

Assignment 1

Suraj - CS20BTECH11050

Download all python codes from

<https://github.com/Suraj11050/Assignment1/blob/main/Assignment1.py>

and latex-tikz codes from

<https://github.com/Suraj11050/Assignment1/blob/main/Assignment1.tex>

$$\Pr(X = 0) = \binom{2}{0} \left(\frac{1}{6}\right)^0 \left(1 - \frac{1}{6}\right)^2 = \frac{25}{36}$$

$$\Pr(X = 1) = \binom{2}{1} \left(\frac{1}{6}\right)^1 \left(1 - \frac{1}{6}\right)^1 = \frac{10}{36}$$

$$\Pr(X = 2) = \binom{2}{2} \left(\frac{1}{6}\right)^2 \left(1 - \frac{1}{6}\right)^0 = \frac{1}{36}$$

PROBLEM 4.11

Two dice are thrown simultaneously. If X denotes the number of sixes, find the expectation of X

SOLUTION :

When 2 fair dice are thrown simultaneously we know that each die has 6 possible outcomes and outcome of one dice is independent of the outcome of other dice.

\therefore Total possible outcomes are ${}^6C_1 \times {}^6C_1 = 36$

Let X be a random variable denoting number of sixes in the above case. Then by Binomial Distribution

$$\Pr(X = k) = \binom{n}{k} p^k (1 - p)^{n-k} \quad (0.0.1)$$

$$k = 0, \dots, n \quad (0.0.2)$$

Where $k = 0, 1, 2$ and $n = 2$ (Number of dice)
 p = Probability of outcome 6 on a dice

$$p = \frac{1}{6}$$

The probability distribution table is

X	0	1	2
Pr(X)	$\frac{25}{36}$	$\frac{10}{36}$	$\frac{1}{36}$

$$\begin{aligned} E(k) &= \sum k \Pr(k) \\ &= \sum k \binom{n}{k} p^k (1 - p)^{n-k} \\ &= n \cdot p \sum \binom{n-1}{k-1} p^{k-1} (1 - p)^{(n-1)-(k-1)} \\ &= n \cdot p \end{aligned}$$

$$E(X = k) = n \cdot p = 2 \times \frac{1}{6} = \frac{1}{3}$$

$$\therefore E(X) = \frac{1}{3}$$

Hence Expectation value of $X = \frac{1}{3} = 0.333333$

From equation (0.0.1) we obtain the following