Sorting — Arrange in ascending/descending.

Bubble sort —

← Heat Water.

4 5 3 2 1

← Swapping of adjacent elements $i, i+1$

Pass 1:   4 5 3 2 1

$j=0$ arr[0] < arr[1]   4 5 3 2 1

$j=1$ arr[1] > arr[2]   4 3 5 2 1

$j=2$ arr[2] > arr[3]   4 3 2 5 1

$j=3$ arr[3] > arr[4]   4 3 2 1 5

unsorted   sorted

Pass 2:   4 3 2 1 5

arr[0] > arr[1]   3 4 2 1 5 $j=0$

arr[1] > arr[2]   3 2 4 1 5 $j=1$

arr[2] > arr[3]   3 2 1 4 5 $j=2$

unsorted   sorted

Pass	j	Pass+j
1	3	4
2	2	4
3	1	4
4	0	4

$Pass + j = n-1$

$j = n-1-Pass$

Pass 3:   3 2 1 4 5

arr[0] > arr[1]   2 3 1 4 5 → $j=0$

arr[1] > arr[2]   2 1 3 4 5 → $j=1$

unsorted   sorted

Pass 4:   2 1 3 4 5

arr[0] > arr[1]   1 2 3 4 5 → $j=0$

Sorted.

2 loop   Pass → 1 to n-1
         j → 0 to n-1-pass

(Selection) sort — Select minimum-value-

14 15 13 12 11.

Step 0 —   14 15 13 12 11

min-ind = 0 2 3 4

Swap (arr[0], arr[min-ind]) → 0

11 15 13 12 14

Sorted   unsorted

Step 1 —   11 15 13 12 14

min-ind = 1 2 3

Swap (arr[1], arr[3]) →

Step 2 —   11 12 13 15 14

Sorted   unsorted.

min-ind = 2

Swap (arr[2], arr[min-ind = 2])

Step 3 —   11 12 13 15 14

Sorted   unsorted

min-ind = 3 4

Swap (arr[3], arr[min-ind = 4])

11 12 13 14 15

Sorted.

Loop → ?

2 loop → step $i = 0$ to $n-2$

find min-ind

$j =$

initial-min-ind = i

$j = i+1$ to $n-1$

X	Y	⇒	X	Y
2	3		3	2

Temp = X → 2

X = Y → 3

Y = Temp → 2

Insertion Sort

Eg -

↑ ↑ ↑ ↑ ↑ ↑ ↑

4   5   3   2   1

Step 1 -   **4** ⟨5⟩ 3 2 1
        ‾‾‾
        Sorted

Step 2 - 4 5 | ③ 2 1 |
        └─────┘ └──────┘
        Sorted   unsorted.

Step 3 - ③ 4 5 | ② 1 |
        └──────┘ └────┘
         Sorted   unsorted

Step 4 - 2 3 4 5 | ① |
        └──────────┘ └──┘
            Sorted   unsorted.

Step 5 - | 1 2 3 4 5 |
        └──────────────┘
              Sorted