

4.11 Parameters for a Binomial Distribution

Name: _____ Class: _____ Date: _____

Total: 11 marks

KEY WORDS random 随机 • probability 概率 • random variable 随机变量 • binomial 二项

Objective

Build the skills to answer exam questions on **the parameters of a binomial distribution**.

You must be able to:

- calculate the **mean** of a binomial, $\mu_X = np$
- calculate the **standard deviation**, $\sigma_X = \sqrt{np(1-p)}$

1 Worked examples

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

■ Binomial parameters

For a binomial random variable with n trials and success probability p :

$$\mu_X = np, \quad \sigma_X = \sqrt{np(1-p)}.$$

■ Example

$n = 100$, $p = 0.2$: $\mu_X = 100(0.2) = 20$ and $\sigma_X = \sqrt{100(0.2)(0.8)} = \sqrt{16} = 4$.

2 Practice

2.1 Write the formula for the mean of a binomial distribution. [1]

2.2 For $n = 50$, $p = 0.4$, find the mean. [2]

2.3 For $n = 100$, $p = 0.5$, find the standard deviation. [2]

3 Exam-style questions

3.1 The mean of a binomial distribution is [1]

- **A** n
- **B** np
- **C** p
- **D** $\sqrt{np}$

3.2 The standard deviation of a binomial distribution is [1]

- **A** np
- **B** $\sqrt{np(1-p)}$
- **C** $n(1-p)$
- **D** p

3.3 A binomial distribution has $n = 200$ and $p = 0.3$.

(a) Find the mean. [2]

(b) Find the standard deviation.

[2]

Solutions

2.1 $\mu_X = np.$

2.2 $\mu_X = 50 \times 0.4 = 20.$

2.3 $\sigma_X = \sqrt{100(0.5)(0.5)} = \sqrt{25} = 5.$

3.1 B.

3.2 B.

3.3 (a) $\mu_X = 200 \times 0.3 = 60.$ (b) $\sigma_X = \sqrt{200(0.3)(0.7)} = \sqrt{42} \approx 6.5.$