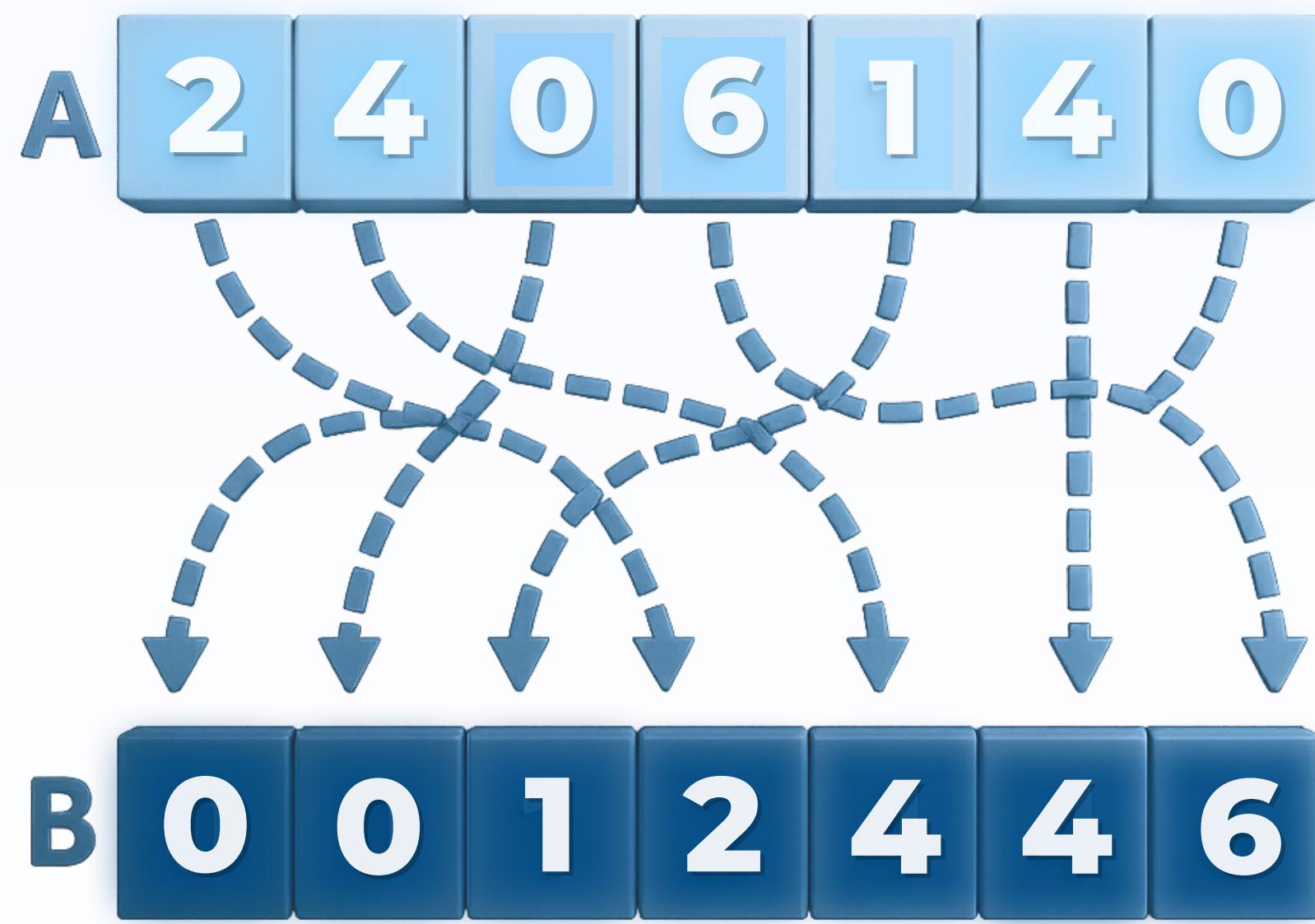


# 20 CODING PATTERNS





## \*Disclaimer\*

Learning all 20 Coding Patterns in DSA can be a challenging journey.

Go at your own pace, take breaks when needed, and remember, it's not about how fast you finish, but how well you understand. Use this doc as your guide, and build a solid foundation in DSA.

# 1. SLIDING WINDOW

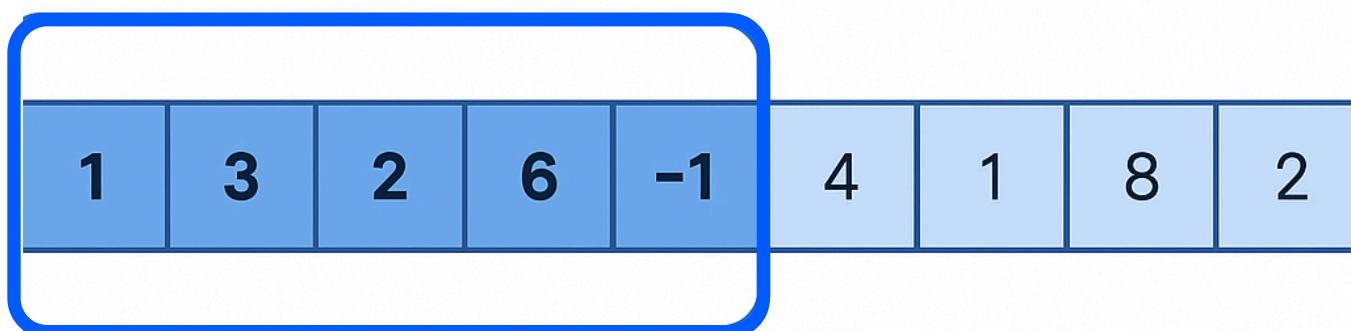
**Usage :** This algorithmic technique is used when we need to handle the input data in a specific window size.

**DS Involved :** Array, String, HashTable

**Sample Problems :**

- Longest Substring with 'K' Distinct Characters
- Fruits into Baskets

Sliding window ->



Slide one element forward



## 2. ISLANDS (MATRIX TRAVERSAL)

**Usage** : This pattern describes all the efficient ways of traversing a matrix (or 2D array).

**DS Involved** : Matrix, Queue

**Sample Problems :**

- Number of Islands
- Flood Fill
- Cycle in a Matrix

1	1	0	0	0
0	1	0	0	1
0	0	1	1	0
0	0	1	0	0
0	0	1	0	0
0	0	1	0	0

## 3. TWO POINTERS

**Usage :** This technique uses two pointers to iterate input data. Generally, both pointers move in the opposite direction at a constant interval.

**DS Involved :** Array, String, LinkedList

**Sample Problems :**

- Squaring a Sorted Array
- Dutch National Flag Problem
- Minimum Window Sort



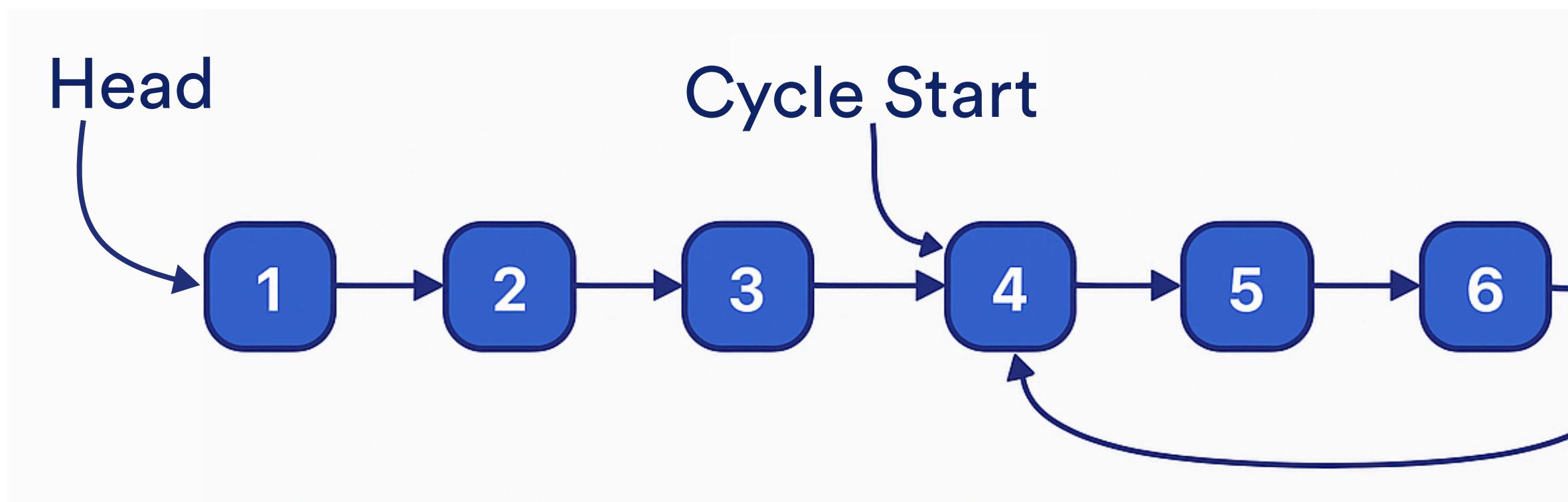
## 4. FAST & SLOW POINTERS

**Usage :** Also known as Hare & Tortoise algorithm. This technique uses two pointers that traverse the input data at different speeds.

**DS Involved :** Array, String, LinkedList

**Sample Problems :**

- Middle of the LinkedList
- Happy Number
- Cycle in a Circular Array



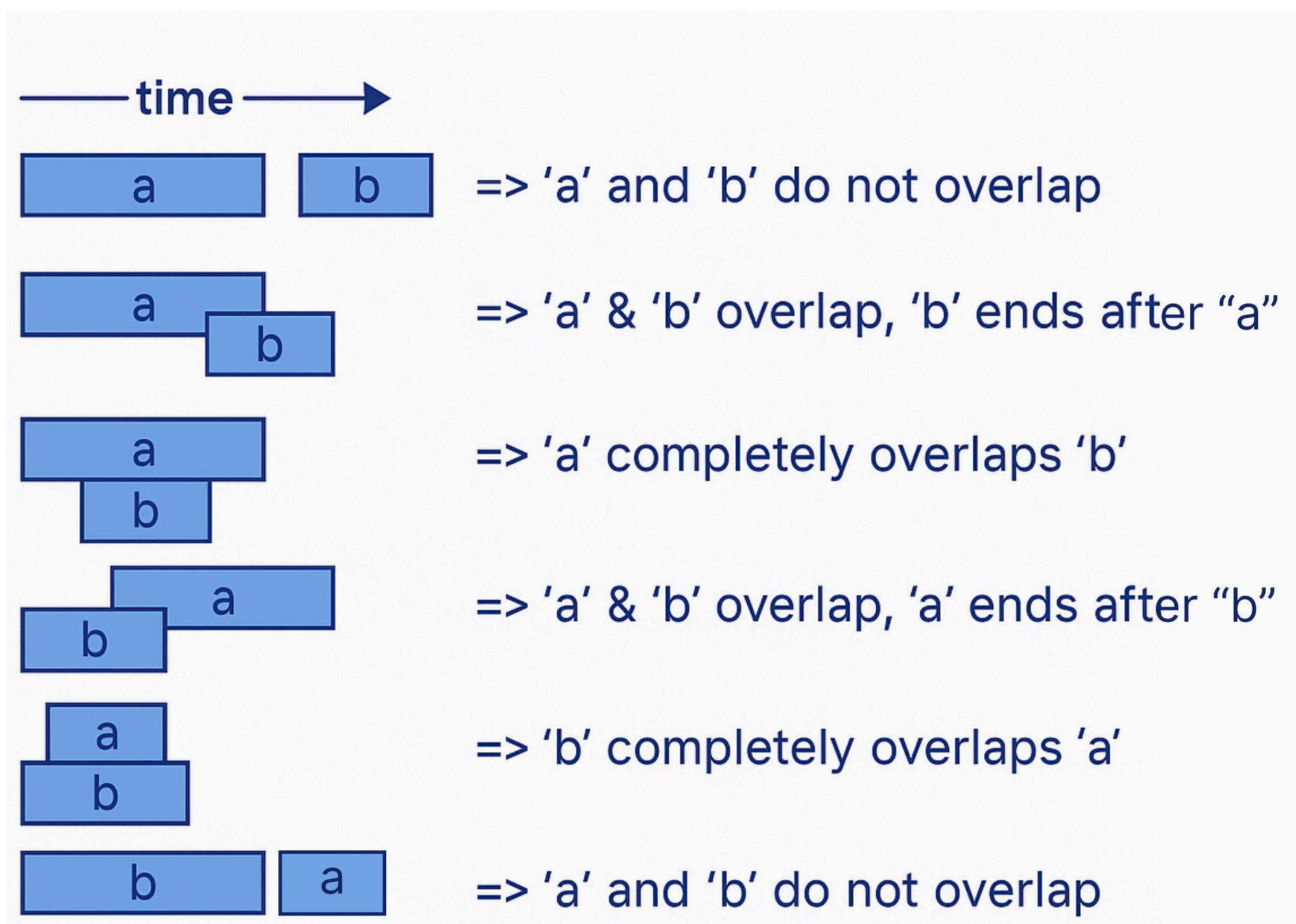
# 5. MERGE INTERVALS

**Usage :** This technique is used to deal with overlapping intervals.

**DS Involved :** Array, Heap

**Sample Problems :**

- Conflicting Appointments
- Minimum Meeting Rooms



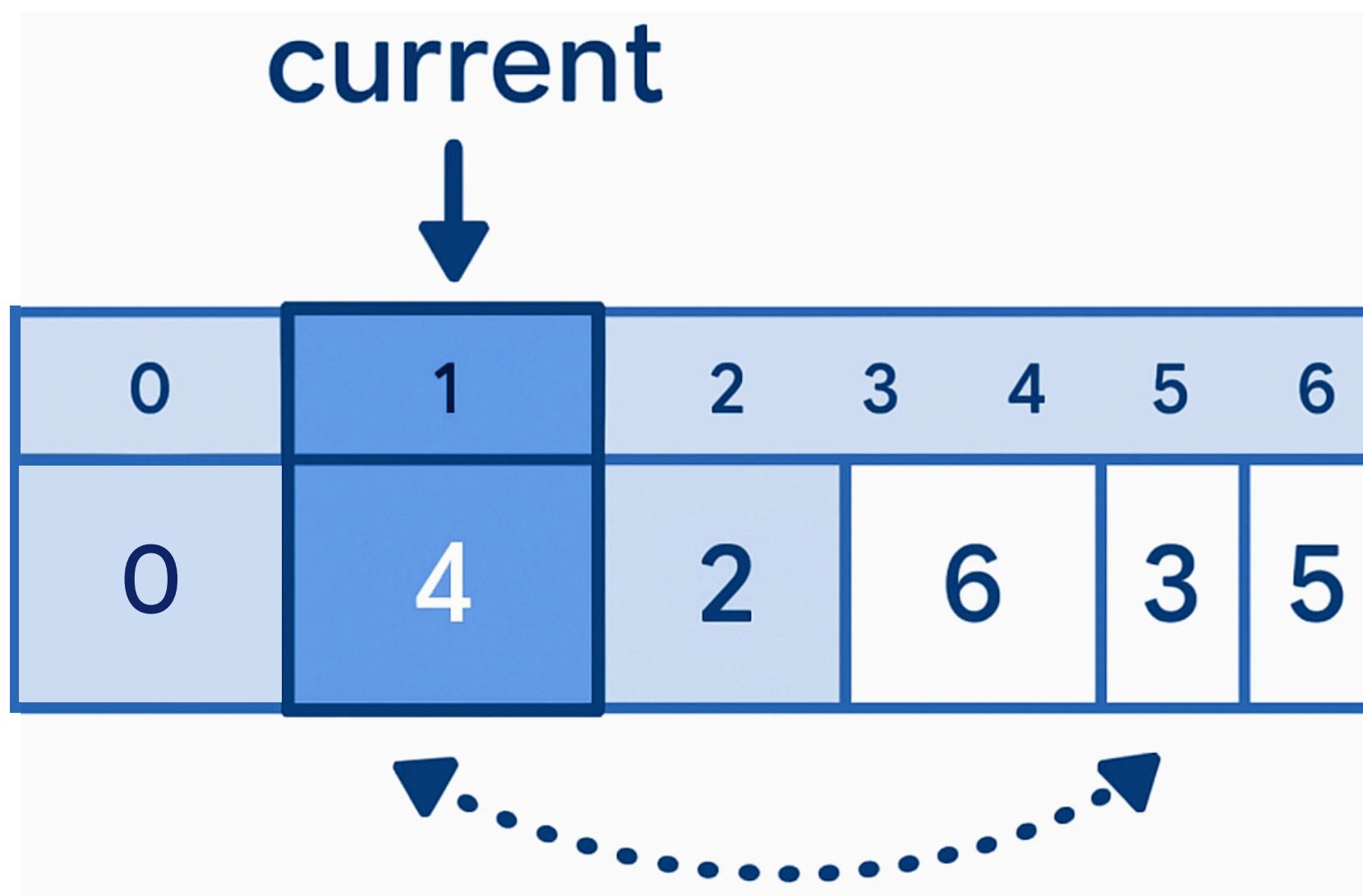
## 6. CYCLIC SORT

**Usage :** Use this technique to solve array problems where the input data lies within a fixed range.

**DS Involved :** Array

**Sample Problems :**

- Find all Missing Numbers
- Find all Duplicate Numbers
- Find the First K Missing Positive Numbers



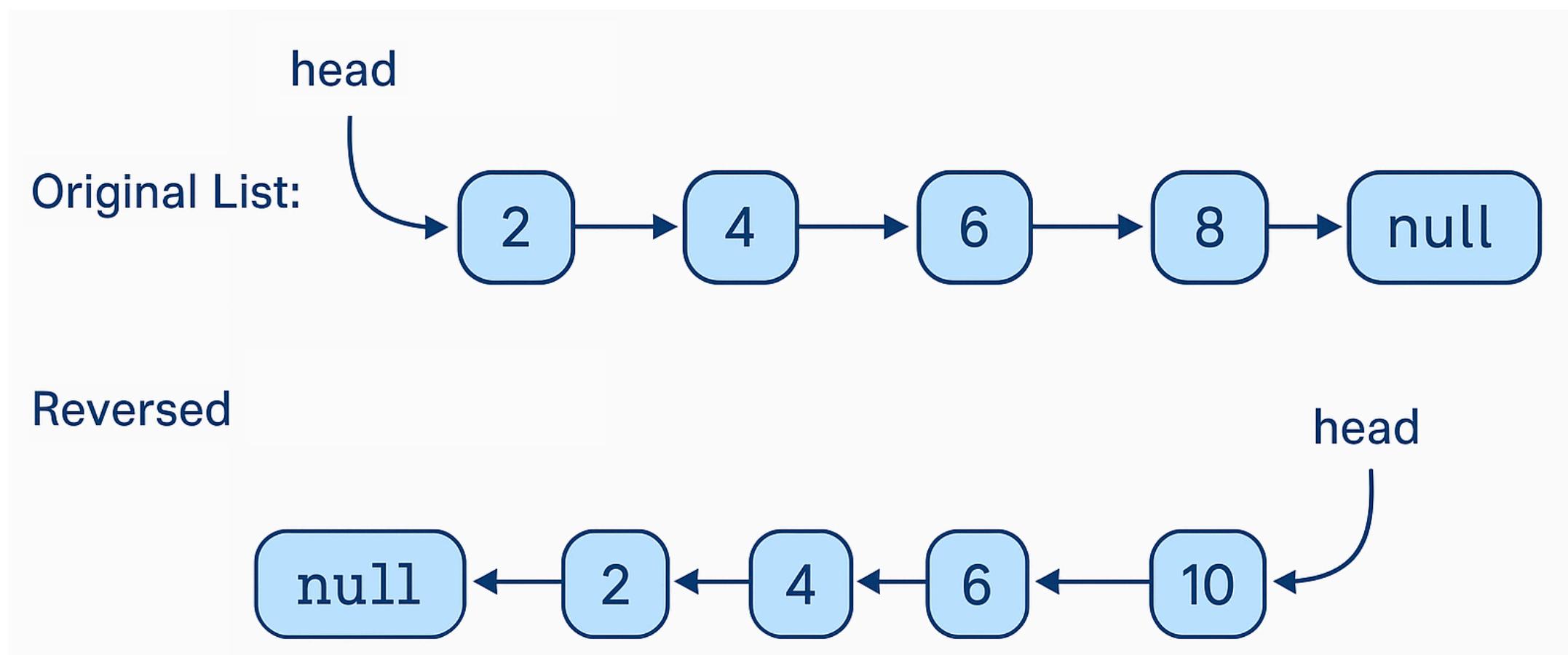
## 7. IN-PLACE REVERSAL OF A LINKEDLIST

**Usage :** This technique describes an efficient way to reverse the links between a set of nodes of a LinkedList. Often, the constraint is that we need to do this in-place, i.e., using the existing node objects and without using extra memory.

**DS Involved :** LinkedList

**Sample Problems :**

- Reverse every K-element Sub-list
- Rotate a LinkedList



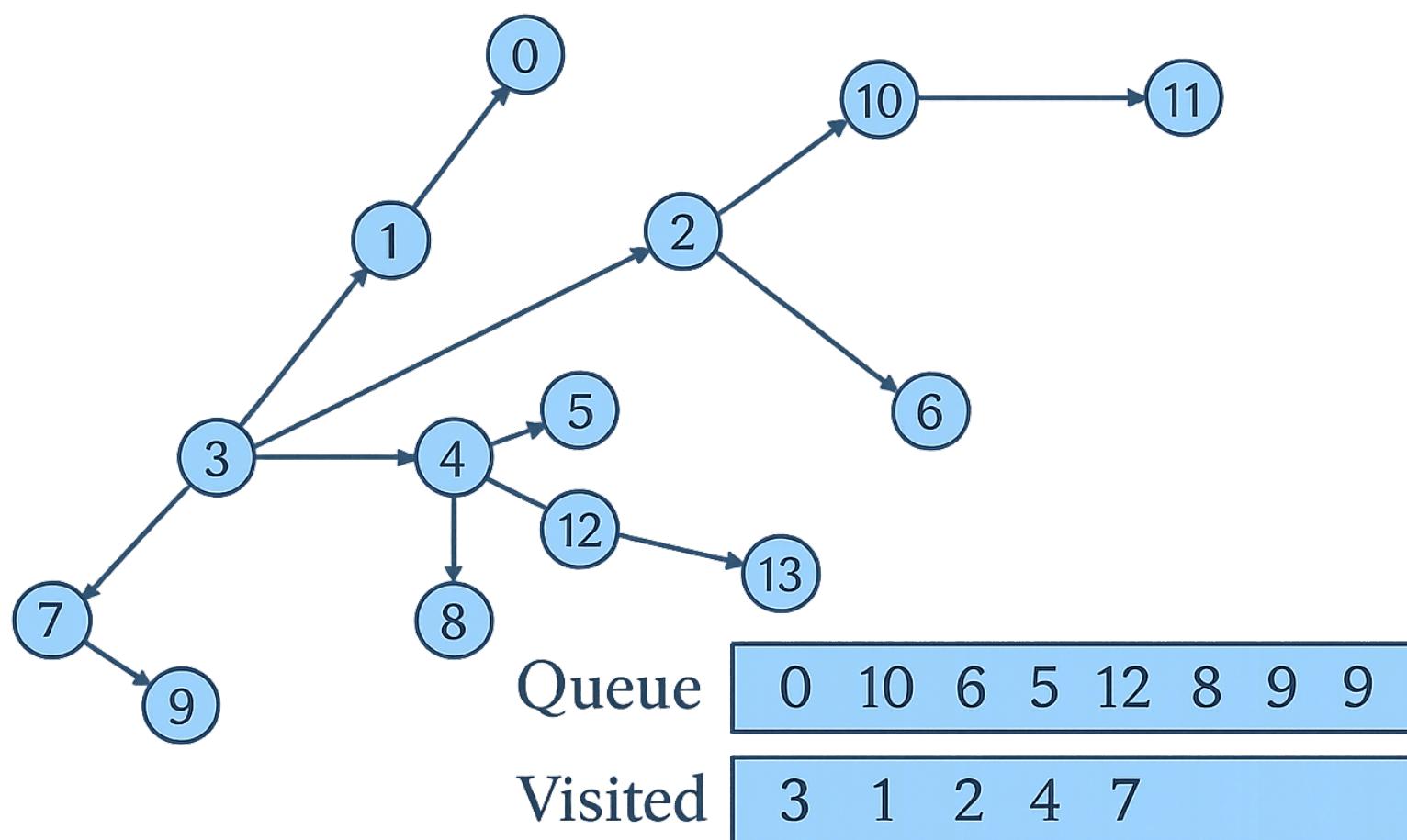
# 8. BREADTH-FIRST SEARCH

**Usage :** This technique is used to solve problems involving traversing trees or graphs in a breadth-first search manner.

**DS Involved :** Tree, Graph, Matrix, Queue

**Sample Problems :**

- Binary Tree Level Order Traversal
- Minimum Depth of a Binary Tree
- Connect Level Order Siblings



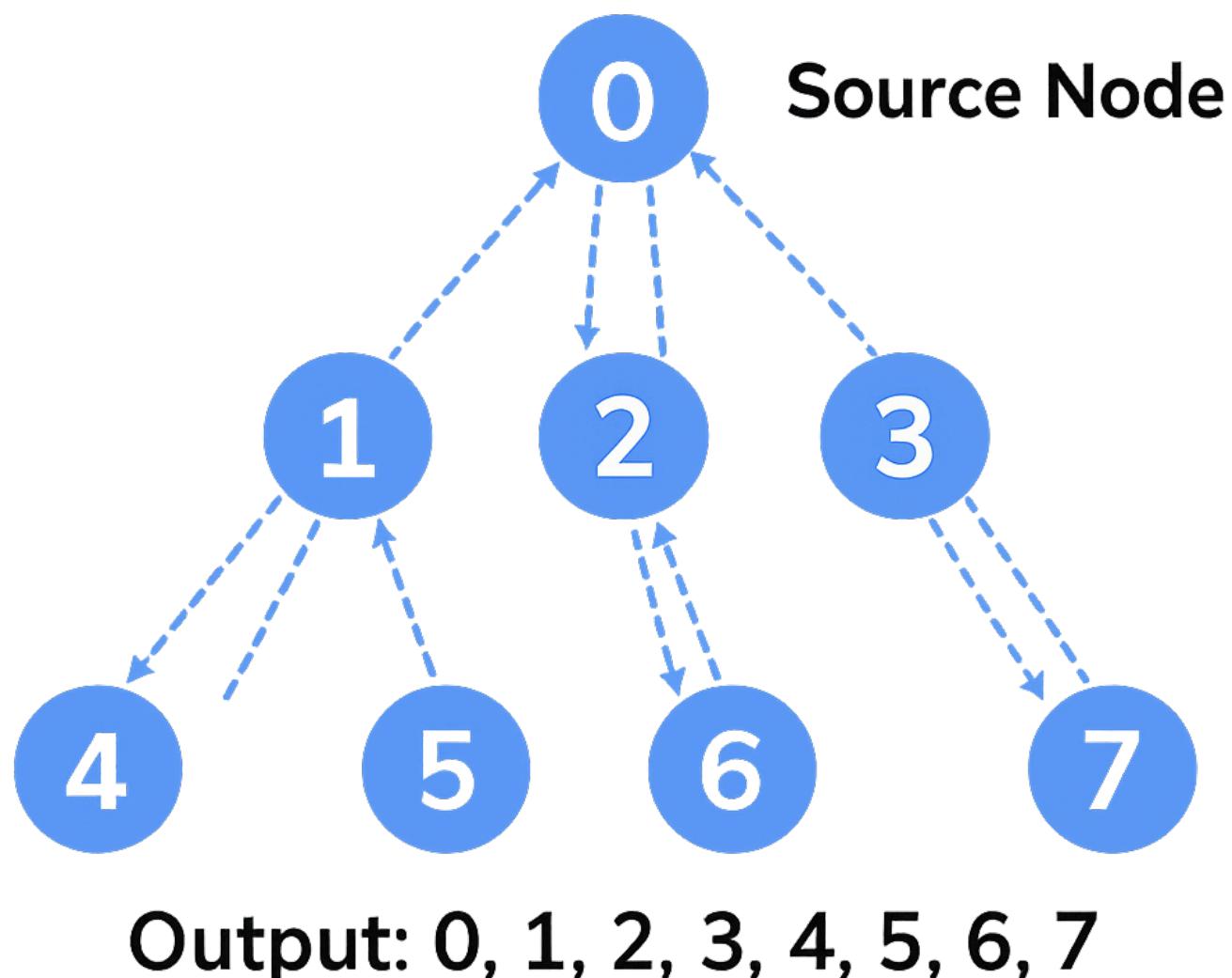
# 9. DEPTH FIRST SEARCH

**Usage :** This technique is used to solve problems involving traversing trees or graphs in a depth-first search manner.

**DS Involved :** Tree, Graph, Matrix

**Sample Problems :**

- Path With Given Sequence
- Count Paths for a Sum



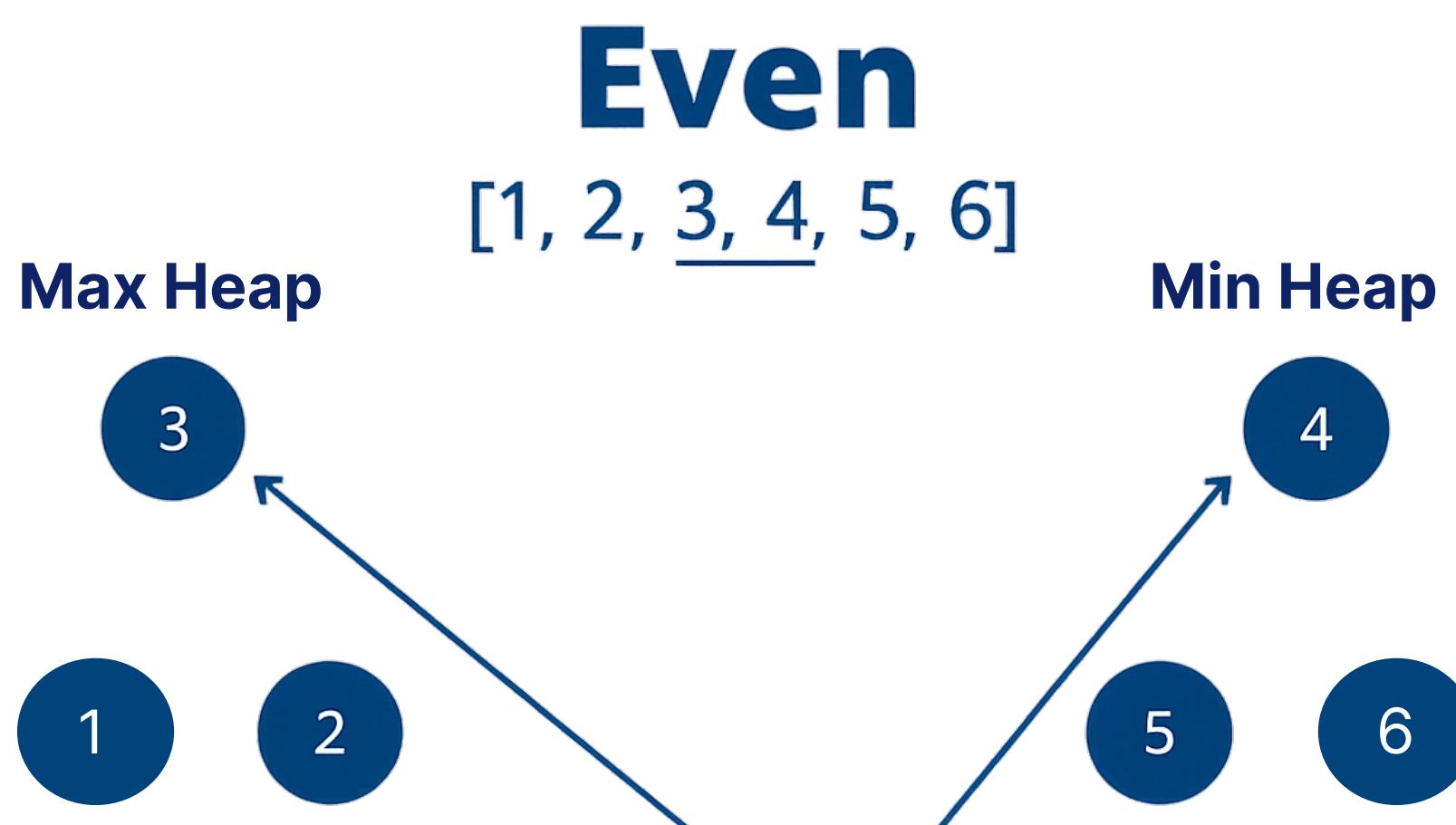
# 10. TWO HEAPS

**Usage :** In many problems, we are given a set of elements that can be divided into two parts. We are interested in knowing the smallest element in one part and the biggest element in the other part. As the name suggests, this technique uses a Min-Heap to find the smallest element and a Max-Heap to find the biggest element.

**DS Involved :** Heap, Array

**Sample Problems :**

- Find the Median of a Number Stream
- Next Interval



$$\begin{aligned}\text{Median} &= (\text{Top of Max Heap (3)} + \text{(4) Top of Min Heap}) / 2 \\ &= (3 + 4) / 2 \\ &= 3.5\end{aligned}$$

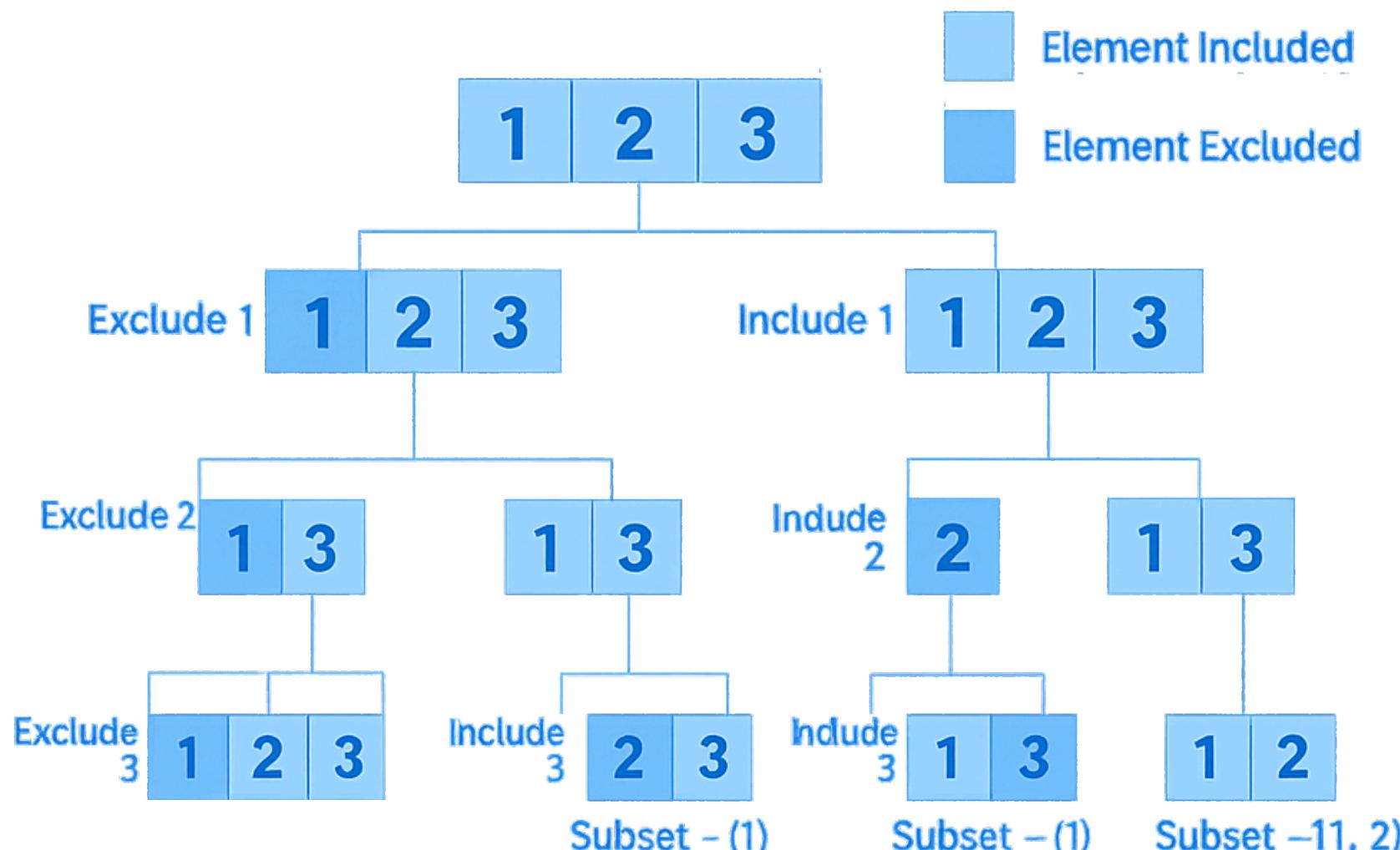
# 11. SUBSETS

**Usage :** Use this technique when the problem asks to deal with permutations or combinations of a set of elements.

**DS Involved :** Queue, Array, String

**Sample Problems :**

- String Permutations by changing case
- Unique Generalized Abbreviations



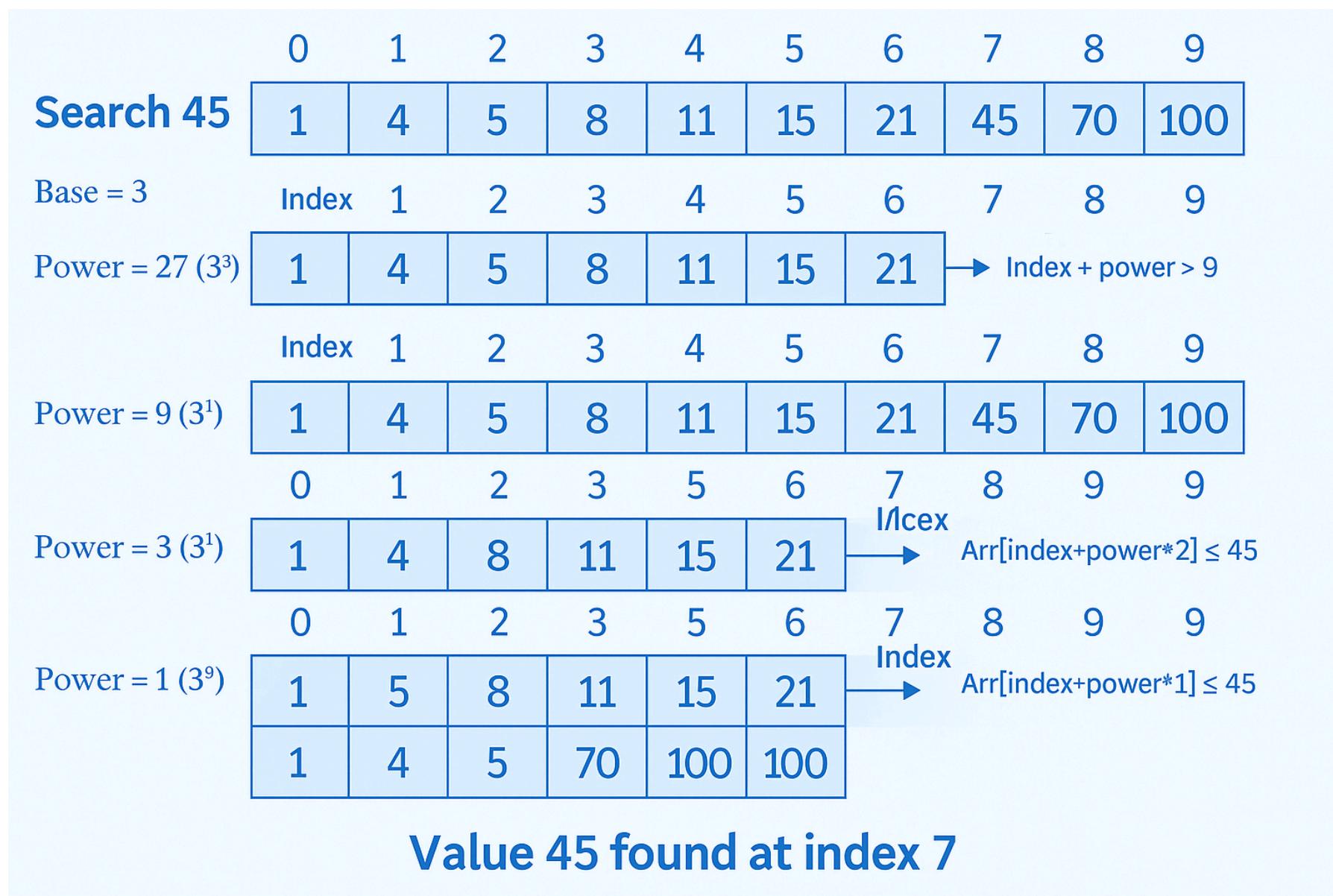
# 12. MODIFIED BINARY SEARCH

**Usage :** Use this technique to search a sorted set of elements efficiently.

**DS Involved :** Array

**Sample Problems :**

- Ceiling of a Number
- Bitonic Array Maximum



# 13. BITWISE XOR

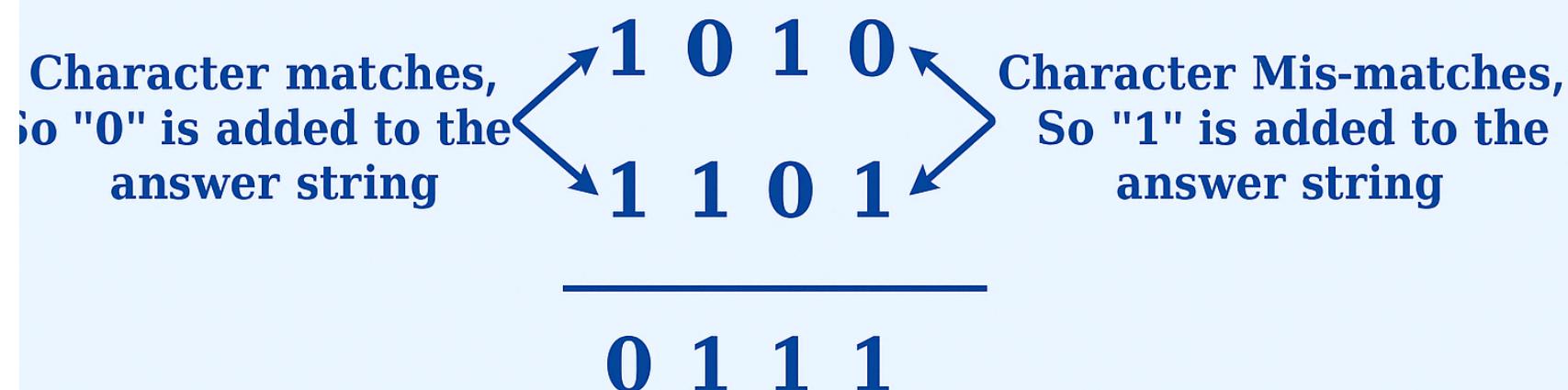
**Usage :** This technique uses the XOR operator to manipulate bits to solve problems.

**DS Involved :** Array, Bits

**Sample Problems :**

- Two Single Numbers
- Flip and Invert an Image

## XOR of two Binary Strings



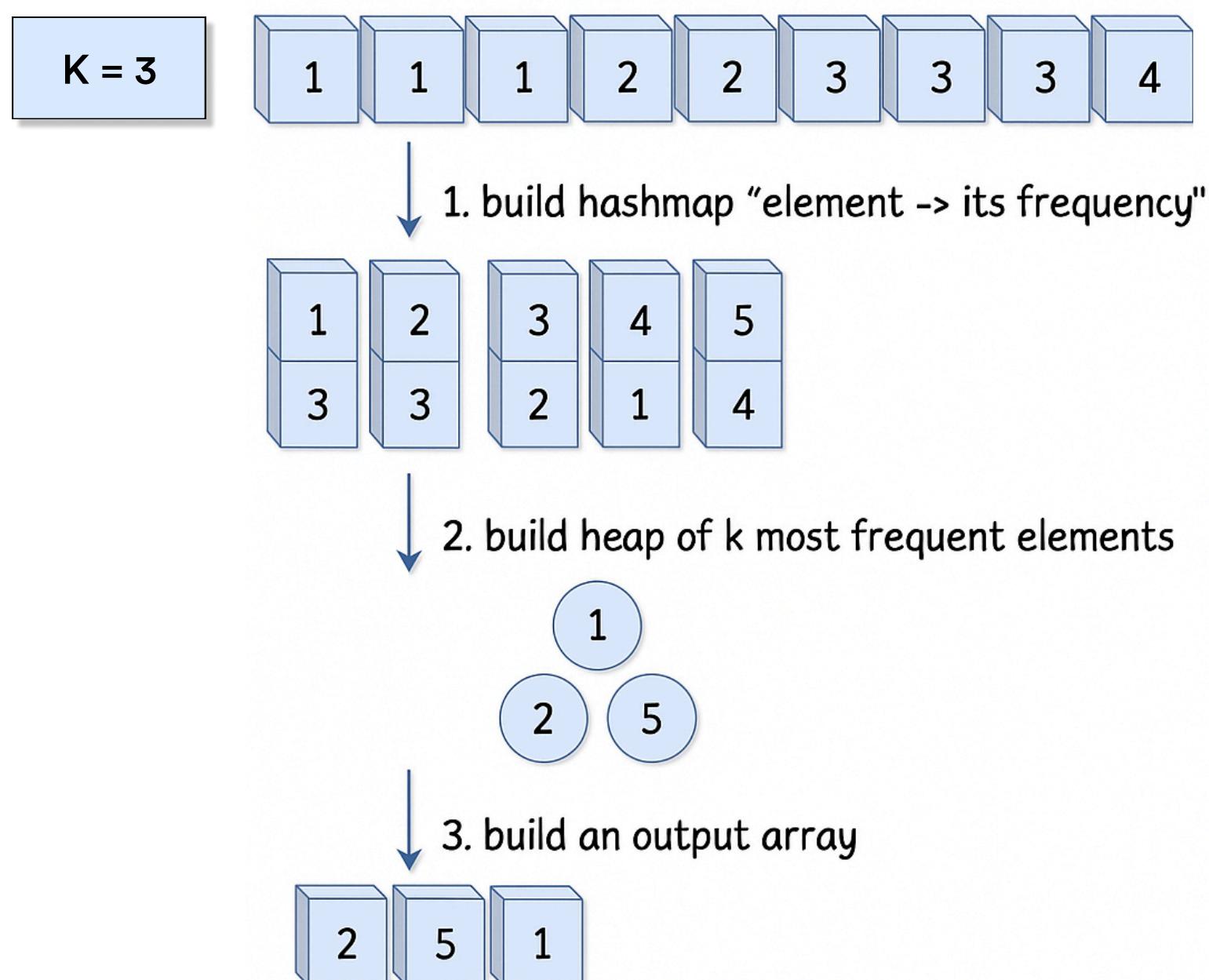
# 14. TOP ‘K’ ELEMENTS

**Usage :** This technique is used to find top/smallest/frequently occurring ‘K’ elements in a set.

**DS Involved :** Array, Heap, Queue

**Sample Problems :**

- ‘K’ Closest Points to the Origin
- Maximum Distinct Elements



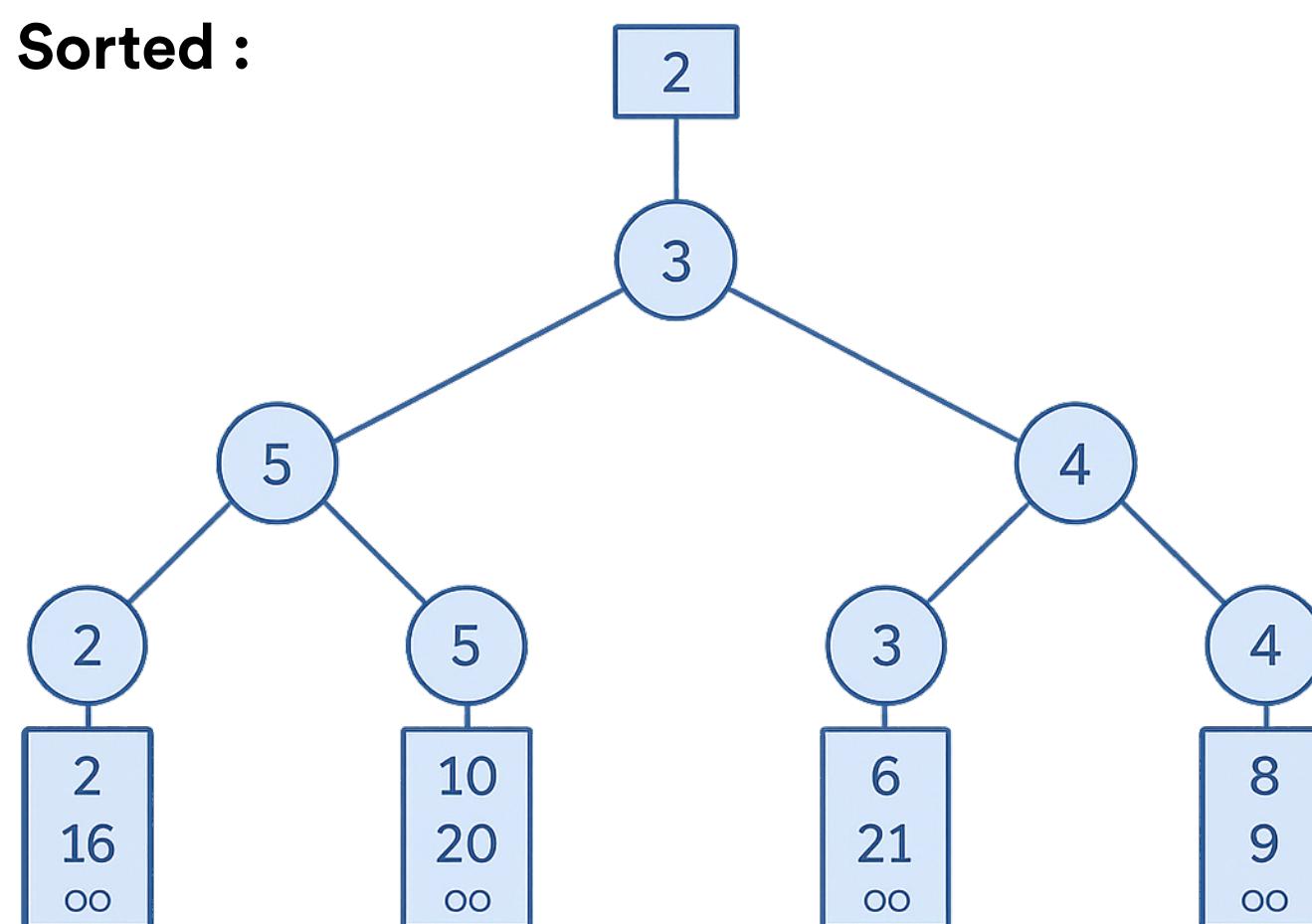
# 15. K-WAY MERGE

**Usage :** This technique helps us solve problems that involve a list of sorted arrays.

**DS Involved :** Array, Queue, Heap

**Sample Problems :**

- Kth Smallest Number in M Sorted Lists
- Kth Smallest Number in a Sorted Matrix



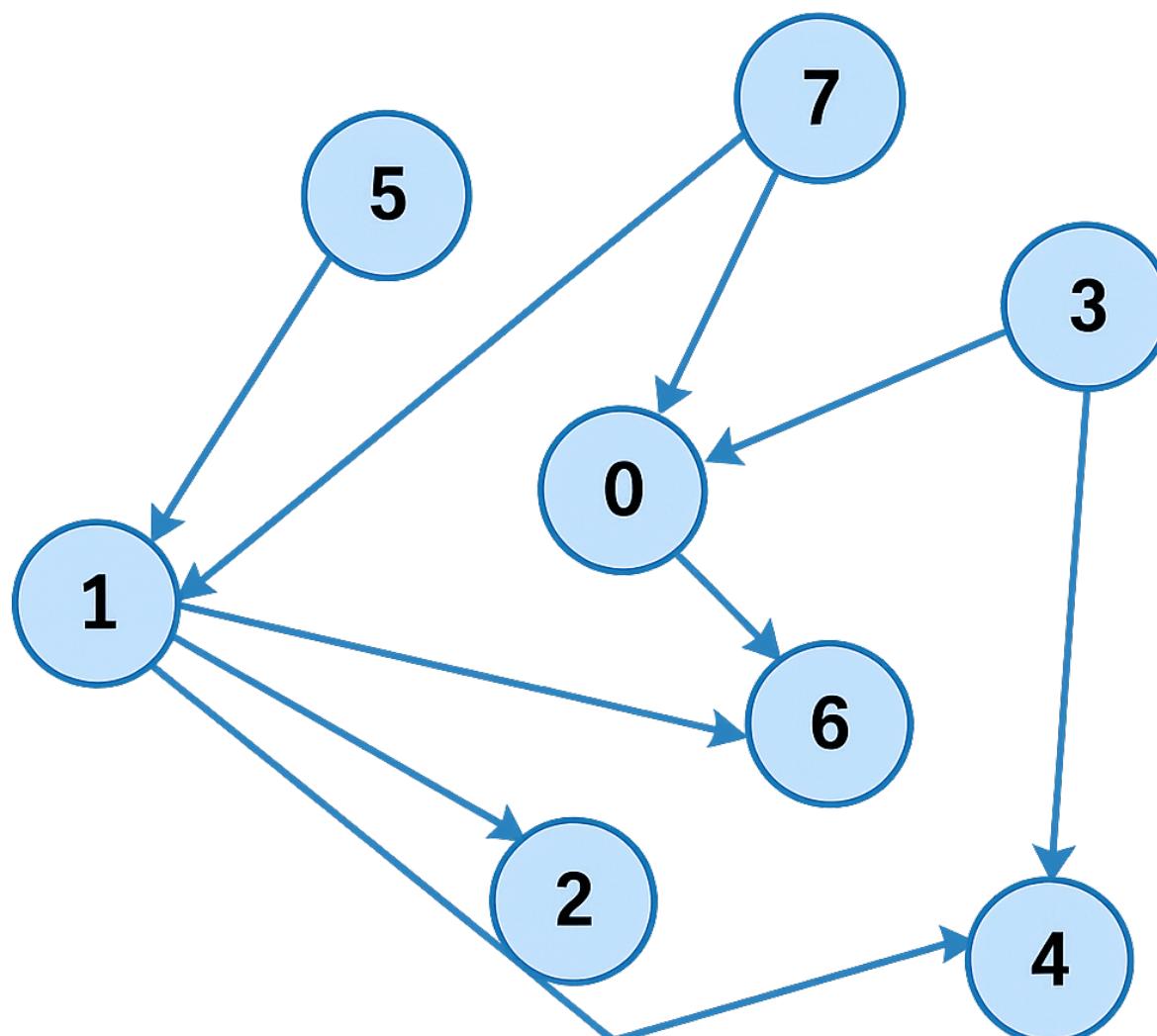
# 16. TOPOLOGICAL SORT

**Usage :** Use this technique to find a linear ordering of elements that have dependencies on each other.

**DS Involved :** Array, HashTable, Queue, Graph

**Sample Problems :**

- Tasks Scheduling
- Alien Dictionary



# 17. 0/1 KNAPSACK

**Usage :** This technique is used to solve optimization problems. Use this technique to select elements that give maximum profit from a given set with a limitation on capacity and that each element can only be picked once.

**DS Involved :** Array, HashTable

**Sample Problems :**

- Equal Subset Sum Partition
- Minimum Subset Sum Difference

		W	\$	0	0	0	4	5	6	7
		item 1: 3	50	0	0	0	0	0	0	0
		item 2: 2	40	1	0	40	0	5	50	50
		item 3: 4	70	2	0	0	0	50	90	90
		item 4: 5	80	3	0	0	0	50	90	110
		item 5: 1	10	4	0	0	0	50	90	110

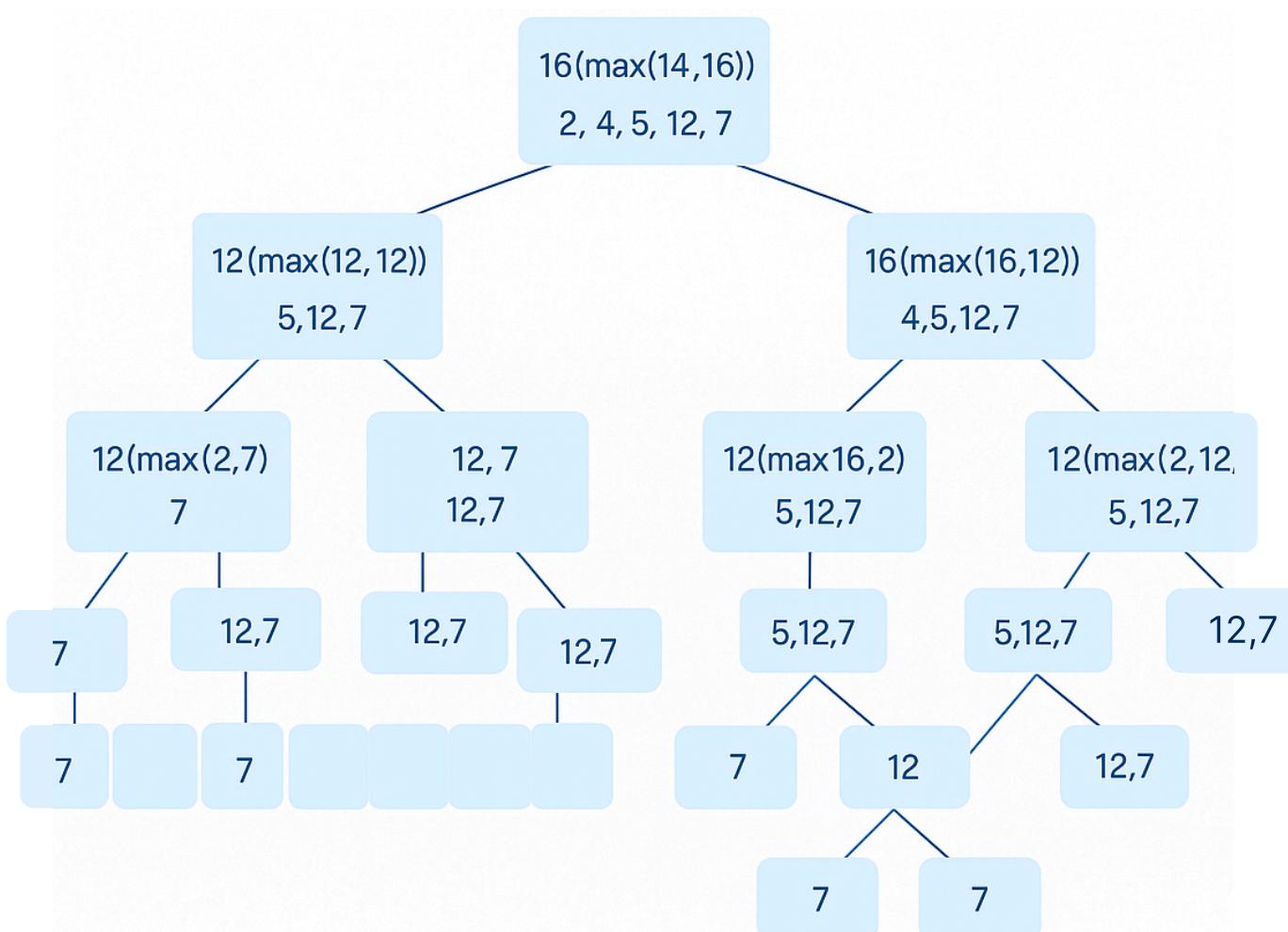
# 18. FIBONACCI NUMBERS

**Usage :** Use this technique to solve problems that follow the Fibonacci numbers sequence, i.e., every subsequent number is calculated from the last few numbers.

**DS Involved :** Array, Hash Table

**Sample Problems :**

- Staircase
- House Thief



# 19. PALINDROMIC SUBSEQUENCE

**Usage :** This technique is used to solve optimization problems related to palindromic sequences or strings.

**DS Involved :** Array, HashTable

**Sample Problems :**

- Longest Palindromic Subsequence
- Minimum Deletions in a String to make it a Palindrome

String: ABABBA

Size 2: AA, BB

Size 3: ABA, AAA, BBB,  
BAB

Size 4: ABBA

Size 5: ABBBA

*Palindromic  
Subsequence*

LPS

# 20. LONGEST COMMON SUBSTRING

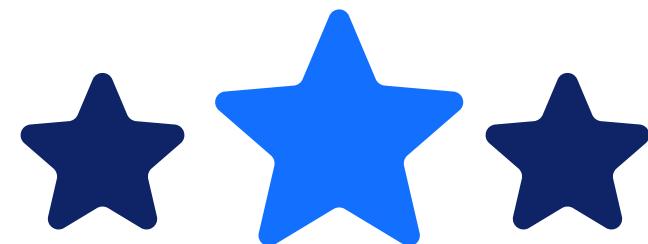
**Usage :** Use this technique to find the optimal part of a string/sequence or set of strings/sequences.

**DS Involved :** Array, HashTable

**Sample Problems :**

- Maximum Sum Increasing Subsequence
- Edit Distance

ABCXYZAY		XYZA		B				
A	0	0	0	0	0	0	0	0
X	0	0	0	0	1	0	0	0
Y	0	0	0	0	2	0	0	0
Z	0	0	0	0	3	0	0	4
B	0	0	0	0	4	0	0	0
C	0	0	0	0	5	0	0	0
B	0	0	0	0	0	0	0	0
String	A	B	C	C	X	Y	Z	Y



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