Assignment 6 12th Class

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https://github.com/GunjitMittal/Assignment6/tree/main/Assignment6/code

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1 Question

Let a pair of dice be thrown and the random variable X be the sum of the numbers that appear on the two dice. Find the mean or expectation of X.

2 Solution

Solution: The sample space of the experiment consists of 36 elementary events in the form of ordered pairs (x_i, y_i), where x_i= 1, 2, 3, 4, 5, 6 and y_i = 1, 2, 3, 4, 5, 6.
The random variable X i.e. the sum of the numbers on the two dice takes the values 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 or 12.
Now

$$\Pr(X=2) = \Pr((1,1)) = \frac{1}{36} \tag{2.1}$$

$$\Pr(X=3) = \Pr((1,2),(2,1)) = \frac{2}{36} \tag{2.2}$$

$$\Pr(X=4) = \Pr((1,3),(2,2),(3,1)) = \frac{3}{36} \tag{2.3}$$

$$\Pr(X=5) = \Pr((1,4),(2,3),(3,2),(4,1)) = \frac{4}{36} \tag{2.4}$$

$$\Pr(X=6) = \Pr((1,5),(2,4),(3,3),(4,2),(5,1)) = \frac{5}{36} \tag{2.5}$$

$$\Pr(X=7) = \Pr((1,6),(2,5),(3,4),(4,3),(5,2),(6,1)) = \frac{6}{36} \tag{2.6}$$

$$\Pr(X=8) = \Pr((2,6),(3,5),(4,4),(5,3),(6,2)) = \frac{5}{36} \tag{2.7}$$

$$\Pr(X=9) = \Pr((3,6),(4,5),(5,4),(6,3)) = \frac{4}{36} \tag{2.8}$$

$$\Pr(X=10) = \Pr((4,6),(5,5),(6,4)) = \frac{3}{36} \tag{2.9}$$

$$\Pr(X=11) = \Pr((5,6),(6,5)) = \frac{2}{36} \tag{2.10}$$

$$\Pr(X=12) = \Pr((6,6)) = \frac{1}{36} \tag{2.11}$$

The probability distribution of X is Therefore,

X *or* x_i	2	3	4	5	6	7	8	9	10	11	12
$\Pr(X)$ *or* p_i	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

$$\mu = E(x) = \sum_{i=1}^{n} x_i p_i = 2\times\frac{1}{36} + 3\times\frac{2}{36} + 4\times\frac{3}{36} + 5\times\frac{4}{36} + 6\times\frac{5}{36} + 7\times\frac{6}{36} + 8\times\frac{5}{36} + 9\times\frac{4}{36} + 10\times\frac{3}{36} 11\times\frac{2}{36} + 12\times\frac{1}{36} \tag{2.12}$$

$$= \frac{2+6+12+20+30+42+40+36+30+22+12}{36} \tag{2.13}$$

$$= 7 \tag{2.14}$$

Thus, the mean of the sum of the numbers that appear on throwing two fair dice is 7.