Assignment 8

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Outline

Question

CBSE 12 13.4 Q 13

Let X denote the sum of the numbers obtained when two fair dice are rolled. Find the variance and standard deviation of X.

Definitions

Let X be a random variable representing the sum of numbers

Variable	Probability
$X = 2$	$\frac{1}{36}$
$X = 3$	$\frac{2}{36}$
$X = 4$	$\frac{3}{36}$
$X = 5$	$\frac{4}{36}$
$X = 6$	$\frac{5}{36}$
$X = 7$	$\frac{6}{36}$
$X = 8$	$\frac{5}{36}$
$X = 9$	$\frac{4}{36}$
$X = 10$	$\frac{3}{36}$
$X = 11$	$\frac{2}{36}$
$X = 12$	$\frac{1}{36}$

Mean of X

$$E(X) = \sum_{i=2}^{12} i \times \Pr(X = i) \tag{1}$$

$$E(X) = 2 \times \frac{1}{36} + 3 \times \frac{2}{36} + 4 \times \frac{3}{36} + 5 \times \frac{4}{36} + 6 \times \frac{5}{36} + 7 \times \frac{6}{36} + 8 \times \frac{5}{36} + 9 \times \frac{4}{36} + 10 \times \frac{3}{36} + 11 \times \frac{2}{36} + 12 \times \frac{1}{36} \tag{2}$$

$$E(X) = \frac{2}{36} + \frac{6}{36} + \frac{12}{36} + \frac{20}{36} + \frac{30}{36} + \frac{42}{36} + \frac{40}{36} + \frac{36}{36} + \frac{30}{36} + \frac{22}{36} + \frac{12}{36} \tag{3}$$

$$= \frac{252}{36} \tag{4}$$

$$= 7 \tag{5}$$

Variance

$$Var = E(X^2) - (E(X))^2 \tag{6}$$

$$= \sum_{i=2}^{12} i^2 \times \Pr(X = i) - (\sum_{i=2}^{12} i \times \Pr(X = i))^2 \tag{7}$$

Calculation:

$$Var = 2^2 \times \frac{1}{36} + 3^2 \times \frac{2}{36} + 4^2 \times \frac{3}{36} + 5^2 \times \frac{4}{36} + 6^2 \times \frac{5}{36} + 7^2 \times \frac{6}{36} + 8^2 \times \frac{5}{36} + 9^2 \times \frac{4}{36} + 10^2 \times \frac{3}{36} + 11^2 \times \frac{2}{36} + 12^2 \times \frac{1}{36} - 7^2 \tag{8}$$

$$Var = \frac{4}{36} + \frac{18}{36} + \frac{48}{36} + \frac{100}{36} + \frac{180}{36} + \frac{294}{36} + \frac{320}{36} + \frac{324}{36} + \frac{300}{36} + \frac{242}{36} + \frac{144}{36} - 7^2 \tag{9}$$

Standard Deviation

$$Var = \frac{1974}{36} - 49 \tag{10}$$

$$= \frac{35}{6} \tag{11}$$

To calculate Standard Deviation:

$$S.D = \sqrt{Var} \tag{12}$$

$$= \sqrt{\frac{35}{6}} \tag{13}$$

$$= 2.415 \tag{14}$$