Question 10.13.3.20

Shaikh Rusna Aiyubbhai
EE22BTECH11048

20. Two dice are thrown simultaneously. What is the probability that the sum of the numbers appearing on the dice is

1. 7?

2. a prime number?

3. 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,

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

Then,

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

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

$$= \frac{1}{6} \tag{3}$$

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

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

$$= \frac{1}{36} + \frac{2}{36} + \frac{4}{36} + \frac{6}{36} + \frac{2}{36} \tag{5}$$

$$= \frac{5}{12} \tag{6}$$

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

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