Binomial mean/variance

6 questions | 14 marks

Equivalent correct methods earn the corresponding marks.

1. $X \sim \text{Bin}(12, 0.25)$. Find its mean and variance. [2 marks]

$np = 12 \times 0.25 = 3.$

$np(1-p) = 3 \times 0.75 = 2.25.$

Answer: Mean 3; variance 2.25.

2. $X \sim \text{Bin}(100, 0.6)$. Find $\text{SD}(X)$. [2 marks]

Variance $= 100 \times 0.6 \times 0.4 = 24.$

Take its positive square root.

Answer: $\sqrt{24} \approx 4.8990.$

3. A binomial variable has mean 8 and variance 4. Find n and p. [3 marks]

$1 - p = \frac{4}{8} = 0.5.$

$p = 0.5$ and $n = \frac{8}{0.5} = 16.$

Answer: $n = 16,\ p = 0.5.$

4. Can a binomial variable have exact mean 5 and exact variance 6? Explain. [2 marks]

$\frac{\text{Variance}}{\text{mean}}$ would give $1-p=\frac{6}{5}$.

This would require $p=-0.2$, which is not a probability.

Answer: No.

5. $X \sim \text{Bin}(40, 0.3)$. Find the variance of the proportion $\frac{X}{40}$. [3 marks]

$\text{Var}(X)=40\times0.3\times0.7=8.4$.

$\text{Var}(\frac{X}{40})=\frac{8.4}{40^2}=0.00525$.

Answer: 0.00525.

6. A binomial variable has $p=1$ and mean 7. State n and describe its spread. [2 marks]

$np=n=7$.

All seven trials succeed with certainty, so there is no variation.

Answer: $n=7$; variance and SD are zero.