Exercise walk-through

Binary Search ▪ 3.11

eXercise

You must be able to

- explain how **binary search** 二分查找 locates a target in a **sorted** list
- describe how each comparison **halves** 减半 the remaining portion
- state the requirement that the data must be **sorted** 已排序
- compare binary search with a linear search

Method — Binary search

On a **sorted** list, look at the **middle** element. If the target is smaller, search the **left** half; if larger, search the **right** half. Each comparison **halves** the items still to check.

Method — Requirement

The list **must be sorted** first, or binary search fails.

Method — Versus linear search

A linear search checks each element in turn; binary search is far faster on large sorted lists (about $\log_2 n$ steps instead of n).

Practice 2.1 ▪ 1 mark

State the requirement a list must meet for binary search to work.

Solution 2.1

Method: Requirement

Worked steps

it must be sorted B1.

Practice 2.2 ▪ 1 mark

State what each comparison in a binary search does to the remaining items.

Solution 2.2

Method: Binary search

Worked steps

it halves them (discards one half) B1.

Practice 2.3 ▪ 1 mark

State one advantage of binary search over linear search.

Solution 2.3

Method: Versus linear search

Worked steps

it is much faster on large sorted lists (fewer comparisons) B1.

Exam-style 3.1 ▪ 1 mark

Binary search requires the list to be

A sorted

B empty

C reversed

D in random order

Solution 3.1

A sorted ✓

B empty

C reversed

D in random order

Worked steps

A.

Exam-style 3.2 ▪ 1 mark

Each step of a binary search
the remaining items to search.

A doubles

B halves

C ignores

D shuffles

Solution 3.2

Method: Binary search

A doubles

B halves ✓

C ignores

D shuffles

Worked steps

B.

Exam-style 3.3 ▪ 1 mark

A sorted list has 16 items.
(a) Name the search method that halves the list at each step.
(b) State roughly how many steps it needs in the worst case ($16 \to 8 \to 4 \to 2 \to 1$).
(c) State whether binary search works on an **unsorted** list.

Solution 3.3

Method: Binary search

Worked steps

(a) binary search B1. (b) about 4 steps B1. (c) no B1.