

4.2 Estimating Probabilities Using Simulation

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

KEY WORDS simulation 模拟 • relative frequency 相对频数 • random 随机 • probability 概率

Objective

Build the skills to answer exam questions on **estimating probabilities using simulation**.

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

1 Worked examples

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

■ **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 ÷ number of trials) estimates its probability.

■ **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.

2 Practice

2.1 State what a simulation uses to estimate a probability. [1]

2.2 State how the estimate improves. [1]

2.3 State what the relative frequency of an event approximates. [1]

3 Exam-style questions

3.1 A simulation estimates a probability using [1]

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

3.2 As the number of simulated trials increases, the estimate [1]

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

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

- (a) State the tool that provides the randomness. [1]
(b) State what the relative frequency of sixes estimates. [1]
(c) State how to improve the estimate. [1]