

Assignment 1

Jaswanth Chowdary Madala

1) A die is thrown, find the probability of following events:

- A prime number will appear
- A number greater than or equal to 3 will appear
- A number less than or equal to one will appear
- A number more than 6 will appear
- A number less than 6 will appear

Solution: The given information is summarized in the following table 1

| RV | Description | Probability |
|---------|----------------|---------------|
| $X = 1$ | Die rolls to 1 | $\frac{1}{6}$ |
| $X = 2$ | Die rolls to 2 | $\frac{1}{6}$ |
| $X = 3$ | Die rolls to 3 | $\frac{1}{6}$ |
| $X = 4$ | Die rolls to 4 | $\frac{1}{6}$ |
| $X = 5$ | Die rolls to 5 | $\frac{1}{6}$ |
| $X = 6$ | Die rolls to 6 | $\frac{1}{6}$ |

TABLE 1: Random variable X

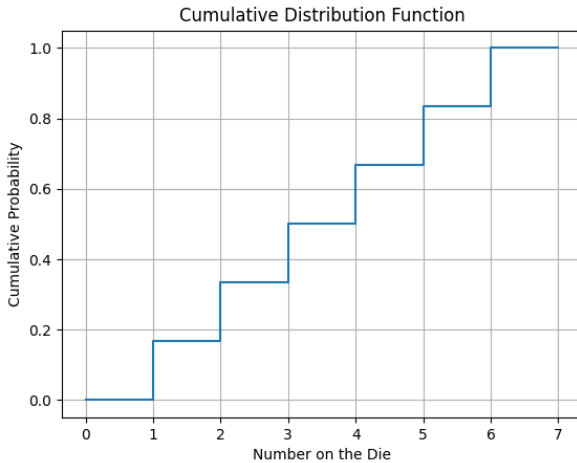


Fig. 1: Graph

The CDF of the random variable X is given by,

$$F_X(n) = \begin{cases} 0 & n < 1 \\ \frac{[n]}{6} & 1 \leq n \leq 6 \\ 1 & \text{otherwise} \end{cases} \quad (0.0.1)$$

where $[.]$ denotes Greatest Integer function. The graph of the CDF function is shown in the figure

- a) The set of possible prime numbers in a die roll contains 2,3,5

$$\Pr(X \in \{2, 3, 5\}) = \Pr(X = 2) + \Pr(X = 3) + \Pr(X = 5) \quad (0.0.2)$$

$$= \frac{1}{2} \quad (0.0.3)$$

- b) The probability that a number greater than or equal to 3 will appear is given by

$$\Pr(X \geq 3) = 1 - \Pr(X \leq 2) \quad (0.0.4)$$

$$= 1 - F_X(2) \quad (0.0.5)$$

$$= \frac{2}{3} \quad (0.0.6)$$

- c) The probability that a number less than or equal to 1 will appear is given by

$$\Pr(X \leq 1) = F_X(1) \quad (0.0.7)$$

$$= \frac{1}{6} \quad (0.0.8)$$

- d) The probability that a number greater than 6 will appear is given by

$$\Pr(X > 6) = 1 - \Pr(X \leq 6) \quad (0.0.9)$$

$$= 1 - F_X(6) \quad (0.0.10)$$

$$= 0 \quad (0.0.11)$$

- e) The probability that a number less than 6

will appear is given by

$$\Pr(X < 6) = \Pr(X \leq 5) \quad (0.0.12)$$

$$= F_X(5) \quad (0.0.13)$$

$$= \frac{5}{6} \quad (0.0.14)$$