AP STATISTICS • EXERCISE SHEET

5.4 Biased and Unbiased Point Estimates

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

KEY WORDS point estimate 点估计 • unbiased 无偏 • sampling distribution 抽样分布 • parameter 参数

Objective

Build the skills to answer exam questions on **biased and unbiased point estimates**.

You must be able to:

- describe a **point estimate** 点估计 of a parameter
- explain what makes an estimator **unbiased** 无偏
- recognise the sample mean and sample proportion as unbiased estimators

1 Worked examples

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

■ Point estimates

A **point estimate** is a single value from a sample used to estimate a population parameter — for example, using $\bar{x}$ to estimate μ.

■ Unbiased estimators

An estimator is **unbiased** if its sampling distribution is **centred on the true parameter** — on average, it neither over- nor under-estimates. The sample mean $\bar{x}$ and sample proportion $\hat{p}$ are unbiased.

2 Practice

2.1 Define a point estimate. [1]

2.2 State what it means for an estimator to be unbiased. [1]

2.3 State one example of an unbiased estimator. [1]

3 Exam-style questions

3.1 A single value used to estimate a parameter is a [1]

- **A** parameter
- **B** point estimate
- **C** population
- **D** census

3.2 An unbiased estimator is centred on the [1]

- **A** sample
- **B** true parameter
- **C** value zero
- **D** maximum

3.3 The sample mean $\bar{x}$ is used to estimate μ.

(a) Name this kind of value. [1]

(b) State what "unbiased" means for $\bar{x}$. [1]

(c) State what $\bar{x}$ estimates. [1]

Solutions

2.1 a single value from a sample used to estimate a population parameter.

2.2 its sampling distribution is centred on the true parameter.

2.3 the sample mean $\bar{x}$ or the sample proportion $\hat{p}$ (any one).

3.1 B.

3.2 B.

3.3 (a) a point estimate. (b) its sampling distribution is centred at μ. (c) the population mean μ.