Time Frame: 50 minutes

Subject Matter: Mean, Variance, & SD of Binomial Distribution

TELL ME

Objective: TSWBAT find the mean, variance, and standard deviation for the variable of a binomial distribution.

Standards: DA – 5.6

 Materials: Transparencies and Worksheets

SHOW ME

Presentation of Information:

The teacher will discuss the following:

|  |
| --- |
| Mean, Variance, and Standard Deviation for the Binomial Distribution |
| The mean, variance, and standard deviation of a variable that has the *binomial distribution* can be found by using the following formulas.Mean $μ=n∙p$Variance $σ^{2}=n∙p∙q$Standard deviation $σ=\sqrt{n∙p∙q }$ |

**Example 1:**

A coin is tossed 4 times. Find the mean, variance, and standard deviation of the number of heads that will be obtained.

**Solution**

With the formulas for the binomial distribution and *n* = 4, *p* = $\frac{1}{2}$, and *q* = $\frac{1}{2}$, the results .are

Mean $μ=n∙p=4∙\frac{1}{2}=2 Answer$

Variance $σ^{2}=n∙p∙q=4∙\frac{1}{2}∙\frac{1}{2}=1 Answer$

Standard deviation $σ=\sqrt{n∙p∙q }= \sqrt{1 }=1 Answer$

**Example 2:**

A die is rolled 480 times. Find the mean, variance, and standard deviation of the number of 2s that will be rolled.

**Solution**

It is given that *n* = 480 and *p* = $\frac{1}{6}$. This is a binomial situation, where getting a 2 is a success and not getting a 2 is a failure; hence,

Mean $μ=n∙p=480∙\frac{1}{6}=80 Answer$

Variance $σ^{2}=n∙p∙q=480∙\frac{1}{6}∙\frac{5}{6}=66.7 Answer$

Standard deviation $σ=\sqrt{n∙p∙q }= \sqrt{66.7 }=8.2 Answer$

**Example 3**

The *Statistical Bulletin* published by Metropolitan Life Insurance Co. reported that 2% of all American births result in twins. If a random sample of 8000 births is taken, find the mean, variance, and standard deviation of the number of births that would result in twins.

Source: *JOO% American* by Daniel Evan Weiss.

**Solution**

This is a binomial situation, since a birth can result in either twins or not twins (i.e., two outcomes).

Mean $μ=n∙p=8000∙0.02=160 Answer$

Variance $σ^{2}=n∙p∙q=480∙0.02∙0.98=156.8 Answer$

Standard deviation $σ=\sqrt{n∙p∙q }= \sqrt{156.8 }=12.5 Answer$

Let Me Try

1. A study found that I% of Social Security recipients are too young to vote. If 800 Social Security recipients are randomly selected, find the mean, variance, and standard deviation of the number of recipients who are too young to vote.

Source: *Harper's Index.*

1. Find the mean, variance, and standard deviation for the number of heads when 15 coins are tossed.
2. lf 2% of automobile carburetors are defective, find the mean, variance, and standard deviation of a lot of 500 carburetors.
3. It has been reported that 83% of federal government employees use e-mail. If a sample of 200 federal government employees is selected, find the mean, variance, and standard deviation of the number who use e-mail.

Source: *USA TODAY.*

1. A survey found that 21% of Americans watch fireworks on television on July 4. Find the mean, variance, and standard deviation of the number of individuals who watch fireworks on television on July 4 if a random sample of 1000 Americans is selected.

Source: USA Snapshot, *USA TODAY.*

Homework:

1. In-a restaurant, a study found that 42% of all patrons smoked. If the seating capacity of the restaurant is 80 people, find the mean, variance, and standard deviation of the number of smokers. About how many seats should be available for smoking customers?
2. A survey found that 25% of pet owners had their pets bathed professionally rather than doing it themselves. If 18 pet owners are randomly selected, find the probability that exactly five people have their pets bathed professionally.

Source: USA Snapshot, *USA TODAY.*

1. In a survey, 63% of Americans said they own an answering machine. If 14 Americans are selected at random, find the probability that exactly 9 own an answering machine.

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