Probability Assignment

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Question: Find the variance of distribution.

X	0	1	2	3	4	5
$P(X)$	$\frac{1}{6}$	$\frac{5}{18}$	$\frac{2}{9}$	$\frac{1}{6}$	$\frac{1}{9}$	$\frac{1}{18}$

Solution: Calculating $E(X)$.

$$E(X) = \sum_{k=0}^{5} k p_X(k) \tag{1}$$

$$= 0\left(\frac{1}{6}\right) + 1\left(\frac{5}{18}\right) + 2\left(\frac{2}{9}\right) + 3\left(\frac{1}{6}\right) + 4\left(\frac{1}{9}\right) + 5\left(\frac{1}{18}\right) \tag{2}$$

$$= \frac{35}{18} \tag{3}$$

Calculating $E(X^2)$

$$E(X^2) = \sum_{k=0}^{5} k^2 p_X(k) \tag{4}$$

$$= 0^2\left(\frac{1}{6}\right) + 1^2\left(\frac{5}{18}\right) + 2^2\left(\frac{2}{9}\right) + 3^2\left(\frac{1}{6}\right) + 4^2\left(\frac{1}{9}\right) + 5^2\left(\frac{1}{18}\right) \tag{5}$$

$$= \frac{105}{18} \tag{6}$$

From (3) and (6).

$$\sigma^2 = E(X - E(X))^2 \tag{7}$$

$$= E\left[X^2 + [E(X)]^2 - 2XE(X)\right] \tag{8}$$

$$= E(X^2) + [E(X)]^2 - 2[E(X)]^2 \tag{9}$$

$$= E(X^2) - [E(X)]^2 \tag{10}$$

$$= \frac{105}{18} - \left(\frac{35}{18}\right)^2 \tag{11}$$

$$= \frac{665}{324} \tag{12}$$