

Question 10.13.3.20

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20. Two dice are thrown simultaneously. What is the probability that the sum of the numbers appearing on the dice is (i) 7? (ii) a prime number? (iii) 1?

Solution: Let X and Y represent number appearing on two dice. Let Z be the sum of the numbers appearing on two dice.

$$Z = X + Y$$

random variables	description
X	number appearing on first dice
Y	number appearing on second dice
Z	sum of numbers appearing on both dice

Table 1: Random Variables for die rolls

We know,

$$\Pr(Z = n) = \begin{cases} 0 & n \leq 1 \\ \frac{n-1}{36} & 2 \leq n \leq 7 \\ \frac{13-n}{36} & 7 < n \leq 12 \\ 0 & n > 12 \end{cases} \quad (1)$$

Then,

1. The sum of numbers appearing on the dice is 7. Then from (1),

$$\Pr(Z = 7) = \frac{7-1}{36} \quad (2)$$

$$= \frac{1}{6} \quad (3)$$

2. The sum of numbers appearing on dice is a prime number. From (1),

$$\Pr(Z \text{ is a prime number}) = \sum_{p \in \{2,3,5,7,11\}} \Pr(Z = p) \quad (4)$$

$$= \frac{1}{36} + \frac{2}{36} + \frac{4}{36} + \frac{6}{36} + \frac{2}{36} \quad (5)$$

$$= \frac{5}{12} \quad (6)$$

3. From (1), the probability of the sum of numbers appearing on the dice is 1 is,

$$\Pr(Z = 1) = 0 \tag{7}$$