Assignment 1

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1) A die is thrown, find the probability of following events:
   a) A prime number will appear
   b) A number greater than or equal to 3 will appear
   c) A number less than or equal to one will appear
   d) A number more than 6 will appear
   e) 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	$\frac{1}{6}$

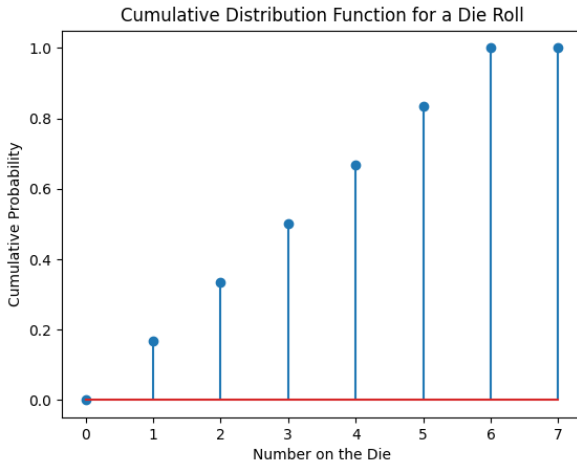   TABLE 1: Random variable X

   Fig. 1: Graph

   The CDF of the random variable X is given by,

   $$F_X(n) = \Pr(X \leq n) \qquad (0.0.1)$$

From the equation (0.0.1) we get,

$$F_X(n) = \begin{cases} 0 & n < 1 \\ \frac{n}{6} & 1 \leq n \leq 6 \\ 1 & \text{otherwise} \end{cases} \qquad (0.0.2)$$

The graph of the CDF function is shown in the figure 1

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

$$\Pr(X \in \{2, 3, 5\}) = \Pr(X = 2) + \Pr(X = 3) + \Pr(X = 5) \qquad (0.0.3)$$

$$= \frac{1}{2} \qquad (0.0.4)$$

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

$$\Pr(X \geq 3) = 1 - \Pr(X \leq 2) \qquad (0.0.5)$$
$$= 1 - F_X(2) \qquad (0.0.6)$$
$$= \frac{2}{3} \qquad (0.0.7)$$

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

$$\Pr(X \leq 1) = F_X(1) \qquad (0.0.8)$$
$$= \frac{1}{6} \qquad (0.0.9)$$

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

$$\Pr(X > 6) = 1 - \Pr(X \leq 6) \qquad (0.0.10)$$
$$= 1 - F_X(6) \qquad (0.0.11)$$
$$= 0 \qquad (0.0.12)$$

e) The probability that a number less than 6 will appear is given by

$$\Pr(X < 6) = \Pr(X \leq 5) \qquad (0.0.13)$$
$$= F_X(5) \qquad (0.0.14)$$
$$= \frac{5}{6} \qquad (0.0.15)$$