More on Binomial Distribution

Mean and Standard Deviation

Suppose X is a binomial random variable with parameters n and p, so $X \sim \mathrm{B}(n, p)$.

- The **mean** of X is $\mu = np$.
- The **standard deviation** of X is $\sigma = \sqrt{np(1-p)}$.
- The **variance** of X is $\sigma^2 = np(1-p)$.

Example 10 **Self Tutor**

A fair die is rolled twelve times and X is the number of sixes that could result.
Find the mean and standard deviation of the X-distribution.

Example 10 **Self Tutor**

A fair die is rolled twelve times and X is the number of sixes that could result. Find the mean and standard deviation of the X-distribution.

This is a binomial distribution with $n =$? and $p =$? so $X \sim \text{B}($? $)$.

Example 10 **Self Tutor**

A fair die is rolled twelve times and X is the number of sixes that could result. Find the mean and standard deviation of the X-distribution.

This is a binomial distribution with $n = 12$ and $p = \frac{1}{6}$, so $X \sim \mathrm{B}(\quad)$.

So, $\mu = np$ and $\sigma = \sqrt{np(1-p)}$

$= ? \times ?$ $= \sqrt{? \times ? \times ?}$

Example 10 **Self Tutor**

A fair die is rolled twelve times and X is the number of sixes that could result.
Find the mean and standard deviation of the X-distribution.

This is a binomial distribution with $n = 12$ and $p = \frac{1}{6}$, so $X \sim \text{B}(\quad)$.

So, $\mu = np$ and $\sigma = \sqrt{np(1-p)}$

$$\mu = np = 12 \times \frac{1}{6} = 2$$

$$\sigma = \sqrt{np(1-p)} = \sqrt{12 \times \frac{1}{6} \times \frac{5}{6}} \approx 1.291$$

We expect a six to be rolled 2 times, with standard deviation 1.291 .

Example 11 **Self Tutor**

5% of a batch of batteries are defective. A random sample of 80 batteries is taken with replacement. Find the mean and standard deviation of the number of defective batteries in the sample.

This is a binomial sampling situation with $n =$? $p =$?

Example 11 **Self Tutor**

5% of a batch of batteries are defective. A random sample of 80 batteries is taken with replacement. Find the mean and standard deviation of the number of defective batteries in the sample.

This is a binomial sampling situation with $n = 80$, $p = 5\% = \frac{1}{20}$.

If X is the random variable for the number of defectives, then $X \sim \text{B}($? $)$.

Example 11 **Self Tutor**

5% of a batch of batteries are defective. A random sample of 80 batteries is taken with replacement. Find the mean and standard deviation of the number of defective batteries in the sample.

This is a binomial sampling situation with $n = 80$, $p = 5\% = \frac{1}{20}$.

If X is the random variable for the number of defectives, then $X \sim B(80, \frac{1}{20})$.

So, $\mu = np$ and $\sigma = \sqrt{np(1-p)}$

$= ? \times ?$ $\qquad = \sqrt{? \times ? \times ?}$

Example 11 **Self Tutor**

5% of a batch of batteries are defective. A random sample of 80 batteries is taken with replacement. Find the mean and standard deviation of the number of defective batteries in the sample.

This is a binomial sampling situation with $n = 80$, $p = 5\% = \frac{1}{20}$.

If X is the random variable for the number of defectives, then $X \sim \text{B}(80, \frac{1}{20})$.

So, $\mu = np$ and $\sigma = \sqrt{np(1-p)}$

$$\begin{aligned}\mu &= np \\ &= 80 \times \tfrac{1}{20} \\ &= 4\end{aligned} \qquad \text{and} \qquad \begin{aligned}\sigma &= \sqrt{np(1-p)} \\ &= \sqrt{80 \times \tfrac{1}{20} \times \tfrac{19}{20}} \\ &\approx 1.949\end{aligned}$$

We expect a defective battery 4 times, with standard deviation 1.949.