AP STATISTICS • EXERCISE SHEET

4.2 Estimating Probabilities Using Simulation

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

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** 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** 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]

4 Go further

- work through the **4.2 Estimating Probabilities Using Simulation** lesson on the **Learn** page;
- read the **Probability, Random Variables, and Probability Distributions** section of the AP Statistics handout on the **Know** page.

Solutions

2.1 many random trials (using a random number generator).

2.2 by running more trials.

2.3 the true probability of the event.

3.1 B.

3.2 B.

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