Random Variables and Probability Distributions

Learning Objectives:

1. Be able to identify a discrete and continuous random variable.
2. Construct a probability distribution for a discrete random variable.
3. Compute the mean, variance and standard deviation for a discrete random variable.

Random Variable: A variable that is assigned to an item of interest in a statistical study such that the values it can assume are the result of chance or a random event.

Example:

Discrete vs. Continuous Random Variables
**Probability Distribution of a Discrete Random Variable**
A table or function that lists all of the possible outcomes and associated probabilities of a discrete random variable.

A probability distribution is a theoretical distribution. It is associated with population probabilities.

**Properties of a proper Probability Distribution**

1. All probabilities are on $[0, 1]$
2. Sum of all probabilities over the entire sample space is 1.

**Example:** Consider tossing 4 coins are recording the number of heads.

1. List all possible outcomes
2. List the probabilities associated with each outcome
Mean of a Discrete Distribution

This is just a *weighted average*, where each outcome is *weighted* by the probability of observing that outcome. As such, outcomes with higher probability will be weighted heavier and have more influence on the value.

For the coin toss example this would be:

The variance is given by:

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