Statistics 1: Elementary Statistics

Section 5-4

Review of the Requirements for a Binomial Distribution

- Fixed number of trials
- All trials are independent
- Each trial: two possible outcomes
- Probabilities same for each trial

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Notation for Binomial Distribution

- **S means "success"**
- **F means "failure"**
- **P(S) = p**
- **P(F) = 1 - p = q**

More Notation for Binomial Distribution

- **n = the number of trials**
- **x = the number of "successes" in n trials**
- **P(x) = the probability of exactly x successes in n trials**

To get P(x), Use Binomial Formula when "n" is small

$$P(x) = {}_nC_x \cdot p^x \cdot q^{n-x}$$

How should we handle Binomial Distributions when "n" is large?

Useful Formulas for Binomial Distribution When "n" is Large

- **Mean**
- **Variance**
- **Standard Deviation**

Useful Formulas for Binomial Distribution: Mean

$$m = n \cdot p$$

Useful Formulas

m = n · p

Apply it: 27% of the apples in an orchard have worms in them. If 180 randomly chosen apples are used for each set of 10 pies, what is the mean number of wormy apples per set?

Answer:

$$m = n \cdot p$$
$$= (180)(0.27)$$
$$= 48.6$$

48.6 apples per set of 10 pies on average

Useful Formulas for Binomial Distribution: Variance

$$s^2 = n \cdot p \cdot q$$

Answer:

$$s^2 = n \cdot p \cdot q$$
$$= (180)(0.27)(0.73)$$
$$= 35.5$$

35.5 apples per set of 10 pies is the variance

Useful Formulas for Binomial Distribution: Standard Deviation

$$s = \sqrt{npq}$$

Answer:

$$s = \sqrt{n \cdot p \cdot q}$$
$$= \sqrt{180 \cdot 0.23 \cdot 0.77}$$
$$= 5.96$$

5.96 apples per set of 10 pies is the standard deviation

Apply Formulas for Binomial Distribution

- Would it be unusual to find a set of 10 pies for which 56 or more wormy apples were used?

Use a s-score to find out if 60 is "unusual"

$$z = \frac{x - m}{s} = \frac{60 - 48.6}{5.96} = 1.91$$

Since z is < 2,
60 is not unusual.