Assignment 2

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Download all python codes from

https://github.com/Ganesh−RB/AI1103prob−and−randomvariables/Assignment2/codes

and latex-tikz codes from

https://github.com/Ganesh−RB/AI1103prob−and−randomvariables/Assignment2

1 Problem

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

Let X_1,$X_2 \in \{1,2,3,4,5,6\}$ be two random variables associated with event.
$X = X_1 + X_2$, representing sum of outcomes of two dices.

$$\therefore X \in \{2,3,4,5,6,7,8,9,10,11,12\}$$

Now

$$\Pr(X = n) = \Pr(X_1 + X_2 = n) \tag{2.0.1}$$

$$P_X(n) = \begin{cases} 0 & n < 2 \\ \frac{n-1}{36} & 2 \le n \le 7 \\ \frac{13-n}{36} & 7 < n \le 12 \\ 0 & 12 < n \end{cases} \tag{2.0.2}$$

n	2	3	4	5	6	7	8	9	10	11	12
$\Pr(X=n)$	$\frac{1}{36}$	$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{5}{36}$	$\frac{1}{6}$	$\frac{5}{36}$	$\frac{1}{9}$	$\frac{1}{12}$	$\frac{1}{18}$	$\frac{1}{36}$

TABLE 0: Probability as a function of n

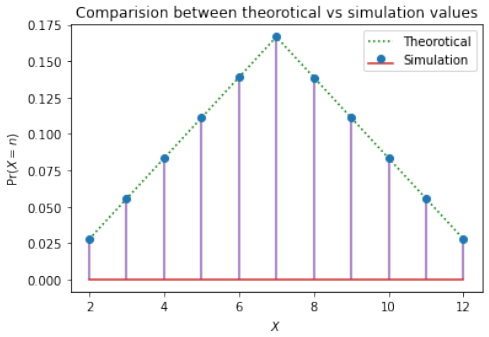

Fig. 0: Probability as a function of n

For mean

$$\hat{X} = \sum_{n=2}^{12} n \times \Pr(X = n) \tag{2.0.3}$$

$$= \sum_{n=2}^{7} n \times \left(\frac{n-1}{36}\right) + \sum_{n=8}^{12} n \times \left(\frac{13-n}{36}\right) \tag{2.0.4}$$

$$\begin{aligned} &= \left(\frac{(7)(8)(15) - (1)(2)(3)}{36 \times 6}\right) \\ &\quad - \left(\frac{(7)(8) - (1)(2)}{36 \times 2}\right) \\ &\quad + 13 \times \left(\frac{(12)(13) - (7)(8)}{36 \times 2}\right) \\ &\quad - \left(\frac{(12)(13)(25) - (7)(8)(15)}{36 \times 6}\right) \end{aligned} \tag{2.0.5}$$

$$= \left(\frac{139}{36} - \frac{27}{36}\right) + \left(\frac{650}{36} - \frac{510}{18}\right) \tag{2.0.6}$$

$$= \frac{112}{36} + \frac{140}{36} \quad = \frac{252}{36} \tag{2.0.7}$$

$$= 7.0 \tag{2.0.8}$$

$\therefore$ expectation value of X is 7