# AI1110 Assignment-8

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# Outline

# Question

A fair coin is tossed twice , and let the random variable $X$ represent the number of heads. Find $F_X(x)$ (Cummulative Distribution Function of X)

## Solution

Let us denote Head by $H$ and tail by $T$.
Sample Space(S) = {HH,HT,TH,TT}.
$X$ : Number of heads obtained

$$X(HH) = 2 \tag{1}$$
$$X(HT) = 1 \tag{2}$$
$$X(TH) = 1 \tag{3}$$
$$X(TT) = 0 \tag{4}$$

$$\Pr(X = 0) = \frac{1}{4} \tag{5}$$
$$\Pr(X = 1) = \frac{1}{2} \tag{6}$$
$$\Pr(X = 2) = \frac{1}{4} \tag{7}$$

From the definition of Cummulative Distribution Function(CDF) of a random variable $X$

$$F_X(x) = \Pr(X \leq x) \tag{8}$$

For $x < 0$ , $X \leq x \Rightarrow X < 0$

$$F_X(x) = \Pr(X < 0) \tag{9}$$
$$F_X(x) = 0 \tag{10}$$

For $0 \leq x < 1$ , $X \leq x \Rightarrow X < 1$

$$F_X(x) = \Pr(X < 1) \tag{11}$$
$$F_X(x) = \Pr(X = 0) \tag{12}$$
$$F_X(x) = \frac{1}{4} \tag{13}$$

For $1 \le x < 2$ , $X \le x \Rightarrow X < 2$

$$F_X(x) = \Pr(X < 2) \tag{14}$$

$$F_X(x) = \Pr(X = 0) + \Pr(X = 1) \tag{15}$$

$$F_X(x) = \frac{1}{4} + \frac{1}{2} \tag{16}$$

$$F_X(x) = \frac{3}{4} \tag{17}$$

For $x \ge 2$ , $X \le x \Rightarrow X < \infty$

$$F_X(x) = \Pr(X = 0) + \Pr(X = 1) + \Pr(X = 2) \tag{18}$$

$$F_X(x) = \frac{1}{4} + \frac{1}{2} + \frac{1}{4} \tag{19}$$
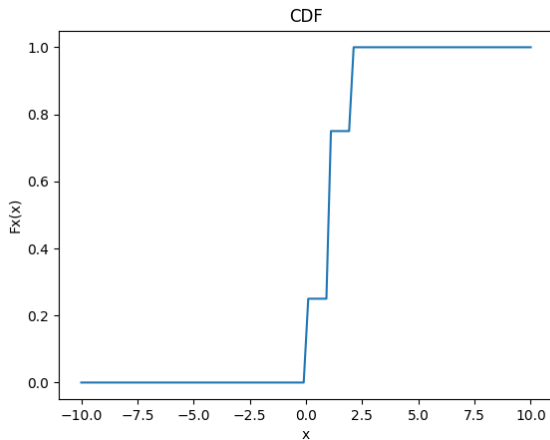
$$F_X(x) = 1 \tag{20}$$

# Graph



Figure: CDF graph