

Exercise walk-through

Mean and Standard Deviation of Random Variables ■ 4.8

eXercise

You must be able to

- calculate the **mean** (expected value) 期望值 $\mu_X = \sum x_i \cdot P(x_i)$
- calculate the **standard deviation** $\sigma_X = \sqrt{\sum (x_i - \mu_X)^2 \cdot P(x_i)}$
- interpret these parameters in context

Method — Mean (expected value)

$$\mu_X = \sum x_i \cdot P(x_i)$$

— a probability-weighted average of the values.

Method — Standard deviation

$$\sigma_X = \sqrt{\sum (x_i - \mu_X)^2 \cdot P(x_i)}.$$

Method — Example

X : 0 (prob 0.5), 1 (prob 0.3), 2 (prob 0.2):

$$\mu_X = 0(0.5) + 1(0.3) + 2(0.2) = 0.7.$$

Practice 2.1 ■ 1 mark

Write the formula for the mean of a discrete random variable.

Solution 2.1

Worked steps

$$\mu_X = \sum x_i \cdot P(x_i) \quad \text{B1}.$$

Practice 2.2 ■ 2 marks

X takes 1 (prob 0.5) and 3 (prob 0.5). Find the mean.

Solution 2.2

Worked steps

$$\mu_X = 1(0.5) + 3(0.5) = 2 \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

State what the mean of a random variable is also called.

Solution 2.3

Worked steps

the expected value **B1**.

Exam-style 3.1 ■ 1 mark

The expected value of X is

A $\sum x_i$

B $\sum x_i \cdot P(x_i)$

C $\sum P(x_i)$

D the largest value of x

Solution 3.1

A $\sum x_i$

B $\sum x_i \cdot P(x_i)$



C $\sum P(x_i)$

D the largest value of x

Worked steps

B.

Exam-style 3.2 ■ 1 mark

The mean of a random variable is also called its

- A** median
- B** expected value
- C** mode
- D** variance

Solution 3.2

A median

B expected value



C mode

D variance

Worked steps

B.

Exam-style 3.3 ■ 2 marks

X takes 2 (prob 0.4) and 5 (prob 0.6).

- (a) Find the mean.
- (b) State what the probabilities sum to.

Solution 3.3

Worked steps

(a) $\mu_X = 2(0.4) + 5(0.6) = 0.8 + 3 = 3.8$ **M1** **A1**. (b) 1 **B1**.