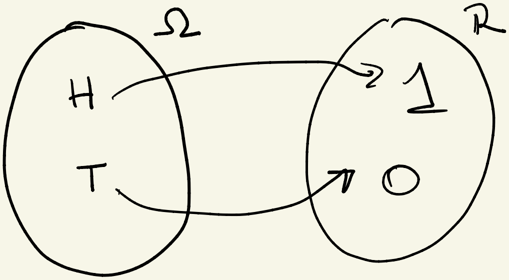
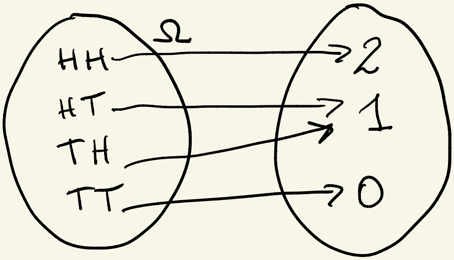
$X: \Omega \to \mathbb{R}$



$X \in \{0, 1\}$

$y \in \{1, 2, 3, 4, 5, 6\}$



Z = number of heads when tossing the coin twice

$Z = \{0, 1, 2\}$

R.V → discrete

R.V → coutinous

$X \in \mathbb{R}$

$X \in \mathbb{R}^+$

$X \in [0, 1]$

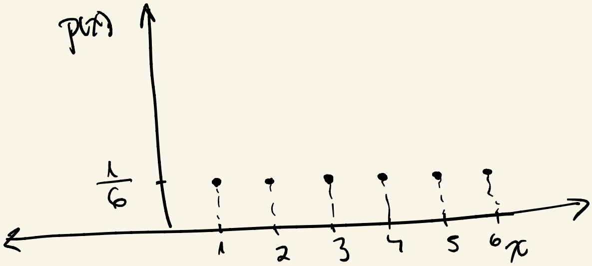
Probability Mass Function

x_i	0	1
$P(X=x_i)$	$1/2$	$1/2$

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

$X \sim$ Binomial distribution (n, p)

$p(x) = \binom{n}{x} p^x (1-p)^{n-x} \qquad x \in \{0, 1, 2, \dots n\}$



$p(x) = \frac{1}{6} \quad x = \{1, 2, \dots, 6\}$

<u>P.M.F</u>

$p(x) = P(X = x)$

X ↳ r.V

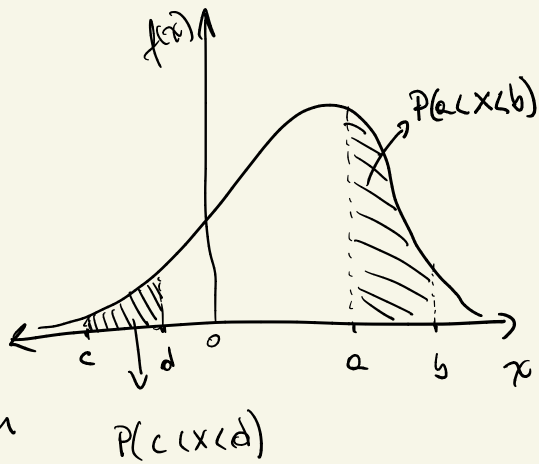
x ↳ outcome

- $p(x) \geq 0$
- $\sum_{\forall x_i} p(x_i) = 1$

X is continous

$P(X = x) = 0$

$P(a < X < b)$

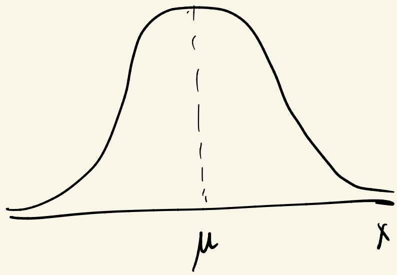


$f(x) \rightarrow$ density function

$\int_a^b f(x)\,dx = P(a < X < b)$

- $f(x) \geq 0$
- $\int_{\mathbb{R}} f(x)\,dx = 1$

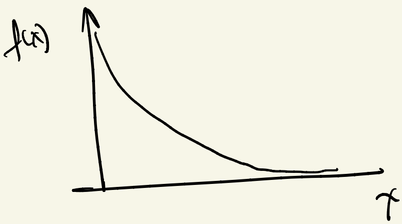
- Normal distribution



$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

$$x \in \mathbb{R}$$

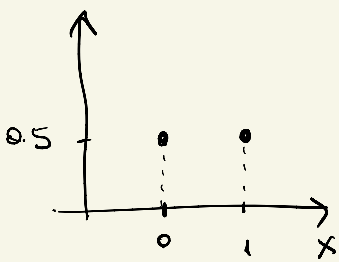
- Exponential distribution



$$f(x) = \lambda e^{-\lambda x}$$

$$x \geq 0$$

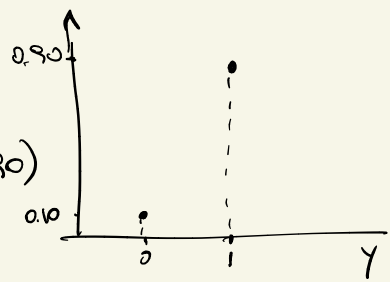
- Expected Value



$$X \in \{0, 1\}$$

$$E(X) = \frac{0+1}{2} = 0\left(\frac{1}{2}\right) + 1\left(\frac{1}{2}\right) = 0.50$$

$$Y \in \{0, 1\}$$



$$E(X) = 0(0.10) + 1(0.90)$$

$$= 0.90$$

$$E(X) = \sum_{\forall x_i} x_i \cdot P(X = x_i) \rightarrow \text{discrete r.v}$$

$$E(X) = \int_{\mathbb{R}} x\, f(x) \cdot dx$$

$$V(X) = E(X^2) - [E(X)]^2$$

$$E(X^2) = \sum_{\forall x_i} x_i^2 \, P(X = x_i)$$

$$E(X^2) = \int_{\mathbb{R}} x^2 f(x)\, dx$$

Properties:

$E(c) = c$

$E(cX) = c\,E(X)$

$E(X+Y) = E(X) + E(Y)$

$V(c) = 0$

$V(cX) = c^2 V(X)$

If X and Y are independant, then

$V(X+Y) = V(X) + V(Y)$