Chapter 16: Random Variables

Discrete and Continuous Random Variables:

A _____ is a quantity whose value changes. A _____ is a variable whose value is obtained by _____. A discrete variable does not take on all possible values within a given interval.

Examples: number of students present
number of red marbles in a jar
number of heads when flipping three coins

A _____ is a variable whose value is obtained by _____. A continuous variable takes on all possible values within a given interval.

Examples: height of students in class
time it takes to get to school
distance traveled between classes

A _____ is a variable whose value is a numerical outcome of a random phenomenon.

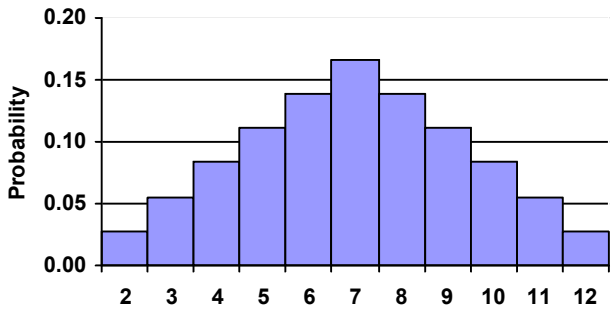
- A random variable is denoted with a _____. A particular value of a random variable will be denoted with a lower case letter.
- The _____ of a random variable *X* tells what the possible values of *X* are and how probabilities are assigned to those values
- A random variable can be _____ or _____

A _____ *X* has a countable number of possible values.

Example: Let *X* represent the sum of two dice. Then the probability distribution of *X* is as follows:

X											
P(*X*)											

To graph the probability distribution of a _____ , construct a _____. The probability distribution for the sum of two dice is given by:



A _____ *X* takes all values in a given interval of numbers.

- The probability distribution of a continuous random variable is shown by a _____ _____. The area under a density curve (no matter what shape it has) is _____.
- The probability that X is between an interval of numbers is the _____ under the density curve between the interval endpoints
- The probability that a _____ _____ _____ *X* is exactly equal to a number is zero

Means and Variances of Random Variables:

The mean of a random variable X is called the _____ _____ of X. The _____ of a discrete random variable, X, is its _____. Each value of X is weighted by its probability. To find the mean of X, _____ each value of X by its probability, then _____ all the products.

$$E(X) = x_1 p_1 + x_2 p_2 + \cdots + x_k p_k$$
$$= \sum x_i p_i$$

Law of Large Numbers:

As the number of observations increases, the mean of the _____ , $\overline{x}$, approaches the mean of the _____, μ .

The more _____ in the outcomes, the more trials are needed to ensure $\overline{x}$ is close to μ .

Rules for Means:

If X is a random variable and *a* and *b* are fixed numbers, then

If X and Y are random variables, then

Example:
Suppose the equation Y = 20 + 10X converts a PSAT math score, X, into an SAT math score, Y. Suppose the average PSAT math score is 48. What is the average SAT math score?

Example:
Let $\mu_X = 625$ represent the average SAT math score.
Let $\mu_Y = 590$ represent the average SAT verbal score.

$E(X+Y)$ represents the average combined SAT score. So the average combined total SAT score is:

The Variance of a Discrete Random Variable:

If X is a discrete random variable with mean μ, then the _____ of X is

$$Var(X) = (x_1 - \mu_X)^2 p_1 + (x_2 - \mu_X)^2 p_2 + \cdots + (x_k - \mu_X)^2 p_k +$$
$$= \sum (x_i - \mu_X)^2 p_i$$

The standard deviation _____ is the _____ _____ of the _____.

$$SD(X) = \sqrt{Var(X)} = \sqrt{\sum (x_i - \mu_X)^2 p_i}$$

Rules for Variances:

If X is a random variable and *a* and *b* are fixed numbers, then

If X and Y are independent random variables, then

Example:
Suppose the equation Y = 20 + 10X converts a PSAT math score, X, into an SAT math score, Y. Suppose the standard deviation for the PSAT math score is 1.5 points. What is the standard deviation for the SAT math score?

Suppose the standard deviation for the SAT math score is 150 points, and the standard deviation for the SAT verbal score is 165 points. What is the standard deviation for the combined SAT score?

*** Because the SAT math score and SAT verbal score are not _____ the rule for adding _____ does not apply!