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| **Random Variable** | |
| A random variable x represents a numerical value associated with each outcome of a probability experiment | |
| **Discrete Random Variable** | **Continuous Random Variable** |
| If it has a finite number of possible outcomes or a countable number  **Example:**  The number of heads we get when flipping a coin 100 times is discrete (0 to 100) | If it has an uncountable number of possible outcomes, like an interval on a number line  **Example:**  The amount of time spent on a class is at least 0 hours (any % of an hour or minute) |

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| **Probability Distribution** | |
| The probability distribution of a discrete random variable X is a list of each possible value of X together with the probability that X takes that value in one trial of the experiment. This must satisfy the following two conditions:   * Each probability P(x) must be between 0 and 1: 0 ≤ P(x) ≤ 1 * The sum of all the probabilities is 1: Σ P(x) = 1 | |
| **Discrete Probability Distributions** | **Continuous Probability Distributions** |
| It lists distinct values that a random variable can take, along with its probability (such as number of children)  **Example:**  The number of math classes that we have taken in our life  **Types of Discrete Distribution:**   * Binomial Distribution * Poisson Distribution * Uniform Distribution * Bernoulli Distribution * Hypergeometric Distribution | A probability distribution in which the random variable X can take on any value (a continuum of outcomes, such as height)  **Example:**  The amount of rainfall in cms in a year for a city  **Types of Continuous Distribution:**   * Normal Distribution * Exponential Distribution * Student's ‘t’ Distribution * F Distribution * Chi-square Distribution |

**Discrete Example:**

* A grocery store owner wants to find out the number of customers the store serves within a day. Using this distribution, the owner can find the probability of customers visiting the store within a day
* Mean, denoted by µ, is the weighted average of the possible values that the variable can take. It is the average of all the observed values when the number of customers visiting the store within a day. Standard deviation, denoted by σ measures how spread out the number of customers visiting the store in a day is
* Suppose the average number of customers within a day is 300 and the restaurant owner wants to find out the probability of serving 400 customers in a day. This distribution can be used to calculate if the store is serving enough number of customers daily or not, so that he can plan to pre-load the stock and increase the staff accordingly. He can also look for store expansions and the revenues it generating from them. Hence, computing these attributes can help the store owner predict the expected revenue and customer visits on particular days

**Continuous Example:**

* In the previous discussions, the lipozene experiment is a continuous normal distribution. For example, let’s calculate the probability that a person lost weight between 20 to 40 pounds after taking the pill. With this distribution, we can calculate average weight loss of fewer than 20 pounds, greater than 20 pounds, or between 20 to 40 pounds, but the probability that someone lost exactly 40 or 20 pounds would be zero
* Mean is defined by the density curve of the distribution. If it is a normal distribution curve, then the mean would lie in the center of the curve. So, the probability of weight loss is within a range of values. And here the mean of a weight loss is a measure of the center of the distribution. Also, the standard deviation would be the measure of the dispersion of the weight lost between 20 and 40 pounds
* This is used to test out the effectiveness of lipozene. This information, in particular, can help the scientists to test out and provide proof for their claim

**References:**

* Bluman, A., (2007). Elementary Statistics A Step by Step Approach. 7th Edition. New York. NY: McGraw-Hill.
* List of Probability Distributions from Wikipedia, <https://en.wikipedia.org/wiki/List_of_probability_distributions>
* Probability Distributions: Discrete vs. Continuous, <https://stattrek.com/probability-distributions/discrete-continuous.aspx>

**Binomial Distribution** can have only 2 outcomes. The characteristic of 1 will be positive and the other is negative. Statics and other mathematical fields make use of binomial probability distribution for finding the outcome for a set of independent experiments. The trial and outcomes vary across conditions. Having 2+ series of outcomes is said to be a Bernoulli process while having n=1 is referred to as the **Bernoulli Distribution**. Bernoulli trial is nothing but getting either success or failure for a single experiment. Tossing a coin, rolling dice, writing an examination, counting the total number of votes. It plays a key role in the prediction of dichotomous outcome, to assess if the Democrat or the Republic will win the upcoming elections. Moreover, even important processes such as finding out the death rate and expected lifespan of an individual have its core model as Binomial Distribution

The **chi-squared distribution** emerges out from the estimates of the variance of a normal distribution. It is an approximation to both the distribution of tests of goodness of fit as well as of independence of discrete classifications. Analysis of variance (for normally distributed data) utilizes the **F distribution**, which is the ratio of independent chi-square, so even if it isn’t used as a major stepping stone, it is, however, one that we use. The chi-squared distribution has many uses in statistics, including:

* Sample variance study when the underlying distribution is normal
* Independence of two criteria of classification of qualitative variables
* Confidence interval estimation for a population standard deviation of a normal distribution from a sample standard deviation
* Tests of deviations of differences between expected and observed frequencies
* Relationships between categorical variables