

The background is a light cream color, decorated with various colorful, hand-drawn style elements. In the top left, there's a pink circular shape with a grid pattern. To its right is a pink shape with four pink dots. Further right is a large light blue wavy shape. In the top right, there's a yellow circle with a star-like pattern. On the right side, there are orange and yellow leaf-like shapes and a pink flower with white dots. At the bottom right, there's a yellow wavy shape with a rainbow-like border. In the bottom left, there's a light blue shape with diagonal lines. In the center, the title 'Counting Sort' is written in a large, dark grey font. Below it, the text '~Ansh Gandhi' is written in a smaller, dark grey font. There are also several small orange and yellow decorative marks scattered around the text.

Counting Sort

~Ansh Gandhi

Way we gonna proceed

- 1) Belief-proof.
- 2) How to do Counting Sort – Method & Steps
- 3) Logic- why these steps?
- 4) Code for Counting Sort
- 5) Time Complexity

Special Characteristics

01

No Comparison

Here we don't compare numbers and sort them

02

Time Complexity

Time complexity is not only depend on input size but also on maximum element.

03

Input Restrictions

Works only for integers, no float , no negative numbers.

Method

Step 1



Make an empty (count) array of the size $\text{max}+1$ and initialize all values till 0

Step 3



Now modify the array such that each index stores the sum of previous counts

Step 2



Iterate over the unsorted array and store the count of each unique element.
If any element repeats itself, simply increase its count.

Step 4



Iterate through the unsorted array and the value-1 at index ($\text{index}=\text{element}$) in the count array will give you the position of the element in sorted array

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	0	1	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	0	1	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	1	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	1	0	0	0	0	0	0	2
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	1	0	0	0	0	1	0	2
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	1	0	0	1	0	1	0	2
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	1	0	1	1	0	1	0	2
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	1	1	1	1	0	1	0	2
---	---	---	---	---	---	---	---	---	---

0

1

2

3

4

5

6

7

8

9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	2	1	1	1	1	0	1	0	2
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

Example

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	2	1	1	1	1	1	1	0	2
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

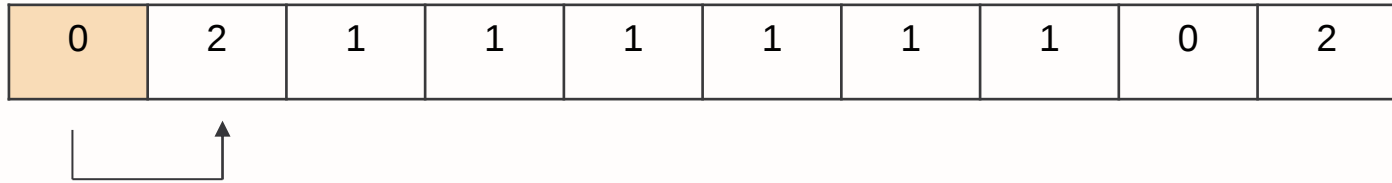
Step 3

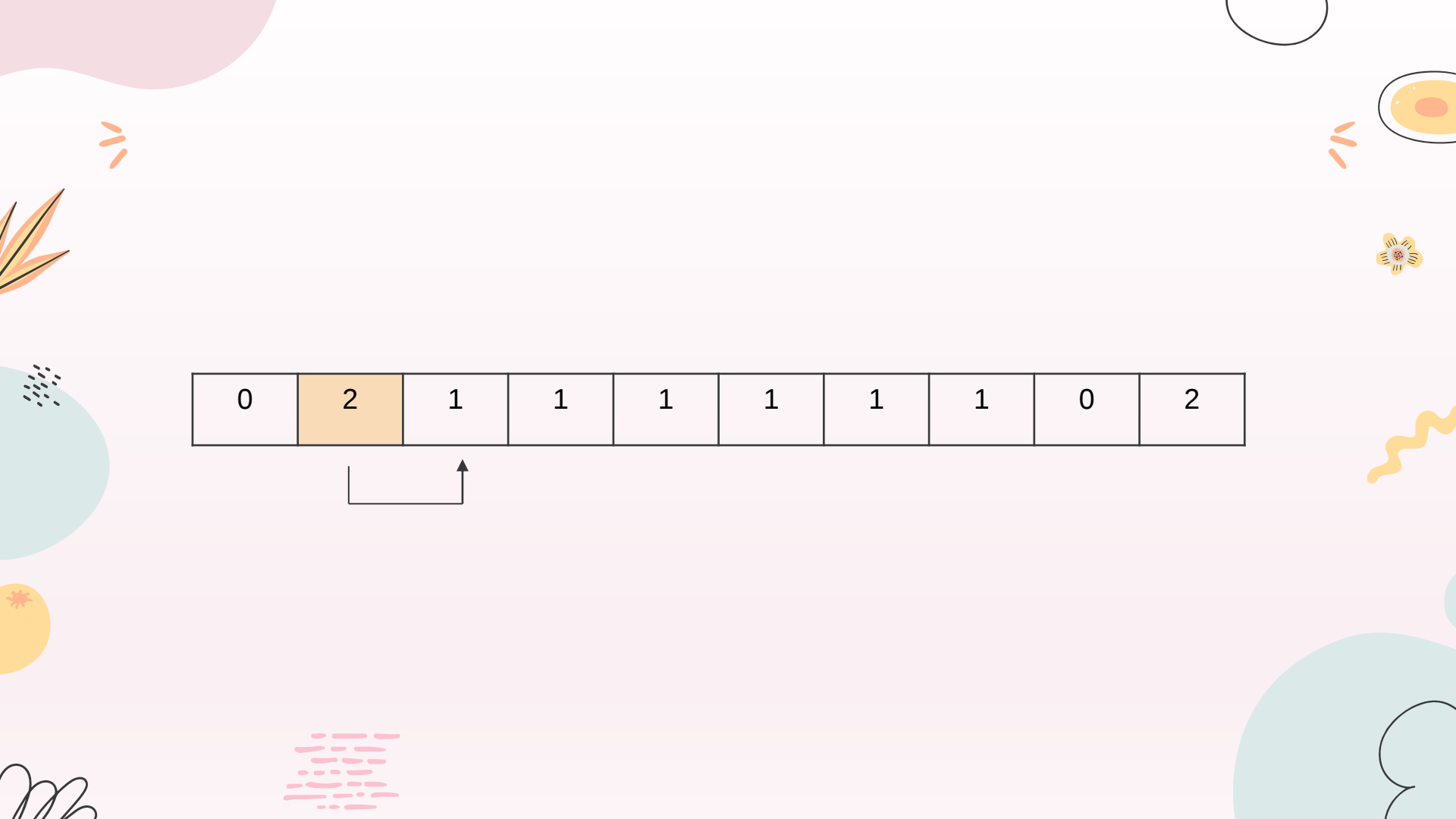
0	2	1	1	1	1	1	1	0	2
---	---	---	---	---	---	---	---	---	---



Trivial

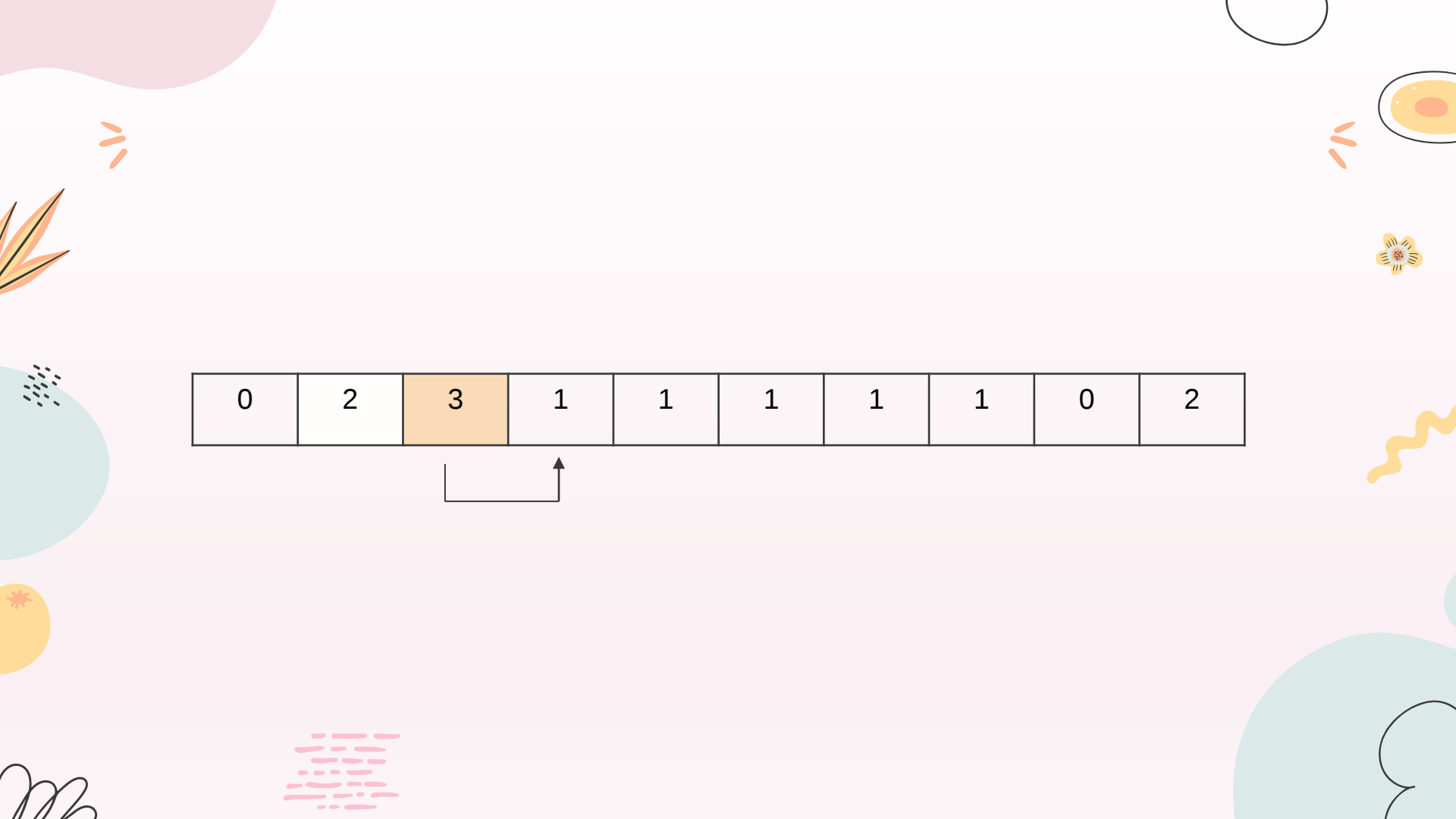
Step 3





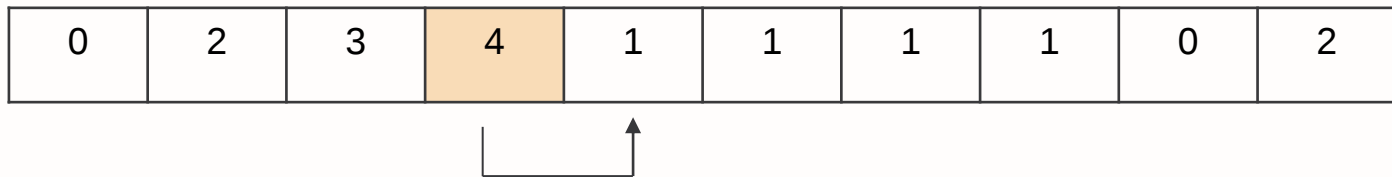
0	2	1	1	1	1	1	1	0	2
---	---	---	---	---	---	---	---	---	---

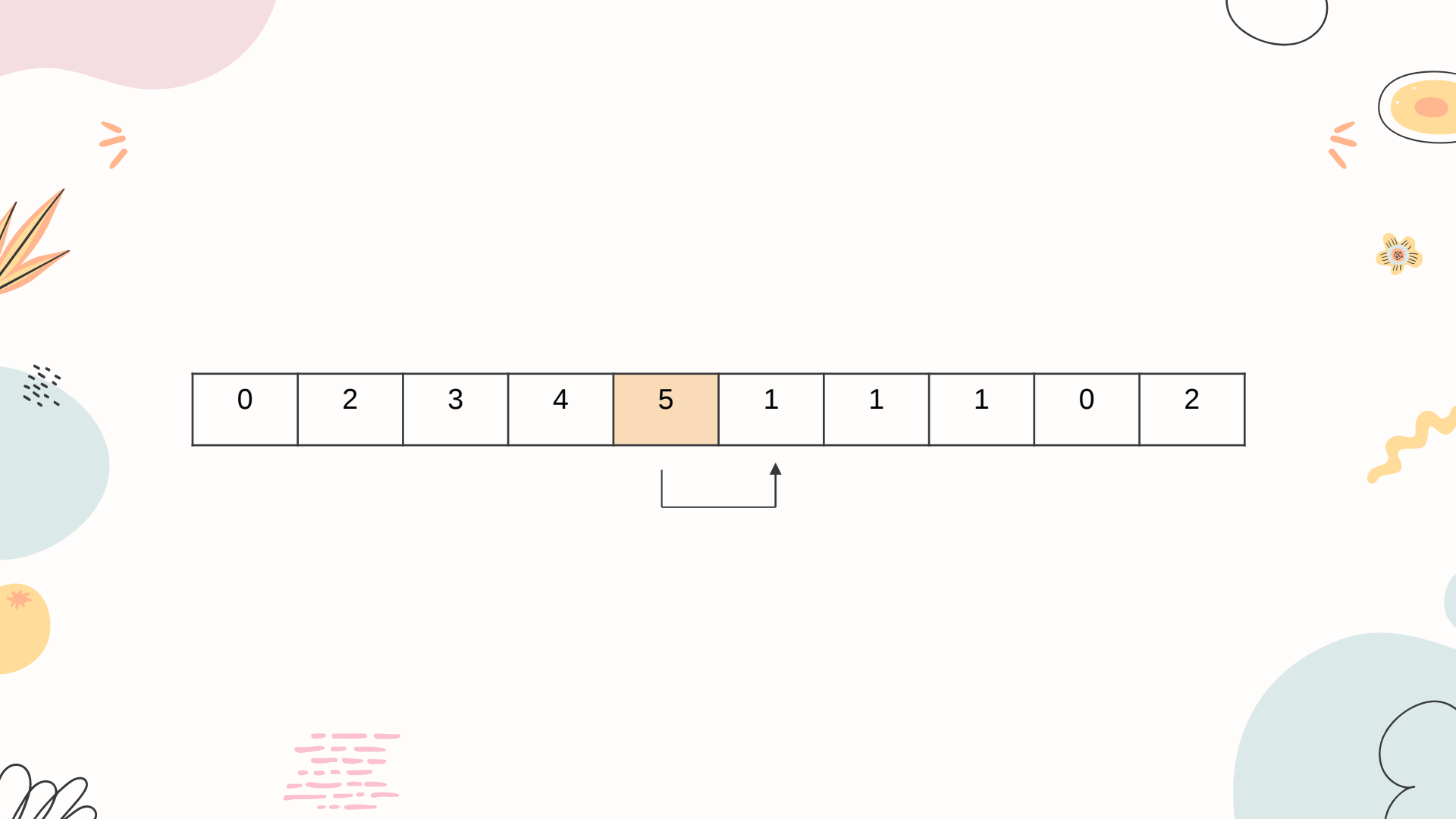




0	2	3	1	1	1	1	1	0	2
---	---	---	---	---	---	---	---	---	---

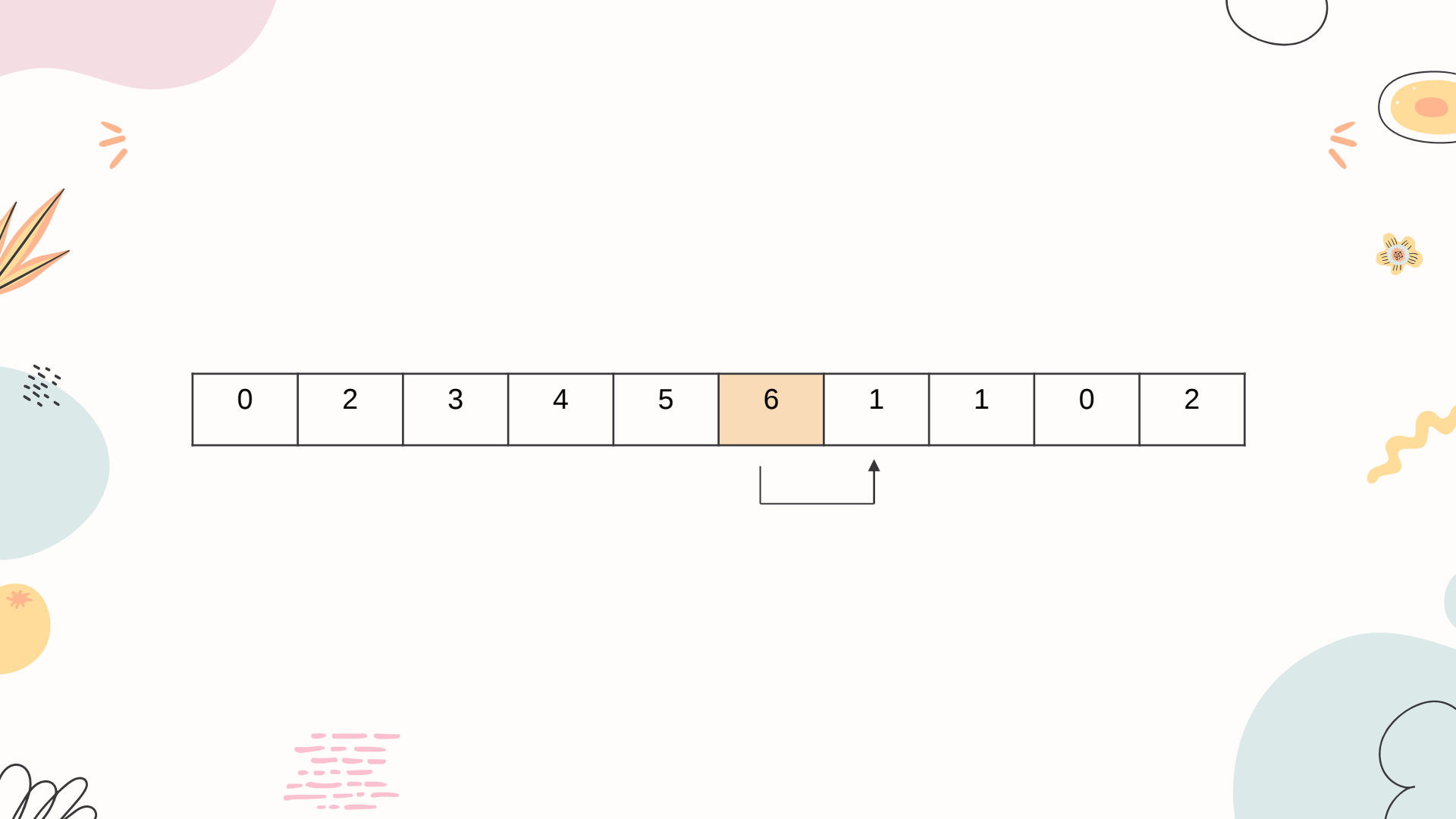






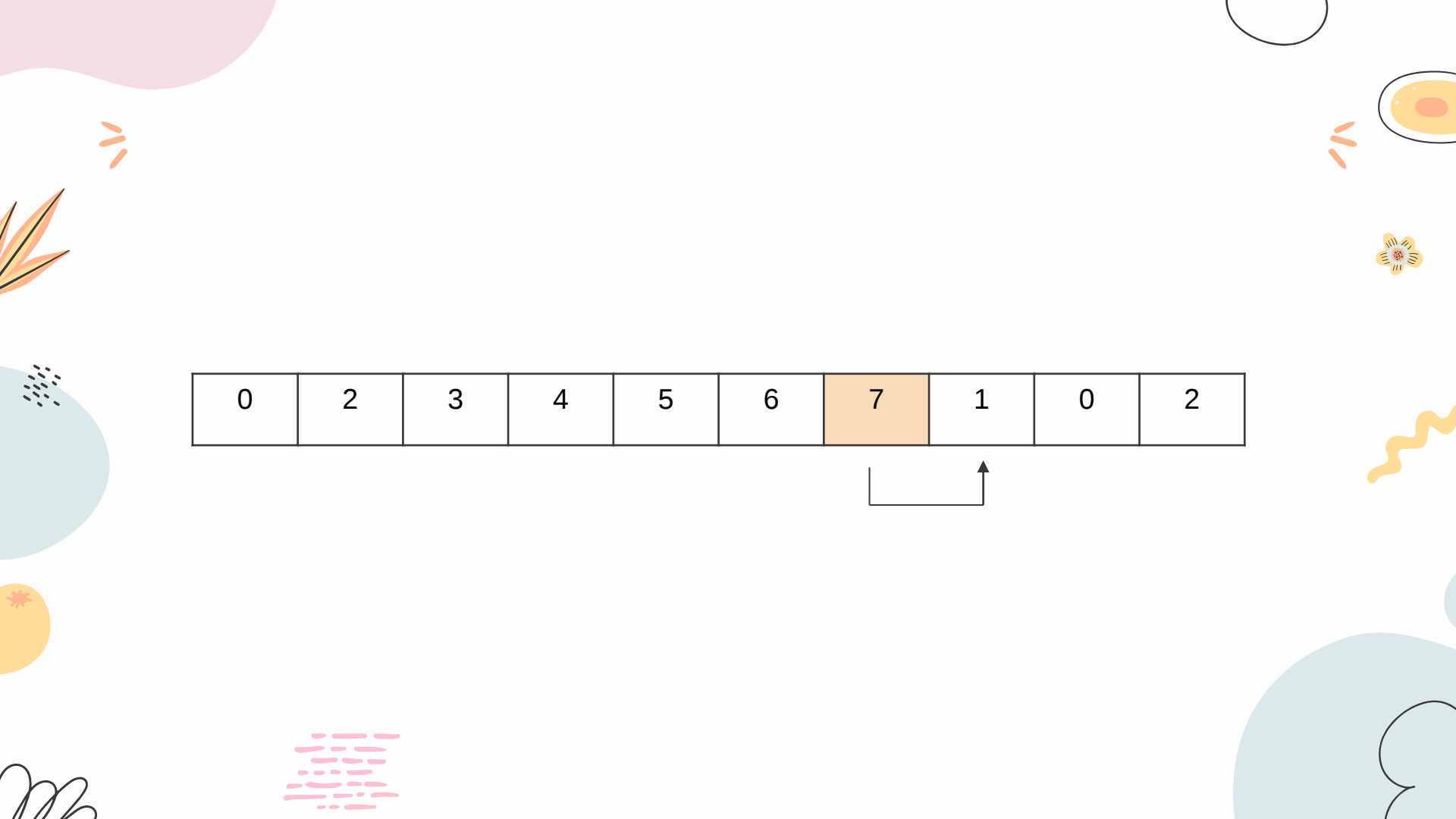
0	2	3	4	5	1	1	1	0	2
---	---	---	---	---	---	---	---	---	---





0	2	3	4	5	6	1	1	0	2
---	---	---	---	---	---	---	---	---	---





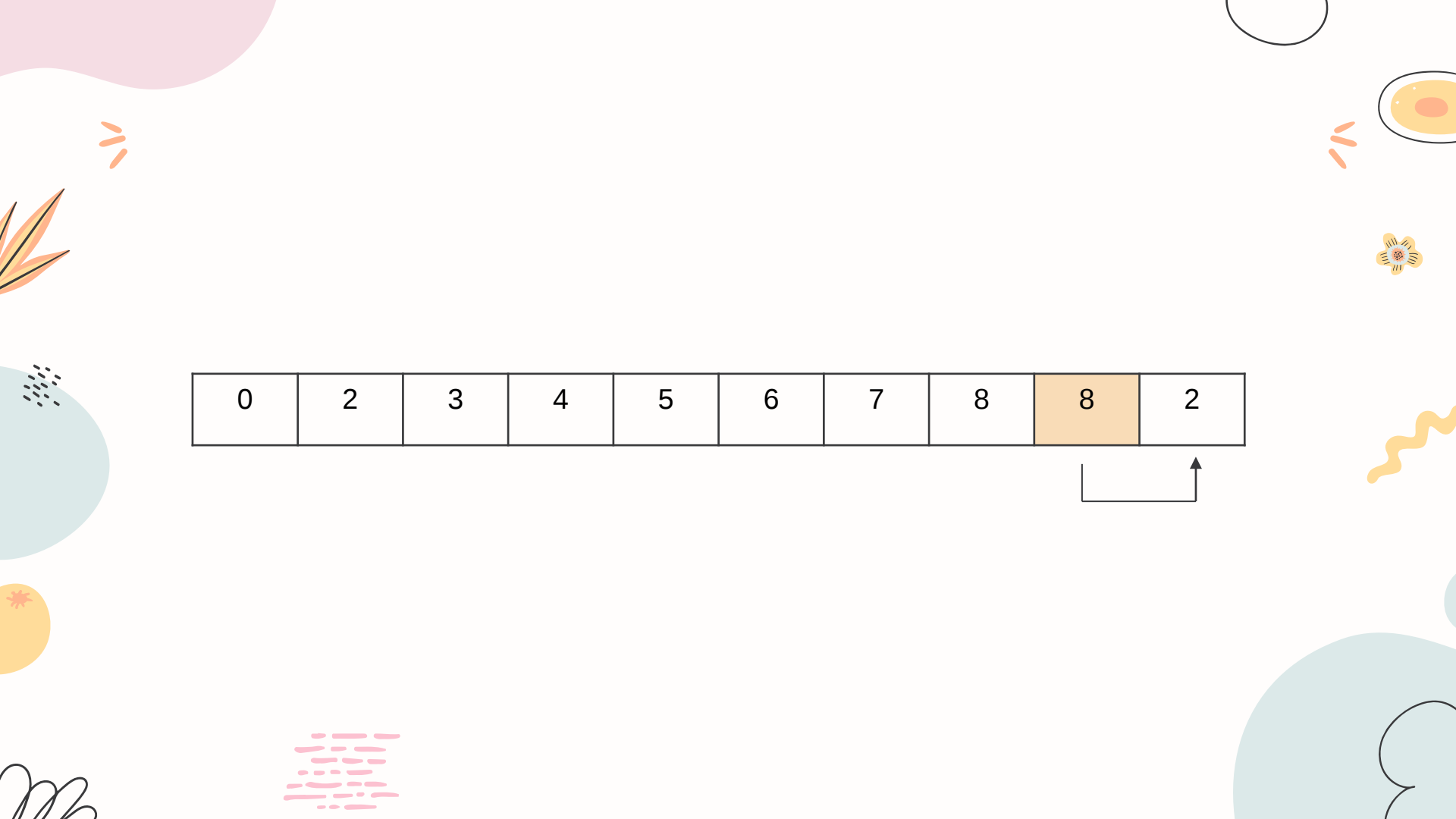
A decorative background featuring various colorful shapes and patterns. In the top left, there is a pink wavy shape. To its right, a white circle is partially visible. Below the pink shape are several orange leaf-like shapes. On the right side, there is a yellow flower, a yellow wavy line, and a yellow circle with a red center. At the bottom left, there is a yellow circle with a red star. In the bottom center, there are several pink horizontal lines. At the bottom right, there is a large light blue shape with a white outline.

0	2	3	4	5	6	7	1	0	2
---	---	---	---	---	---	---	---	---	---



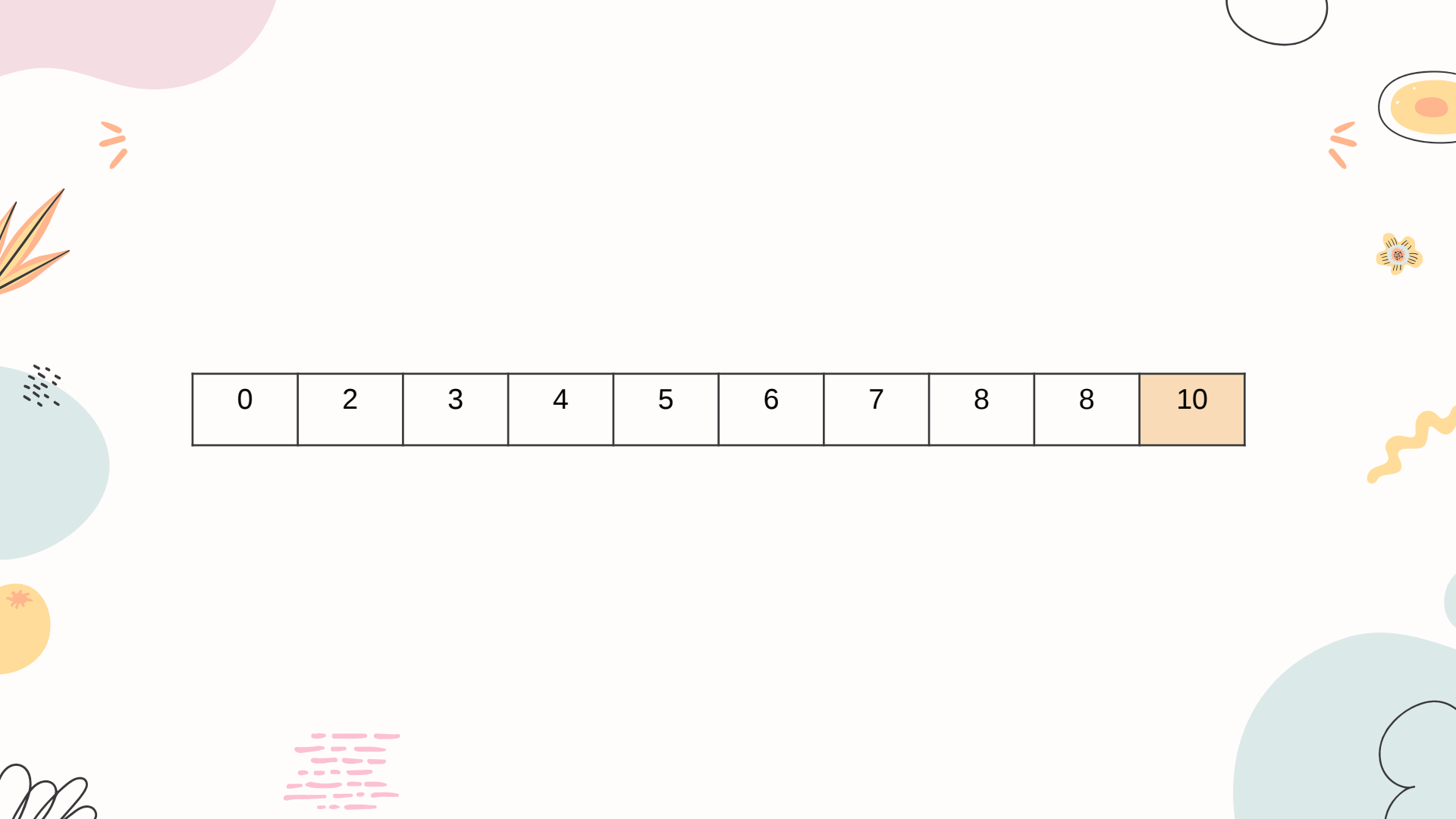
0	2	3	4	5	6	7	8	0	2
---	---	---	---	---	---	---	---	---	---





0	2	3	4	5	6	7	8	8	2
---	---	---	---	---	---	---	---	---	---

A diagram showing an array of 10 elements. The 9th element (index 8) is highlighted in orange. A bracket and an arrow point from the 9th element to the 10th element (index 9), indicating a swap operation.



0	2	3	4	5	6	7	8	8	10
---	---	---	---	---	---	---	---	---	----

Step 4

New empty array

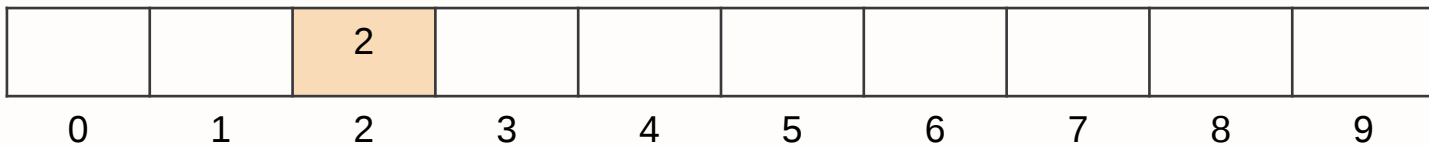
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

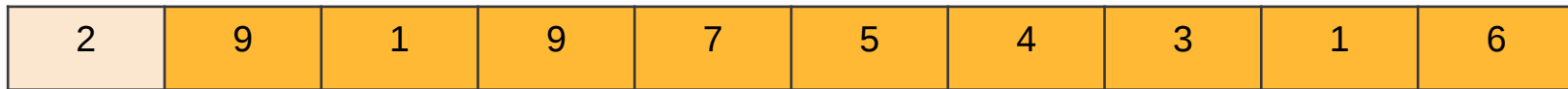
0	2	3	4	5	6	7	8	8	10
0	1	2	3	4	5	6	7	8	9

Step 4

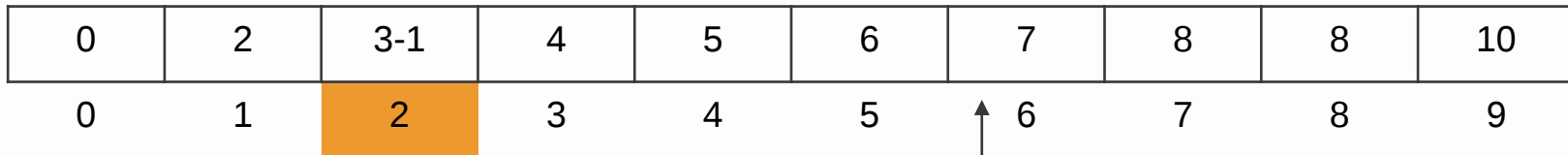
New empty array



		2							
0	1	2	3	4	5	6	7	8	9



2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---



0	2	3-1	4	5	6	7	8	8	10
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

		2							9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	2	2	4	5	6	7	8	8	10-1
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

	1	2							9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	2-1	2	4	5	6	7	8	8	9
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

	1	2						9	9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	2	4	5	6	7	8	8	9-1
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

	1	2					7	9	9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	2	4	5	6	7	8-1	8	8
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

	1	2			5		7	9	9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	2	4	5	6-1	7	7	8	9-1
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

	1	2		4	5		7	9	9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	2	4	5-1	5	7	8	8	9-1
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

	1	2	3	4	5		7	9	9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1	2	4-1	4	6	7	8	8	9-1
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

1	1	2	3	4	5		7	9	9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	1-1	2	3	5	6	7	8	8	9-1
0	1	2	3	4	5	6	7	8	9

Count array

Step 4

New empty array

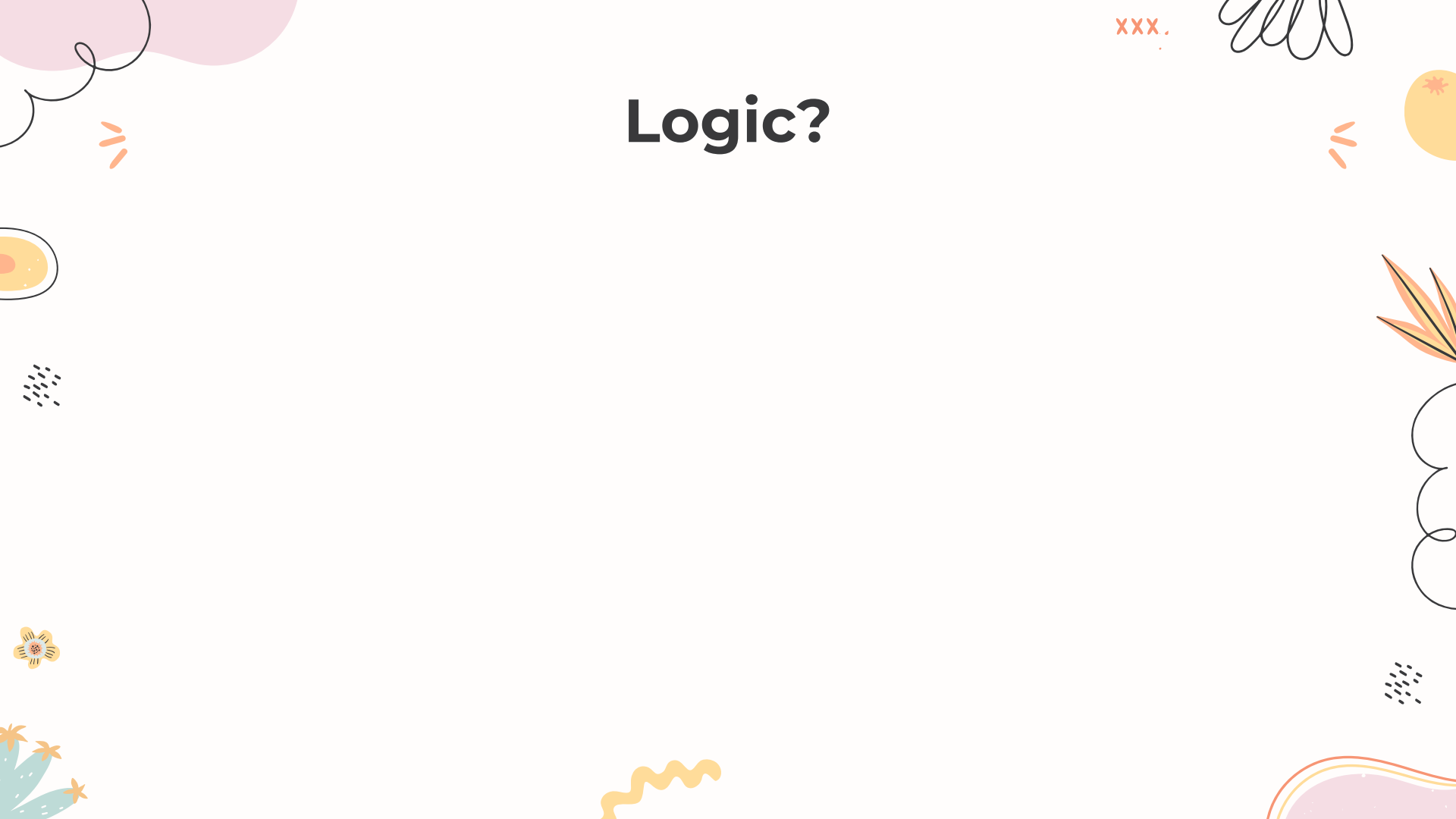
1	1	2	3	4	5	6	7	9	9
0	1	2	3	4	5	6	7	8	9

2	9	1	9	7	5	4	3	1	6
---	---	---	---	---	---	---	---	---	---

0	0	2	4	5	6	7-1	8	8	9-1
0	1	2	3	4	5	6	7	8	9

Count array

Logic?





Code?→Less go to VS CODE!

Time Complexity

- Time complexity depends on input size as well as the maximum element.
- Why it depends on maximum element?
- When can the effect of maximum element be ignored
- $O(n+k)$



Thankyou :)