# AI1103 : Assignment 1

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Download all python codes from

https://github.com/Santosh−Dhaladhuli2003/AI1103−Assignment−1/blob/main/Assignment%201.py

and latex codes from

https://github.com/Santosh−Dhaladhuli2003/AI1103−Assignment−1/blob/main/Assignment%201.tex

## PROBLEM 5.12

Random Variable X has the following Probability Distribution

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| P(X) | 0 | k | 2k | 2k | 3k | $k^2$ | $2k^2$ | $7k^2$ + k |

Determine:

1) k
2) $\Pr(X < 3)$
3) $\Pr(X > 6)$
4) $\Pr(0 < X < 3)$

## Solution

PMF of X:

$$\Pr(X) = \begin{cases} 0, & \text{for } X = 0 \\ k, & \text{for } X = 1 \\ 2k, & \text{for } X = 2 \\ 2k, & \text{for } X = 3 \\ 3k, & \text{for } X = 4 \\ k^2, & \text{for } X = 5 \\ 2k^2, & \text{for } X = 6 \\ 7k^2 + k, & \text{for } X = 7 \end{cases} \tag{5.12.1}$$

1) It is known that the sum of probabilities of a probability distribution is always one.

$$\therefore 0 + k + 2k + 3k + k^2 + 2k^2 + (7k^2 + k) = 1 \tag{5.12.2}$$

$$\implies 10k^2 + 9k - 1 = 0 \implies (10k - 1)(k + 1) = 0 \tag{5.12.3}$$

$$\implies k = -1, \frac{1}{10} \tag{5.12.4}$$

$$\therefore k = \frac{1}{10} (\because k \geq 0) \tag{1}$$

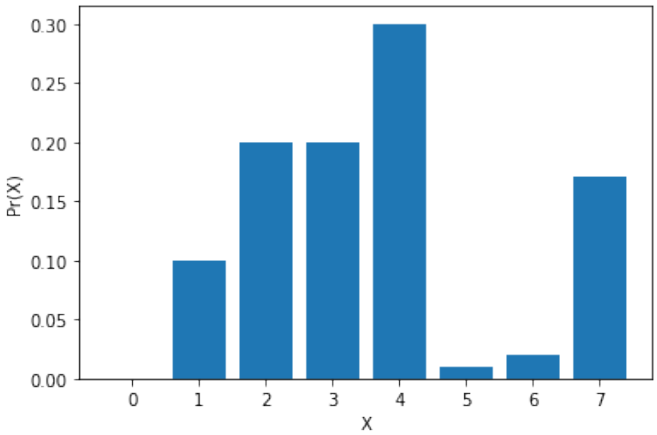


Fig. 1: Probability Mass Function(PMF)

CDF of X:

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| F(X) | 0 | 1/10 | 3/10 | 5/10 | 8/10 | 81/100 | 83/100 | 1 |

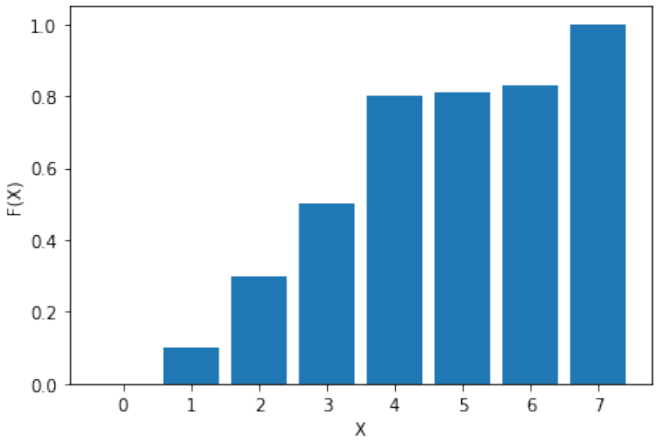


Fig. 1: Cummulative Distribution Function(CDF)

2) $\Pr(X < 3) = \Pr(X = 0) + \Pr(X = 1) + \Pr(X = 2)$

$$\implies \Pr(X < 3) = 0 + k + 2k = 3k \quad (5.12.5)$$

$$\therefore \Pr(X < 3) = \frac{3}{10} \quad (2)$$

3) $\Pr(X > 6) = \Pr(X = 7) = 7k^2 + \mathrm{k}$

$$\implies \Pr(X > 6) = \frac{7}{100} + \frac{1}{10} \quad (5.12.6)$$

$$\therefore \Pr(X > 6) = \frac{17}{100} \quad (3)$$

4) $\Pr(0 < X < 3) = \Pr(X = 1) + \Pr(X = 2)$

$$\implies \Pr(0 < X < 3) = k + 2k = 3k \quad (5.12.7)$$

$$\therefore \Pr(0 < X < 3) = \frac{3}{10} \quad (4)$$