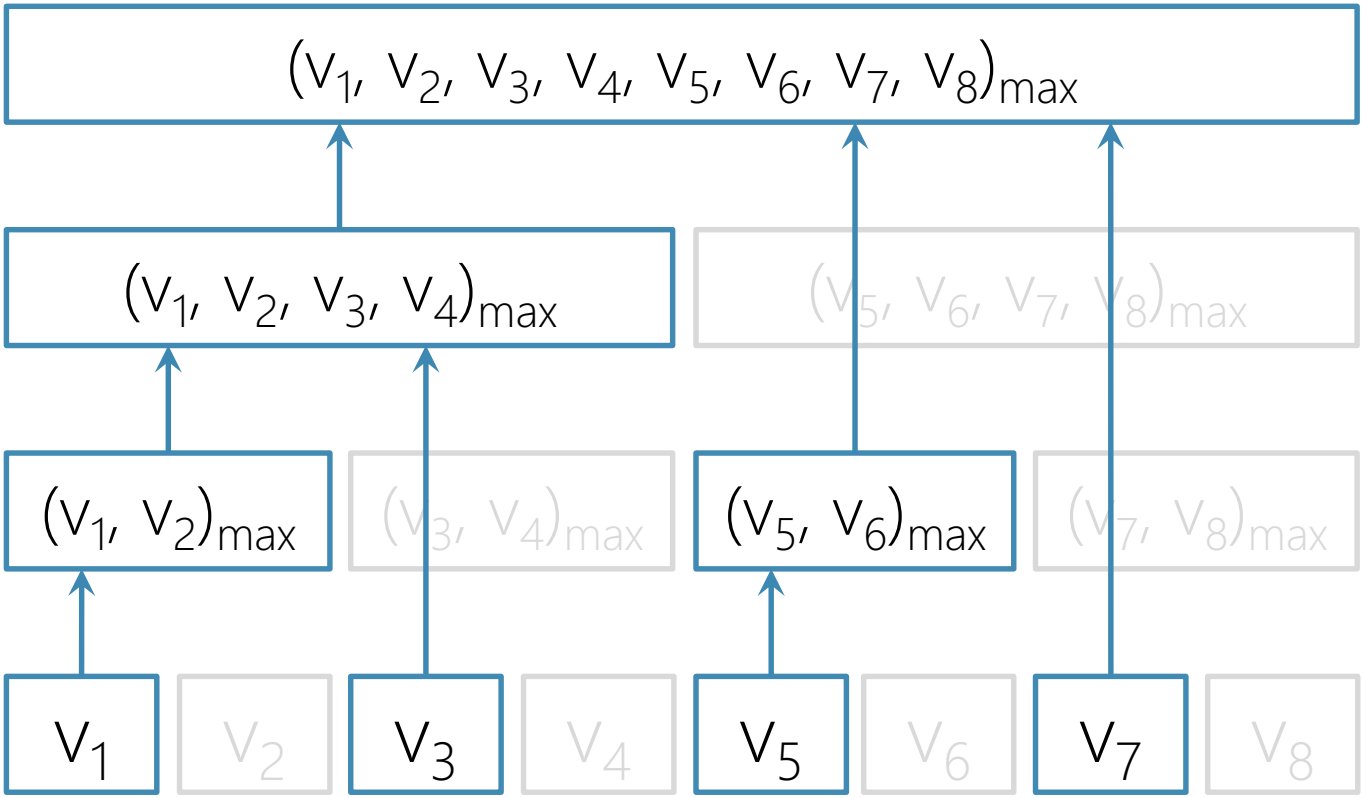
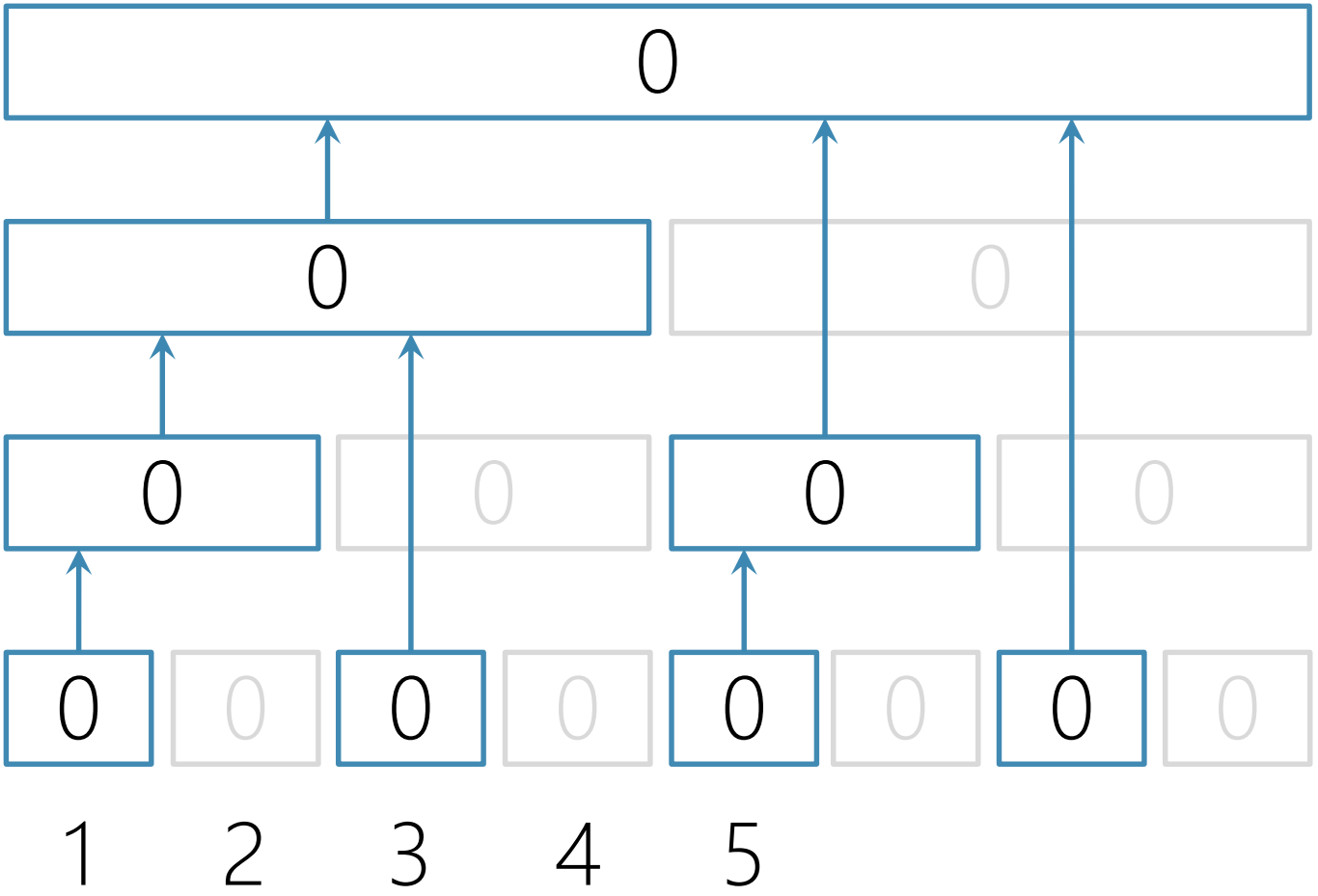


BIT

$x = \{ 2, 3, 1, 5, 4 \}$



BIT

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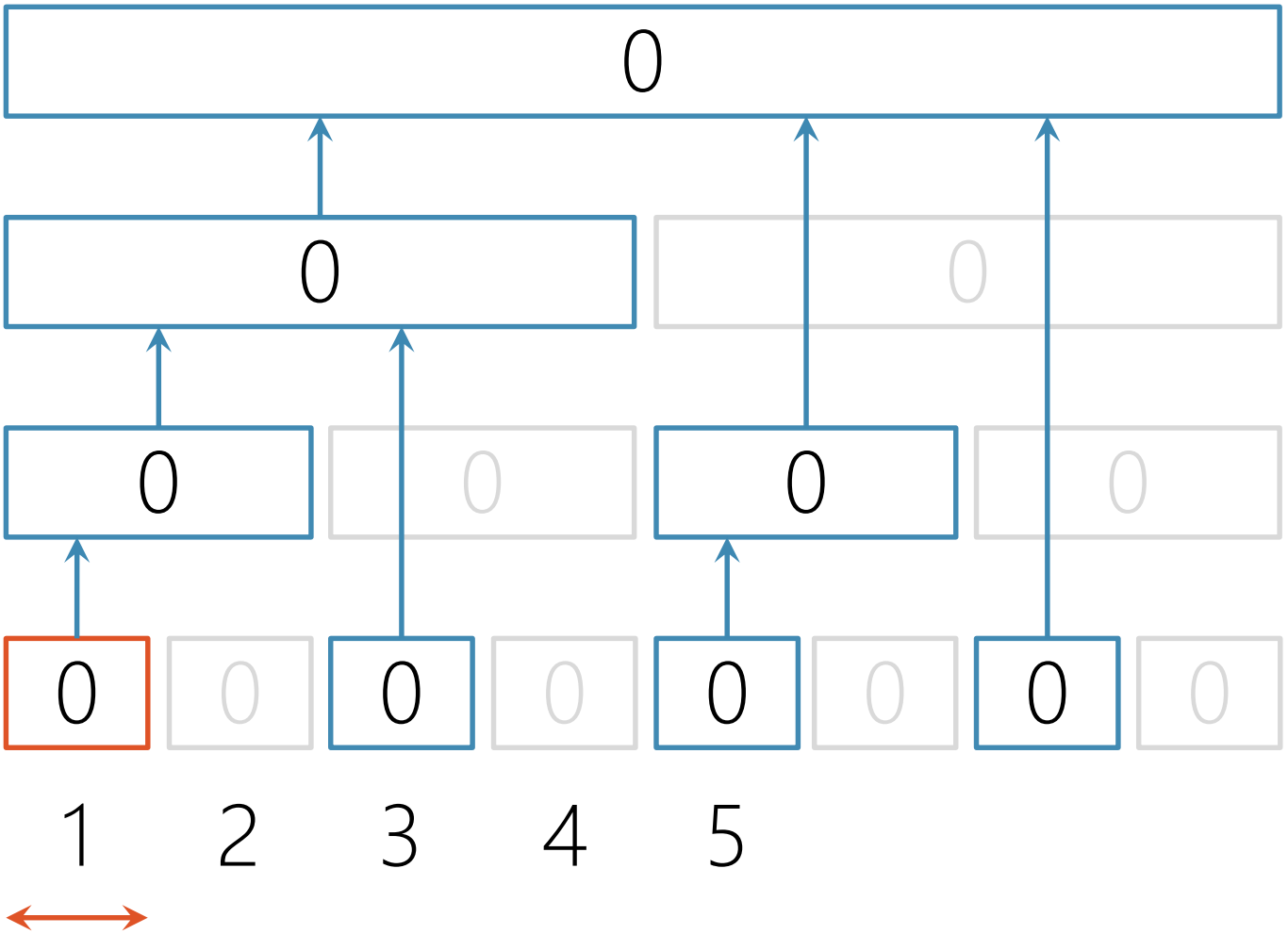

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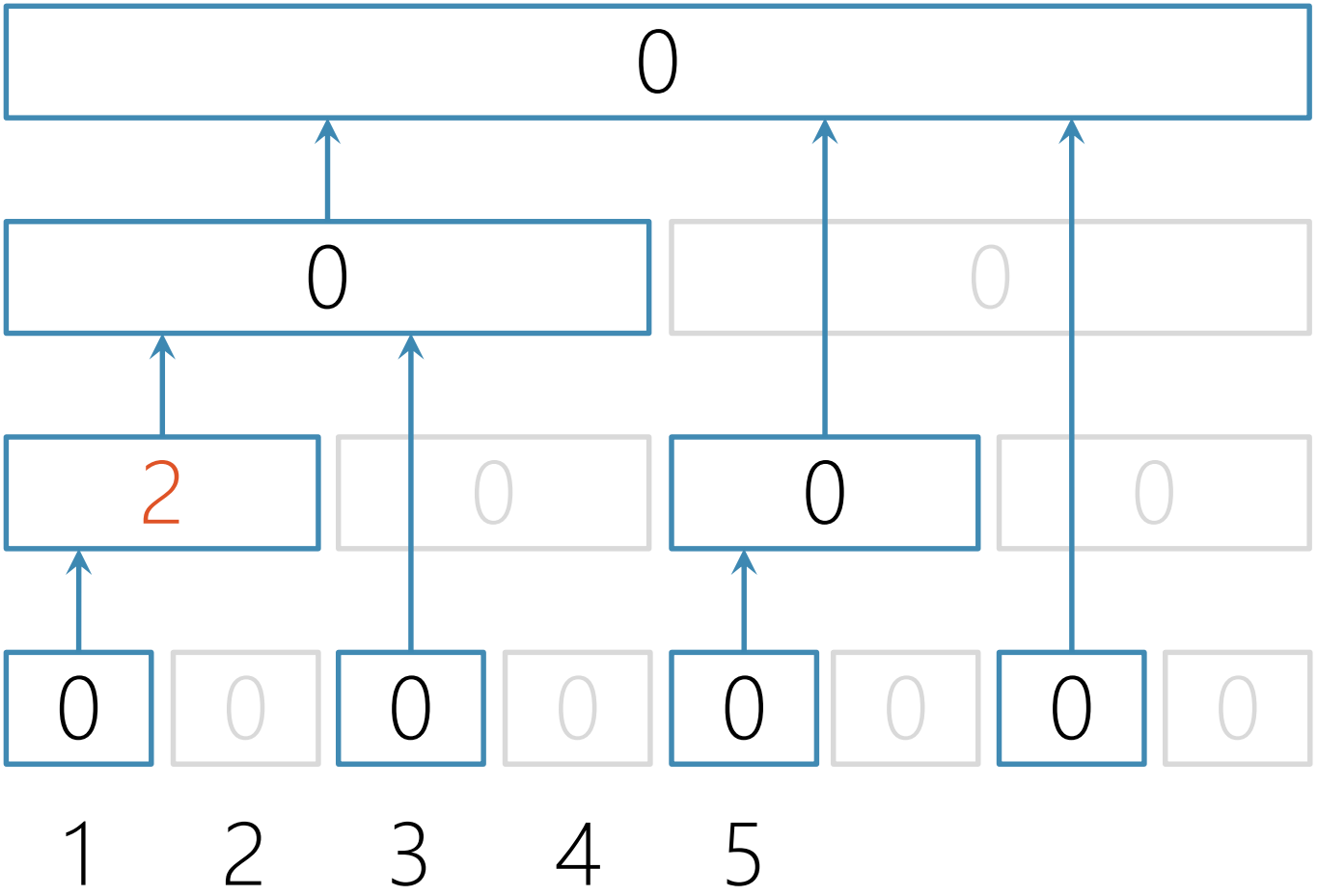

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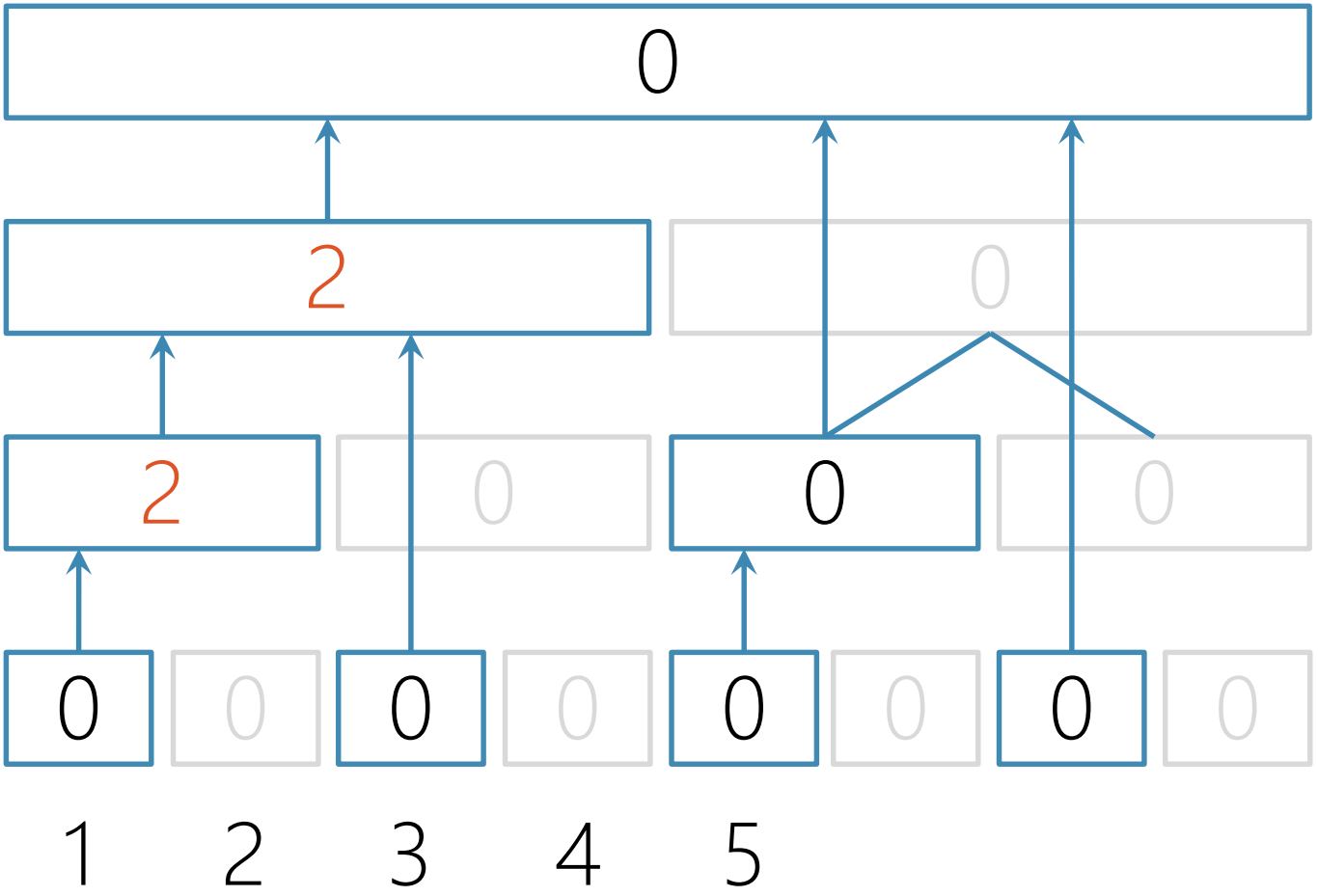

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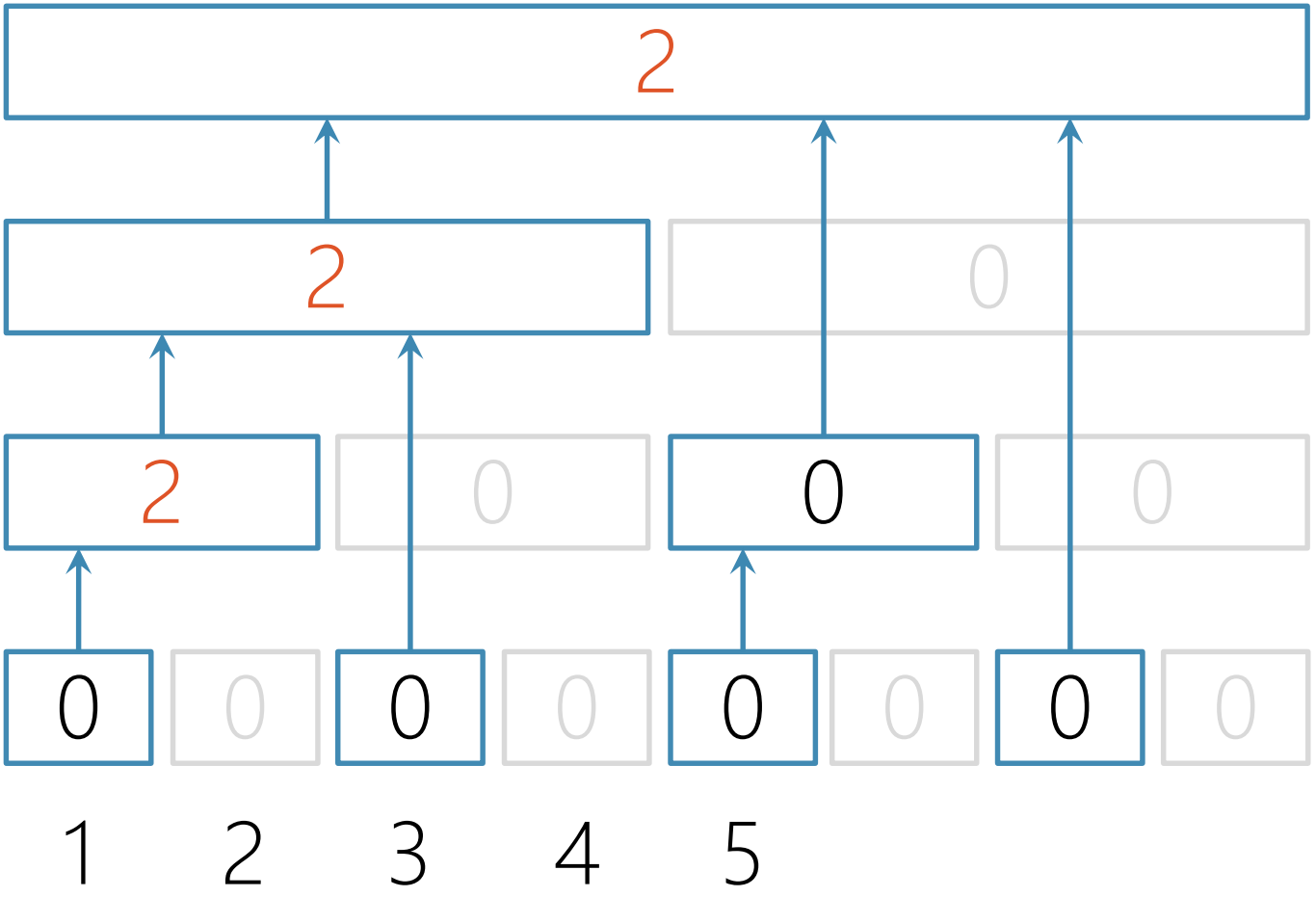
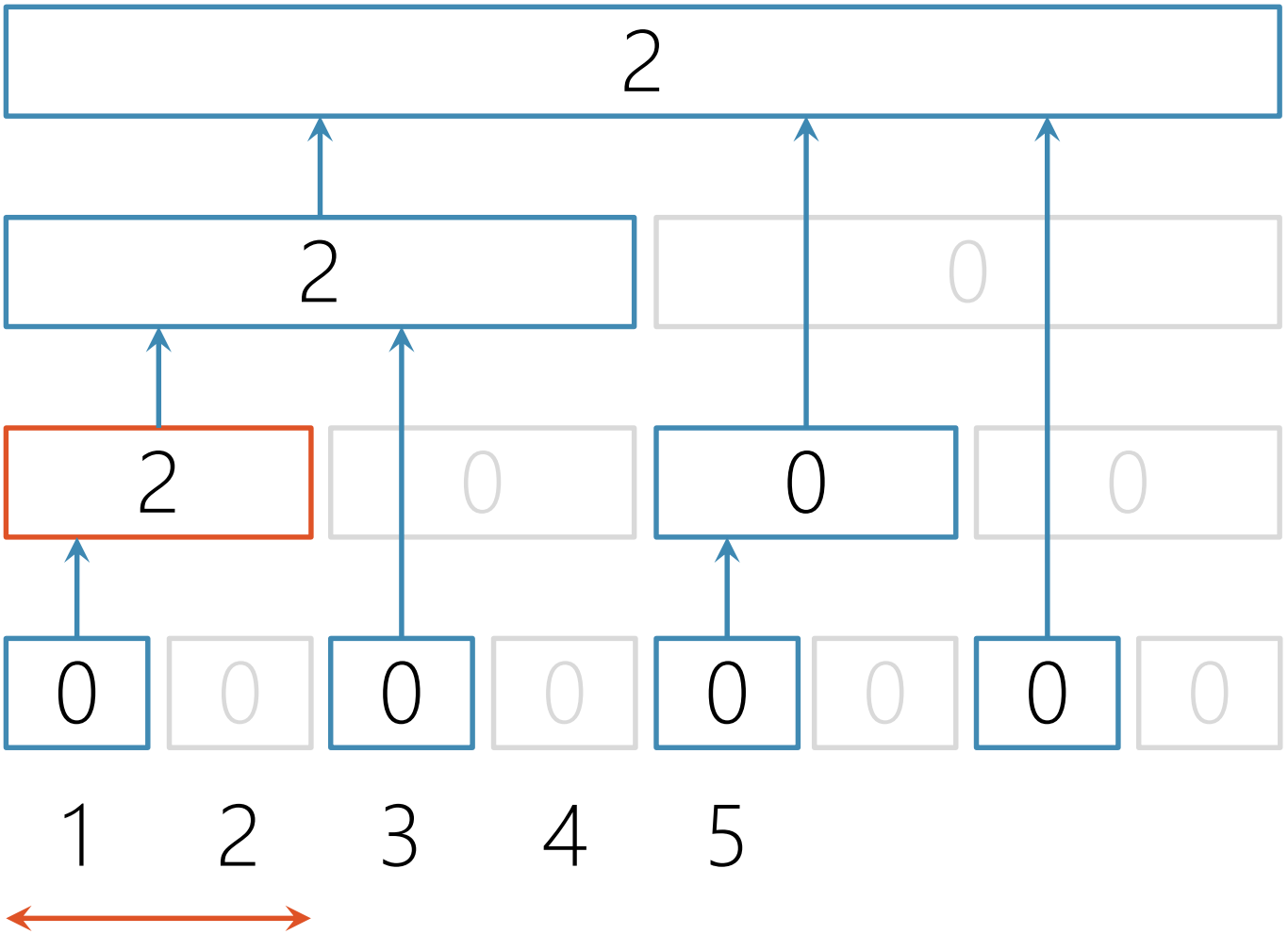


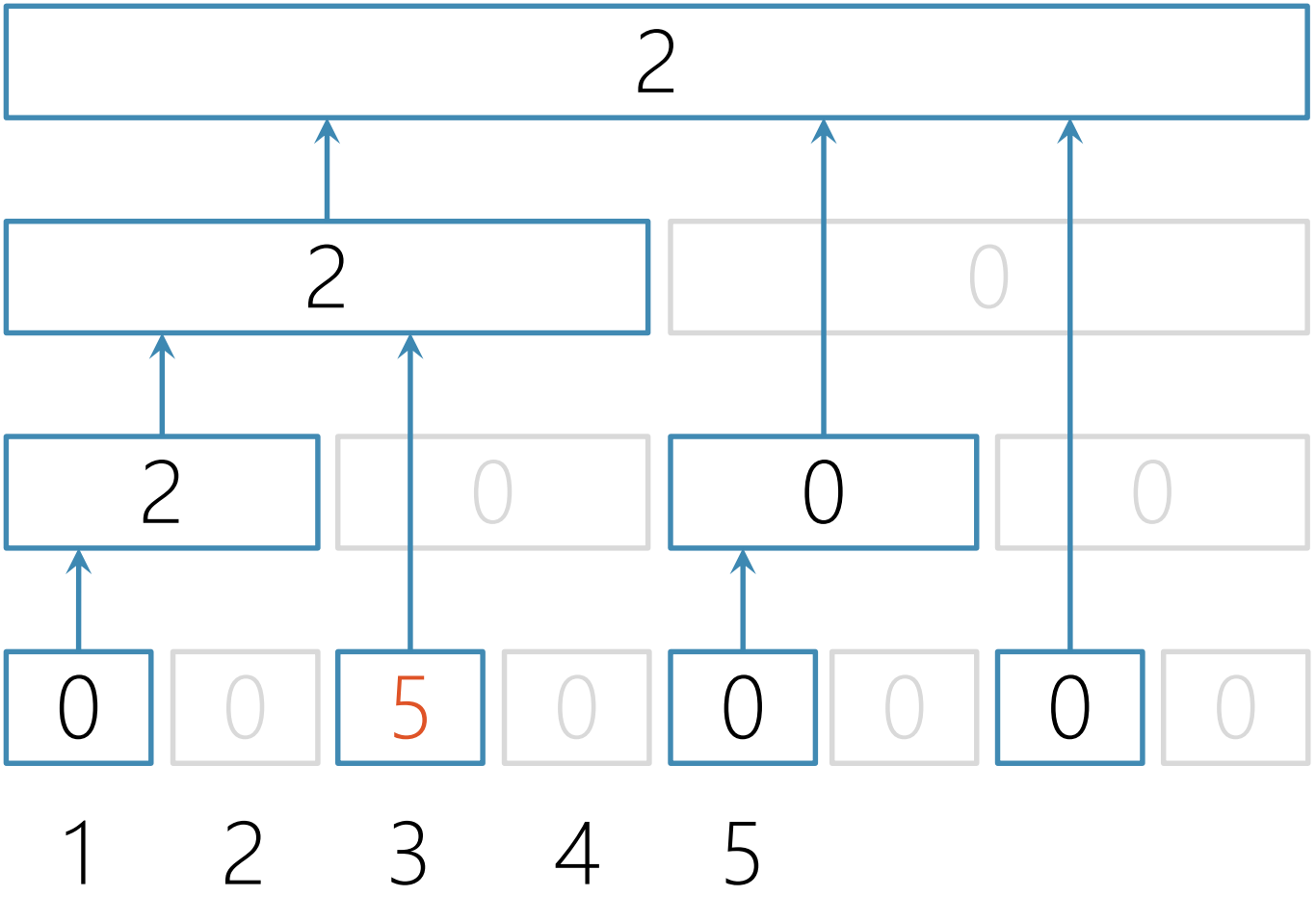
BIT

$x = \{ 2, 3, 1, 5, 4 \}$



BIT

$x = \{ 2, 3, 1, 5, 4 \}$



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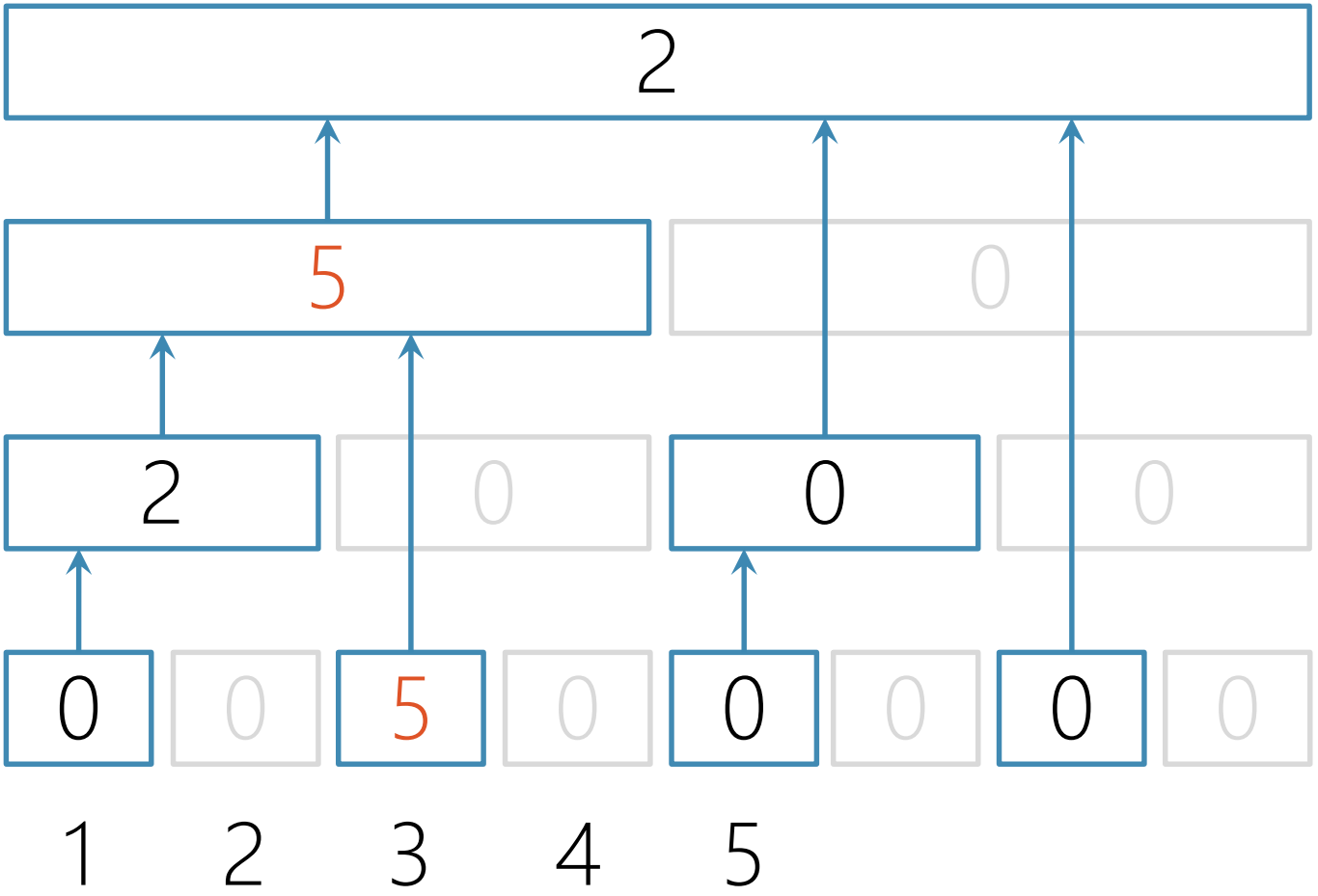

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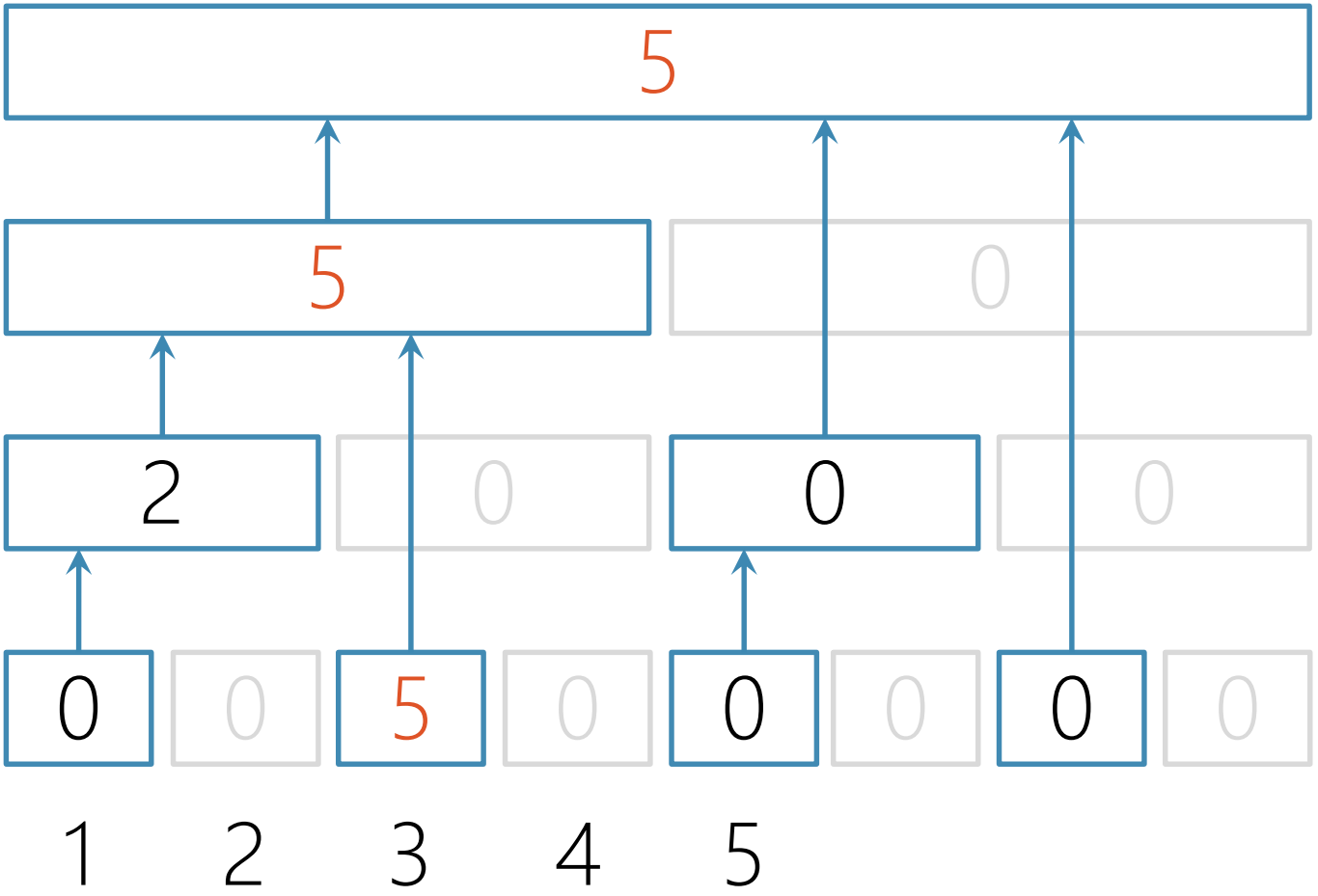

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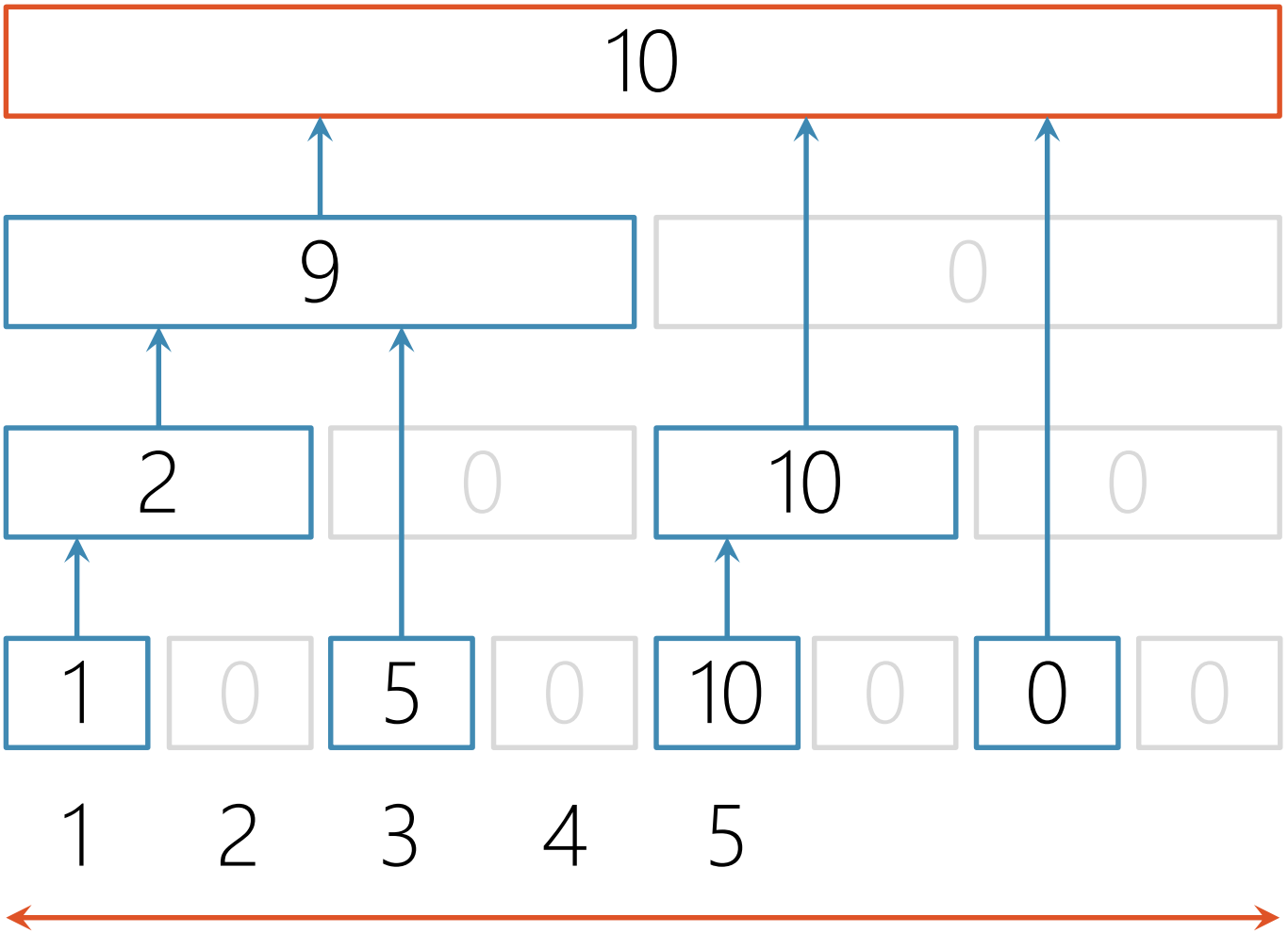

ソースコード

- 2431_segtree.cpp
- 2431_bit.cpp