

Exercise walk-through

Estimating Probabilities Using Simulation ■ 4.2

eXercise

You must be able to

- use a **simulation** 模拟 with random numbers to estimate a probability
- explain how running more trials improves the estimate
- interpret a **relative frequency** 相对频数 as an estimate of a probability

Method — Simulation

A **simulation** uses a **random number generator** to imitate a random process many times. The **relative frequency** of an event (how often it happens $\div$ number of trials) estimates its probability.

Method — More trials, better estimate

By the long-run pattern of randomness, the estimate gets **closer to the true probability** as the number of simulated trials increases.

Practice 2.1 ■ 1 mark

State what a simulation uses to estimate a probability.

Solution 2.1

Method: Simulation

Worked steps

many random trials (using a random number generator) **B1**.

Practice 2.2 ■ 1 mark

State how the estimate improves.

Solution 2.2

Worked steps

by running more trials **B1**.

Practice 2.3 ■ 1 mark

State what the relative frequency of an event approximates.

Solution 2.3

Method: Simulation

Worked steps

the true probability of the event **B1**.

Exam-style 3.1 ■ 1 mark

A simulation estimates a probability using

- A** a single trial
- B** many random trials
- C** a formula only
- D** a guess

Solution 3.1

Method: Simulation

- A a single trial
- B many random trials
- C a formula only
- D a guess



Worked steps

B.

Exam-style 3.2 ■ 1 mark

As the number of simulated trials increases, the estimate

- A** gets worse
- B** gets closer to the true probability
- C** stays fixed
- D** becomes 1

Solution 3.2

Method: More trials, better estimate

- A gets worse
- B gets closer to the true probability**
- C stays fixed
- D becomes 1



Worked steps

B.

Exam-style 3.3 ■ 1 mark

A student simulates rolling a die 1000 times to estimate $P(\text{six})$.

- (a) State the tool that provides the randomness.
- (b) State what the relative frequency of sixes estimates.
- (c) State how to improve the estimate.

Solution 3.3

Method: Simulation

Worked steps

- (a) a random number generator **B1**.
- (b) the true probability of rolling a six **B1**.
- (c) run more trials **B1**.