AI1103-Assignment 2

Name : Ayush Jha
Roll Number: CS20BTECH11006

Download all python codes from

https://github.com/ayushjha2612/AI11003/tree/main/Assignment2/Codes

and latex-tikz codes from

https://github.com/ayushjha2612/AI11003/tree/main/Assignment2

Problem 5.27

Find the probability distribution of number of doublets in three throws of a pair of dice?

Solution

Let $X_1, X_2 \in \{1,2,3,4,5,6\}$ represent the two dice. We have,

$$\Pr(X_1 = X_2) = \frac{6}{36} \tag{0.0.1}$$
$$= \frac{1}{6} \tag{0.0.2}$$

Similarly we have,

$$\Pr(X_1 \neq X_2) = \frac{30}{36} \tag{0.0.3}$$
$$= \frac{5}{6} \tag{0.0.4}$$

Let the number of doublets in three throws of a pair of dice be represented by a random variable, X
When a pair of dice is thrown three times the number of doublets can be 0,1,2 and 3 respectively. So X can take these values

$$\Pr(X = 0) = \Pr(X_1 \neq X_2)^3 \tag{0.0.5}$$
$$= \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \tag{0.0.6}$$
$$= \frac{125}{216} \tag{0.0.7}$$
$$= 0.5787 \tag{0.0.8}$$

Similarly we have,

$$\Pr(X = 1) = 3 \times \Pr(X_1 \neq X_2)^2 \times \Pr(X_1 = X_2) \tag{0.0.9}$$
$$= 3 \times \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} \tag{0.0.10}$$
$$= \frac{75}{216} \tag{0.0.11}$$
$$= 0.34722 \tag{0.0.12}$$

Note : 3 is multiplied as we have to select which dice will have doublet

$$\Pr(X = 2) = 3 \times \Pr(X_1 \neq X_2) \times \Pr(X_1 = X_2)^2 \tag{0.0.13}$$
$$= 3 \times \frac{5}{6} \times \frac{1}{6} \times \frac{1}{6} \tag{0.0.14}$$
$$= \frac{15}{216} \tag{0.0.15}$$
$$= 0.06944 \tag{0.0.16}$$

And lastly,

$$\Pr(X = 2) = \Pr(X_1 = X_2)^3 \tag{0.0.17}$$
$$= \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} \tag{0.0.18}$$
$$= \frac{1}{216} \tag{0.0.19}$$
$$= 0.00463 \tag{0.0.20}$$

The probability distribution of number of doublets in three throws of a pair of dice can be found out at figure 0.

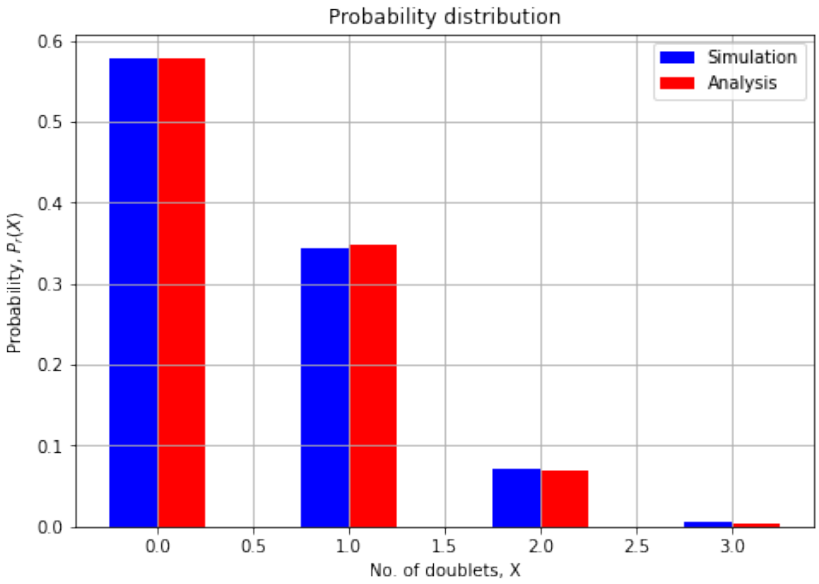

Fig. 0: Probability distribution