

2.3 ALGORITHMS · 2.3.1(F)

Bubble & insertion sort

The two simple $O(n^2)$ sorts — how they work & how to trace them. Spec 2.3.1(f).

01 Bubble sort

How Compare adjacent pairs, swap if out of order.

Per pass Largest **bubbles to the end**.

Stop When a pass makes **no swaps**.

Trace Show list **after each pass**.

02 Insertion sort

How Insert each item into the **sorted left part**.

Shift Larger items move right to make room.

Like Sorting a hand of cards.

Trace Show list **after each insertion**.

03 Complexity

Worst Both **$O(n^2)$** (nested loops).

Best **$O(n)$** on nearly-sorted data.

Memory Both **in place** (no big extra list).

04 When to use

Good for Small or nearly-sorted lists.

Avoid for Large lists (use merge/quick — $O(n \log n)$).

Insertion vs bubble Insertion usually a bit faster in practice.

FINAL PASS BEFORE THE EXAM

Rapid exam tips

Six slips on sorting questions.

01

Bubble = swap adjacent; insertion = insert into sorted part.

02

Both are $O(n^2)$ worst case (nested loops).

03

Bubble stops early when a pass has **no swaps** → $O(n)$ best.

04

Trace bubble **after each pass**; insertion **after each insertion**.

05

Both sort **in place** — no big extra array.

06

Large list → use **merge/quick sort** ($O(n \log n)$) instead.