

3.11 Binary Search

Name: _____ Class: _____ Date: _____ Total: 8 marks

KEY WORDS binary search 二分查找 • sorted 已排序 • halves 减半 • list 列表

Objective

Build the skills to answer exam questions on **binary search**.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ 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.

■ Requirement

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

■ 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).

2 Practice

2.1 State the requirement a list must meet for binary search to work. [1]

2.2 State what each comparison in a binary search does to the remaining items. [1]

2.3 State one advantage of binary search over linear search. [1]

3 Exam-style questions

3.1 Binary search requires the list to be [1]

- | | |
|---|---|
| A | B |
| C | D |
- A sorted
 - B empty
 - C reversed
 - D in random order

3.2 Each step of a binary search [1]

- A doubles
- B halves
- C ignores
- D shuffles

the remaining items to search.

3.3 A sorted list has 16 items.

(a) Name the search method that halves the list at each step. [1]

(b) State roughly how many steps it needs in the worst case ($16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$). [1]

(c) State whether binary search works on an **unsorted** list. [1]