



# Merge Sort & Inversion Count



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# Ques: Merge 2 Sorted Arrays

a

10	20	60	80	90	120
----	----	----	----	----	-----

i

b

30	40	50	70	100	110	130	140
----	----	----	----	-----	-----	-----	-----

j

c

10	20	30	40	50	60	70	80	90	100	110	120	130	140
----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----

k

# Merge Sort using Magic

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

5	2	8	4
---	---	---	---

1	6	7	3
---	---	---	---

↓ magic

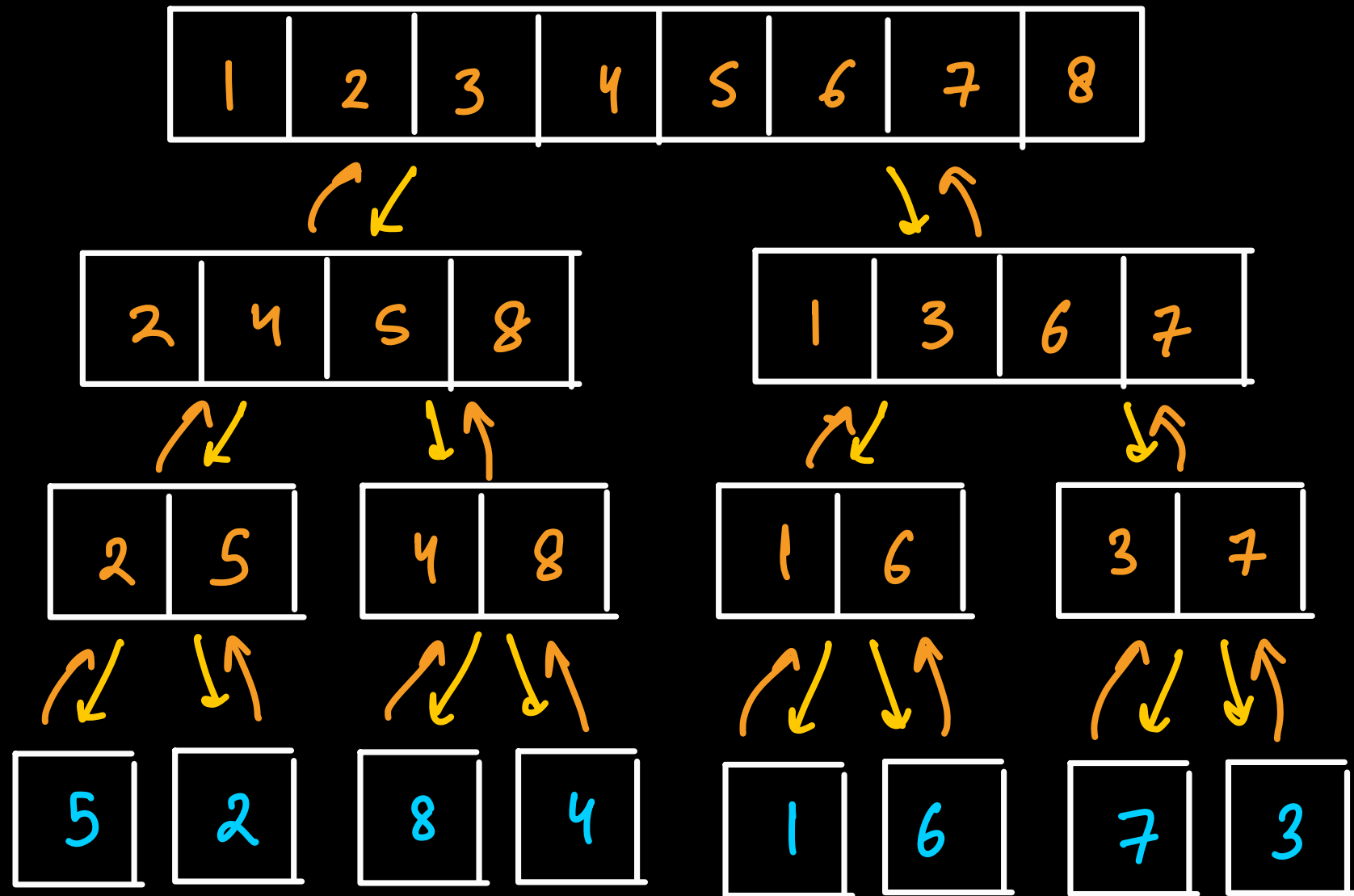
↓ magic

2	4	5	8
---	---	---	---

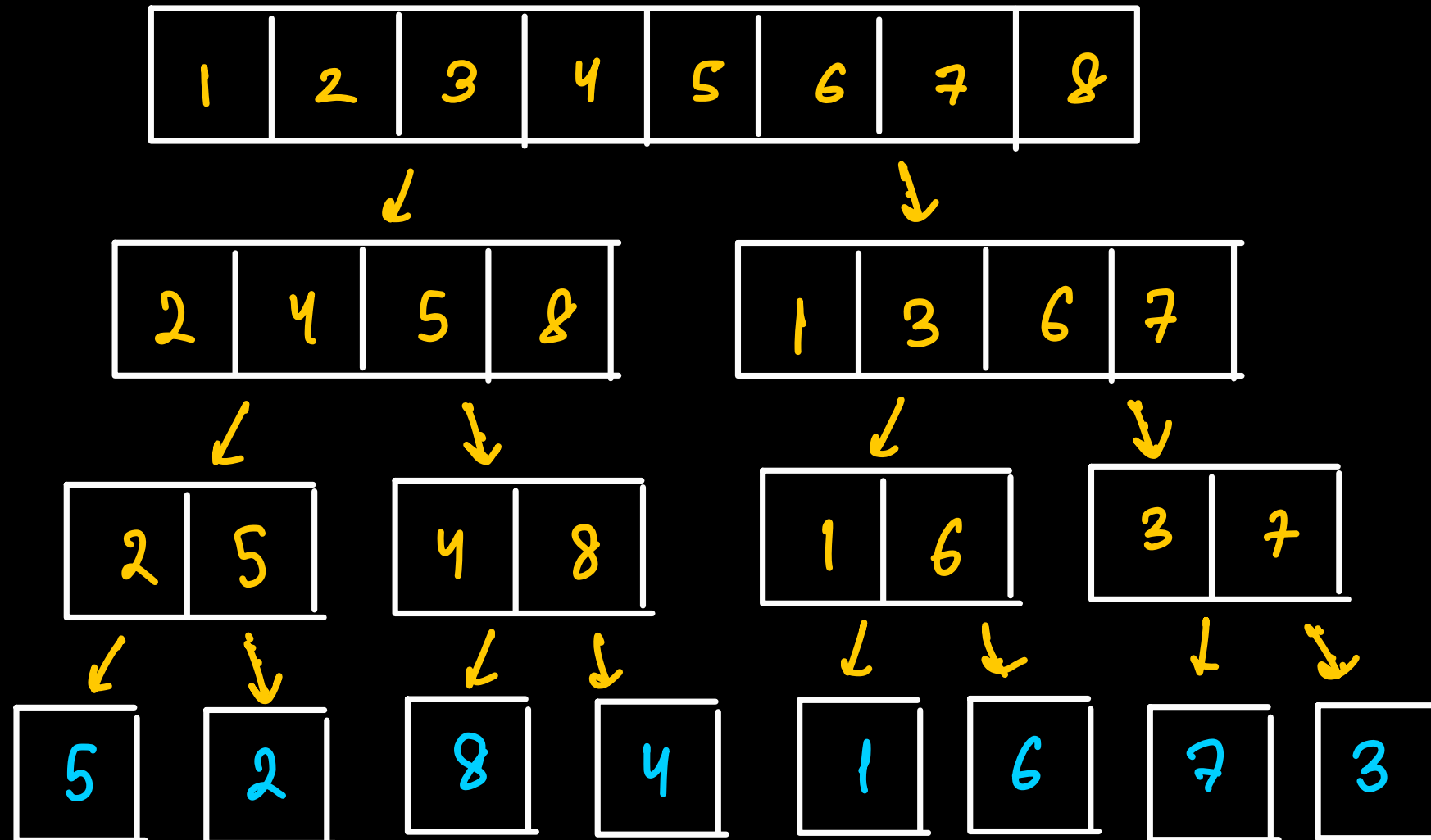
1	3	6	7
---	---	---	---

↘ merge ↙

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

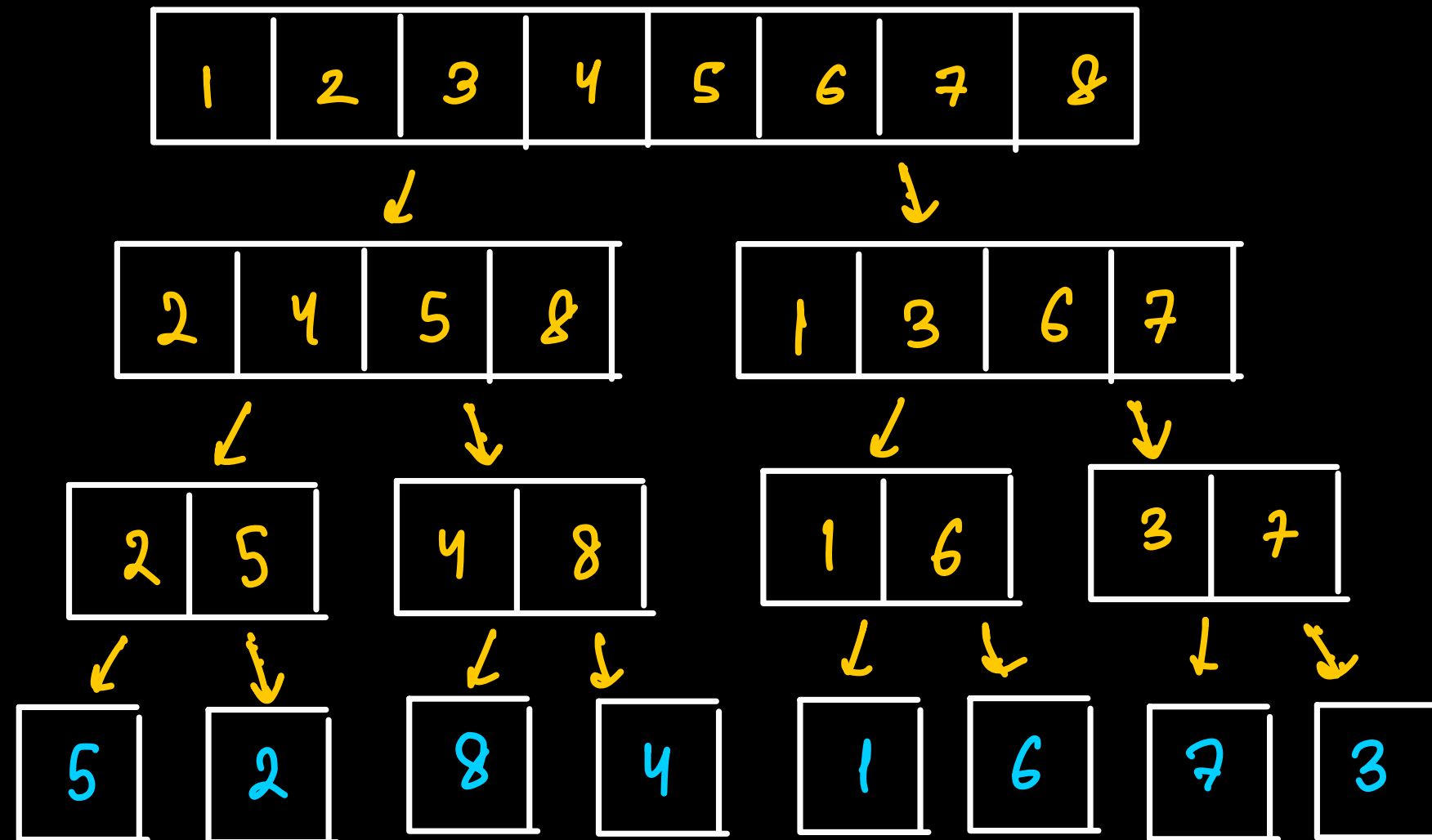


# Merge Sort (Complete Recursion Calls)



# Time & Space Analysis

$$\log_2 n = 3$$



$n$

$$\frac{n}{2} + \frac{n}{2} = n$$

$$\frac{n}{4} + \frac{n}{4} + \frac{n}{4} + \frac{n}{4} = n$$

$$T.C. = O(n \cdot \log n)$$
$$A.S. = O(n \log n) / O(n)$$

# Ques: Inversions Count

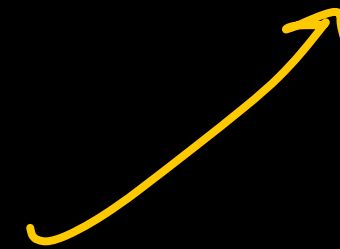
$$a = \{ 2 \quad 3 \quad 5 \} \quad b = \{ 1 \quad 2 \quad 4 \}$$

$i \qquad j$

$$\text{count} = 3 + 2 + 1 = 6$$

$$a[i] > b[j]$$

$$\text{count} += (a.\text{length} - i)$$







# Ques: Inversions Count

Count

0 1 2 3 4 5 6 7 8 9 10 11 12  
13 14

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

↗ ↘

2	4	5	8
---	---	---	---

↙ ↗

1	3	6	7
---	---	---	---

↗ ↘

2	5
---	---

↘ ↗

4	8
---	---

↗ ↘

1	6
---	---

↙ ↗

3	7
---	---

↗ ↘

5	2
---	---

↗ ↘

8	4
---	---

↗ ↘

1	6
---	---

↗ ↘

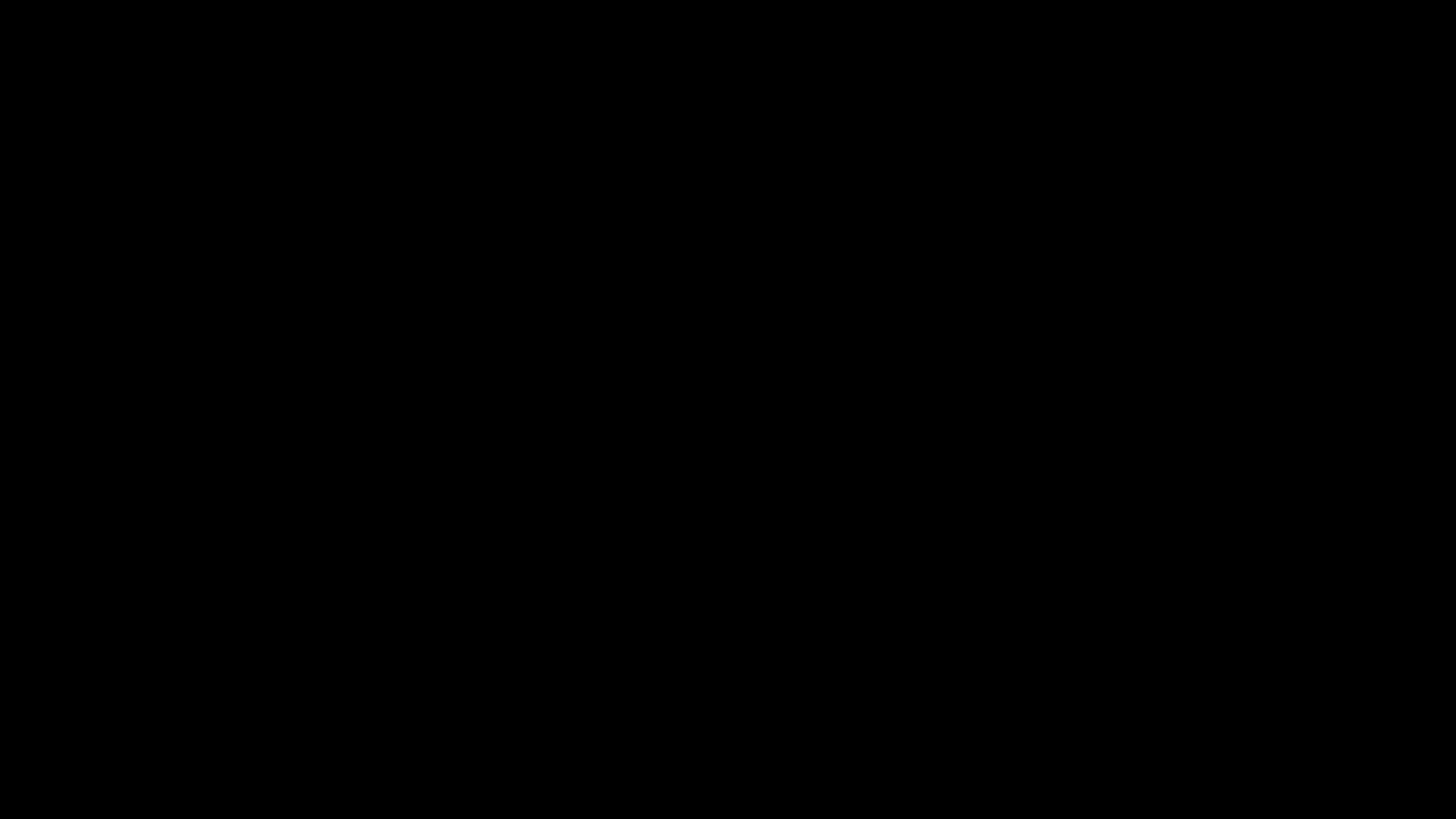
7	3
---	---

inversions  
= 14



# **Ques:** Reverse Pairs

**Leetcode 493**





THANKYOU  
*Cuties*