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AP Statistics, Period 7

Chapter 16 Summary
Random Variables

Key Knowledge (THE "K^2" OF RANDOM!)

- **Random Variable**- A random variable assumes any of several different values as a result of some random event. Denoted by a capital letter such as X.
- **Discrete Random Variable**- A random variable that can take one of a finite number of distinct outcomes.
    - ***Example: The number of hours spent driving in any given week.***
- **Continuous Random Variable**- A random variable that can take any numeric value within a range of values. The range my be infinite or bounded at either or both ends.
    - ***Example: The number of days you spent driving to work in any given week.***
- **Probability Model**- The probability model is a function that associates a probability *P* with each value of a discrete random variable *X* , denoted ***P(X= x)***, or with any interval of values of a continuous random variable.
- **Expected Value**- The expected value of a random variable is its theoretical long-run average value, the center of its model. Denoted ***μ*** or ***E(X)***, it is found (if the random variable is discrete) by summing the products of variable values and probabilities:

$$\mu = E(X) = \sum x \cdot P(x)$$

- **Variance**- The variance of a random variable is the expected value of the squared deviation from the mean. For discrete random variables, it can be calculated as:

$$\sigma^2 = Var(X) = \sum (x - \mu)^2 P(x)$$

- **Standard Deviation**- The standard deviation of a random variable describes the spread in the model, and is the square root of the variance:

$$\sigma = SD(X) = \sqrt{VAR(X)}$$

- **Changing a random variable by a constant:**
    - **Adding or subtracting random variables:**

$E(X \pm Y) = E(X) \pm E(Y)$ and if ***X*** and ***Y*** are independent,

$$Var(X \pm Y) = Var(X) + Var(Y)$$

Remember, adding or subtracting a constant from data shifts the mean, but does not affect the variance or standard deviation.

$E(X \pm c) = E(X) \pm c$ $\qquad$ $Var(X \pm c) = Var(X)$

Example: Imagine adding $50 more a month to the insurance policy

- **Multiplying random variables :**

Remember, multiplying each value of a random variable by a constant multiplies the mean by <u>that</u> constant and the variance by the <u>square</u> of that constant.

$E(aX) = aE(X)$ $\qquad$ $Var(aX) = a^2Var(X)$

Example: Imagine multiplying the driver's probability of getting into a second accident by 10%