

Week 2 LIVE

# Basic Array Problems and Sorting Algorithms

# In This Lecture

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- 3.Q: Place the Number in the Sorted position in an Array ✓
4. Bubble Sort
5. Selection Sort
6. Insertion Sort

# Swap two Numbers in an Array

`int a[] = { 1, 3, 5, 2, 4 }`

→ `i & j`

`int temp = a[i];`  
`a[i] = a[j];`  
`a[j] = temp;`

`int a = 5;`

`int b = 2;`

`temp = a;`

`a = b;`

`b = temp;`

`a = a ^ b`  
`b = a ^ b`  
`a = a ^ b`

# Find the Smallest Number in an Array



`int min = Integer.MAX_VALUE; →  $2^{32} \times 10^9$`

`for (int i = 0; i < a.length; i++) {`

`if (a[i] < min) {`

`min = a[i];`

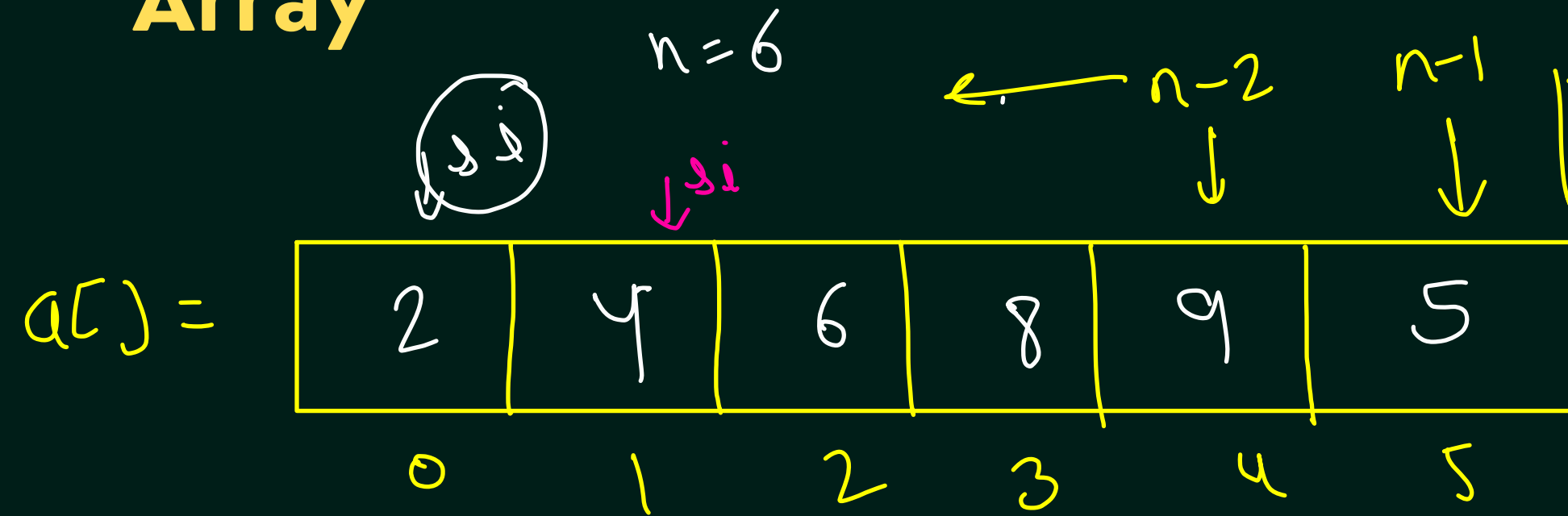
`}`

`}`

`return min;`

`min = 1`

# Place the Last Number in the Sorted position in an Array



```
static void lastNumberInSortedPosition(int a[]) {
    int n = a.length;
    int last = a[n-1];
    int swapIndex = n-2;

    while(swapIndex >= 0 && a[swapIndex] > last) {
        swapIndex--;
    }
}
```

$swapIndex = 0;$

Handwritten code for shifting elements:

```

    for (int i = n-1; i > 1; i--) {
        a[i] = a[i-1];
    }
    a[1] = last;

```

Annotations:

- $n-1$  points to the first element (2)
- $a[i] = a[i-1];$
- $si + 2$  points to index 1
- Swapped elements are marked with checkmarks:
  - $a[5] = a[4];$
  - $a[4] = a[3];$
  - $a[3] = a[2];$
  - $a[2] = a[1];$
  - $a[1] = last;$

$swapIndex + 2$

# Bubble Sort

$n = 6$

int a[] =

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 4 | 1 | 8 | 2 | 3 | 7 |
|---|---|---|---|---|---|

outer loop  $\rightarrow (n-1)$

inner loop

$0 \rightarrow (n-i-1)$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 4 | 2 | 3 | 7 | 8 |
|---|---|---|---|---|---|

1st iteration

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 7 | 8 |
|---|---|---|---|---|---|

2nd iteration

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 7 | 8 |
|---|---|---|---|---|---|

$(n-1)$  iteration

# Bubble Sort

④

<sup>0</sup><sub>j</sub>  
<sup>1</sup>  
<sup>2</sup>  
<sup>3</sup>  
<sup>4</sup>  
 $n=5$   
 $[9, 5, 4, 2, 3]$

$O(N^2)$

$i=0$   $[5, 4, 2, 3, 9]$  4

$i=1$   $[4, 2, 3, 5, 9]$  3

$i=2$   $[2, 3, 4, 5, 9]$  2

↓  
 $i=3$   $[2, 3, 4, 5, 9]$  1

# Selection Sort

$i=0$

$n=6$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 4 | 1 | 8 | 2 | 3 | 7 |
|---|---|---|---|---|---|

sorted      unsorted

$i=0$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 4 | 8 | 2 | 3 | 7 |
|---|---|---|---|---|---|

0 1 2 3 4 5

$i=1$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 2 | 8 | 4 | 3 | 7 |
|---|---|---|---|---|---|

$i=2$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 8 | 7 |
|---|---|---|---|---|---|

$i=3$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 |
| 1 | 2 | 3 | 4 | 8 | 7 |

$i=4$

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 7 | 8 |
|---|---|---|---|---|---|

$[i=0 \rightarrow 4]$



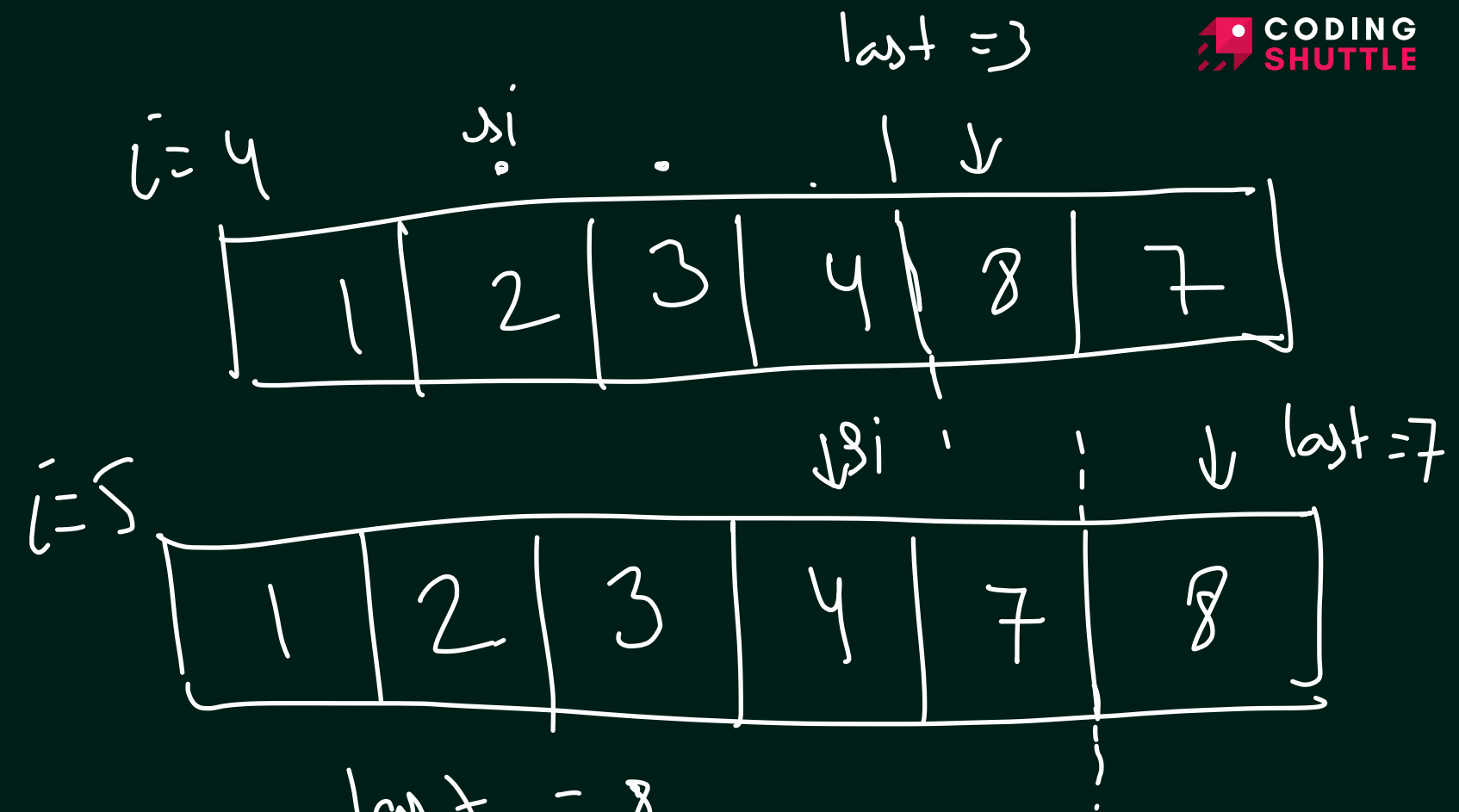
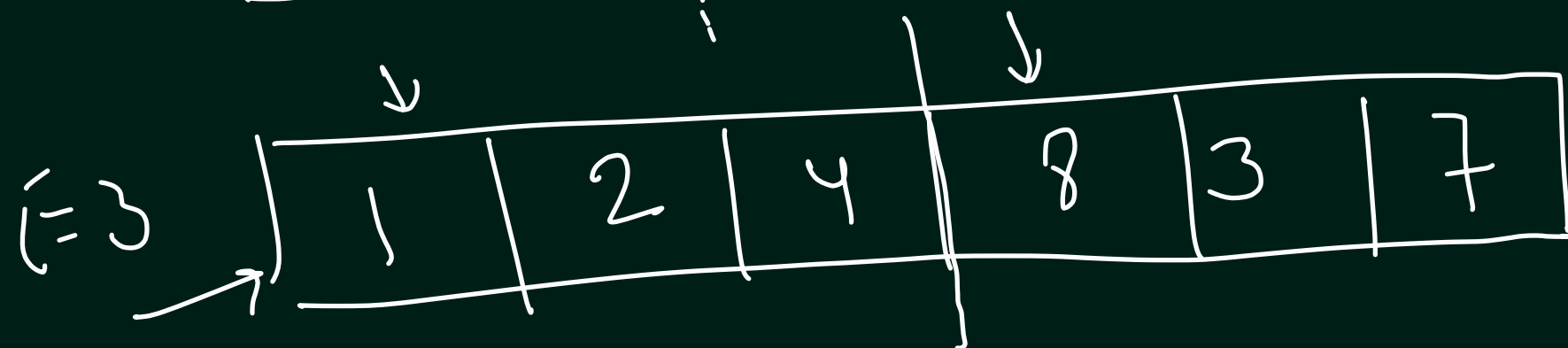
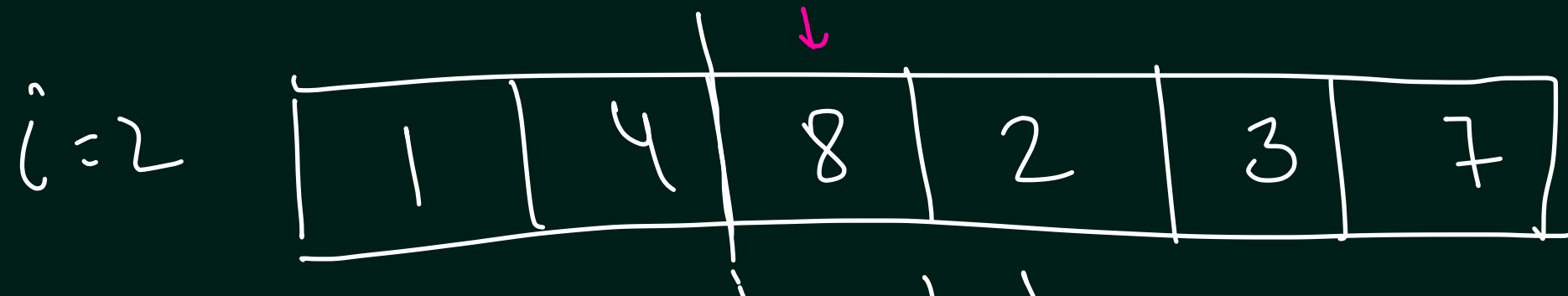
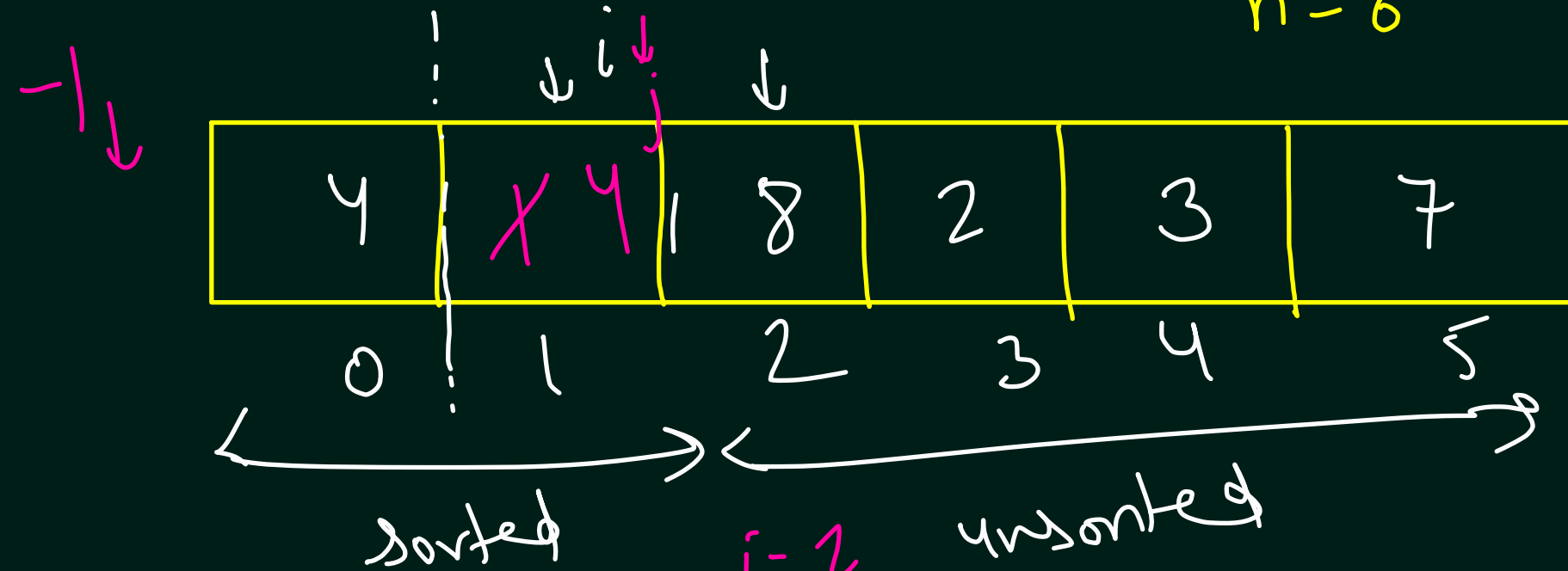
# Selection Sort

# Insertion Sort

$last = 1$

$n = 6$

$last$



$last = 8$   
 $a[j] = i$   
 $a[j] = a[j-1]$

# Insertion Sort

