Assignment 6

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Question: (CBSE CLASS 12 - Example 28)
Find the variance of the number obtained on a throw of an unbiased die.
Solution: The sample space of the die experiment is $S = \{1, 2, 3, 4, 5, 6\}$.Let X denote the number obtained on the throw. Then X is a random variable which can take values 1, 2, 3, 4, 5, or 6. Also,
$\Pr(X = 1) = \Pr(X = 2) = \Pr(X = 3) = \Pr(X = 4) = \Pr(X = 5) = \Pr(X = 6) = \frac{1}{6}$

Therefore the probability distribution of X is:-

X	1	2	3	4	5	6
$\Pr(X)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$

TABLE I

Now,

$$E(X) = \sum_{i=1}^{n} x_i p(x_i) \tag{1}$$

$$= 1 \times \frac{1}{6} + 2 \times \frac{1}{6} + 3 \times \frac{1}{6} + 4 \times \frac{1}{6} + 5 \times \frac{1}{6} + 6 \times \frac{1}{6} = \left(\frac{21}{6}\right) \tag{2}$$

$$E(X^2) = \sum_{i=1}^{n} x_i^2 p(x_i) \tag{3}$$

$$= 1^2 \times \frac{1}{6} + 2^2 \times \frac{1}{6} + 3^2 \times \frac{1}{6} + 4^2 \times \frac{1}{6} + 5^2 \times \frac{1}{6} + 6^2 \times \frac{1}{6} = \left(\frac{91}{6}\right) \tag{4}$$

$$\therefore Var(X) = E(X^2) - (E(X))^2 \tag{5}$$

$$= \frac{91}{6} - \left(\frac{21}{6}\right)^2 \tag{6}$$

$$= \frac{91}{6} - \frac{441}{36} = \left(\frac{35}{12}\right) \tag{7}$$