Definition of random variable is: "Random variable is a way to map outcomes of random processes to numbers". It is denoted by capital letter (say X).

Lets break this definition into three parts:

Part 1: Random Processes

Part 2: Map outcomes

Part 3: Numbers

Random process is: Flipping a fair coin (**Part 1**)

Map outcomes: While flipping a coin either you have Head or Tail. (**Part 2**)

Numbers: 1 and 0 (**Part 3**)

When you get head you take number 1 and when you get tail you take number 0.

Assigning value 1 to random variable X after getting a head is mapping an outcome. In a simpler way you are mapping the outcome (head in case 1) to a number (1). You are mapping the outcome (tail in case 2) to a number (0).

$$\mathbf{X} = \begin{Bmatrix} \mathbf{1, if\ Head} \\ \mathbf{0, if\ Tail} \end{Bmatrix}$$

Quantifying outcome (head) to value 1. X becomes 1 in case of Head. **This is called mapping of outcome head to value 1.**

Quantifying outcome (tail) to value 0. X becomes 0 in case of Tail. **This is called mapping of outcome tail to value 0.**

Need of Random Variables:

Random variables are different from traditional variables. We have seen traditional variables in linear algebra.

$5 + x = 6$

$y = x + 7$

In the above equations; x and y are traditional variables.

x can have only one value i.e 1, and y can have one value i.e 8.

But What if we have different values with different probabilities.

P(Y<=30) probability of a random variable having value less than or equal to 30. Then the value of Y is not just a single value, it can have multiple values with different probabilities.

This is where we require random variables.

There are two types of RV:

1. Discrete Random Variables

2. Continuous Random Variables

Discrete Random Variables: you can list the values or you can count the values.

Continuous Random Variables: you cannot list the values or you cannot count the values.

Let us dig deeper:

Case 1:

Y = year of a random student in which he was born

In the above scenario values of Y can be 1994, 1998, 1999,……., so on. Even if you are taking infinite number of values but still you are able to count the values and list them. This is the case of **Discrete Random Variables.**

Case 2:

Y = exact amount of rain in Delhi

In the above scenario values of Y can be 2.7mm, 11.7mm, 12.8888…mm, 13.6mm, 15.687……mm, 15.7mm. There can be multiple values between 2.7mm and 11.7mm and so on. Count will never stop, we will continue to have values. And we can't say that value is exact 2.7mm only, it can be 2.7……mm. This is the case of **Continuous Random Variables.**