

## 6. RANDOM VARIABLES

**Defn:** A random variable is a rule which assigns a numerical value to each possible outcome of an experiment

Example: Toss a coin:  $S = H, T$

Call a head 1 and a tail 0

$$S = \{ 1, 0 \}$$

Random variables are **DISCRETE**  
or **CONTINUOUS**

● **Discrete Random Variable:**

A random variable is discrete if its values can assume isolated points on the number line.

Examples:

- number of sales in a week;
- number of errors in a page of an accountant's ledger;
- number of telephone calls in an hour
- number of customers waiting to be served in a restaurant.

- **Continuous Random Variable:**

A random variable is continuous if its values can assume all points in a particular interval.

Examples:

- time between telephone calls;
- weight of a food item;
- lifetime of a component;

## Probability Distributions:

**Defn:** The probability distribution consists of all possible values of a random variable and its associated probabilities.

### Examples:

1. Toss a coin:  $X = \text{Face value}$

$X = x$	0	1
$P(X = x)$	0.5	0.5

2. Roll a die:  $X = \text{Face value}$

$X = x$	1	2	3	4	5	6
$P(X = x)$	1/6	1/6	1/6	1/6	1/6	1/6

3. The number of claims ( $X$ ) per policy holder in a five-year period has the following probabilities:

$X = x$	0	1	2	3	4	5	6
$P(X = x)$	.18	.28	.25	.18	.06	.04	.01

# Probability Distributions

## Probability Density Function

**(PDF)** is the set of probabilities of a random variable. It satisfies

- $p(x) \geq 0$

- $\sum_x p(x) = 1$

# Cumulative Distribution Function (CDF):

$$F(x) = P(X \leq x)$$

No. of Claims	0	1	2	3	4	5	6
PDF $P(X=x)$	.18	.28	.25	.18	.06	.04	.01
CDF $P(X \leq x)$	.18	.46	.71	.89	.95	.99	1.00