

Exercise walk-through

Algorithmic Efficiency ■ 3.17

eXercise

You must be able to

- explain how **algorithmic efficiency** 算法效率 compares algorithms by the resources they use
- estimate the number of **steps** an algorithm takes as the input grows
- distinguish a **reasonable** from an **unreasonable** running time
- use a **heuristic** 启发式 when an exact solution is too slow

Method — Efficiency

Compares algorithms by the **resources** (steps or time) they use as the input grows.

Method — Reasonable vs unreasonable

A **reasonable** running time grows slowly (e.g. proportional to n or n^2). An **unreasonable** one grows explosively (e.g. 2^n), becoming impractical on large inputs.

Method — Heuristics

When an exact solution is too slow, a **heuristic** finds a **good-enough** answer quickly.

Practice 2.1 ■ 1 mark

State what algorithmic efficiency compares.

Solution 2.1

Method: Efficiency

Worked steps

the resources (steps or time) that algorithms use **B1**.

Practice 2.2 ■ 1 mark

State what a heuristic is.

Solution 2.2

Worked steps

an approach that finds a good-enough solution when an exact one is too slow **B1**.

Practice 2.3 ■ 1 mark

State why some correct algorithms are not used in practice.

Solution 2.3

Worked steps

they take an unreasonable (too long) time on large inputs **B1**.

Exam-style 3.1 ■ 1 mark

Algorithmic efficiency compares algorithms by

- A** their length in lines
- B** the resources they use
- C** their author
- D** the language used

Solution 3.1

Method: Efficiency

A their length in lines

B the resources they use 

C their author

D the language used

Worked steps

B.

Exam-style 3.2 ■ 1 mark

A heuristic gives a

- A** guaranteed exact answer
- B** good-enough answer quickly
- C** deliberately wrong answer
- D** random answer

Solution 3.2

A guaranteed exact answer

B good-enough answer quickly



C deliberately wrong answer

D random answer

Worked steps

B.

Exam-style 3.3 ■ 1 mark

Algorithm A takes about n steps; algorithm B takes about 2^n steps.

- (a) State which is more efficient for large n .
- (b) State whether B could be too slow to use.
- (c) State one option when an exact solution is too slow.

Solution 3.3

Method: Heuristics

Worked steps

(a) A **B1**. (b) yes **B1**. (c) use a heuristic **B1**.