AI1103-Assignment 2

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PROBLEM 5.27

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

SOLUTION

Let $X1, X2 \in \{1, 2, 3, 4, 5, 6\}$ represent the two dice. We have,

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

Similarly we have,

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

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

$$\Pr(X = 0) = \Pr(X_1 \neq X_2)^3 \tag{0.0.1}$$

$$= \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \tag{0.0.2}$$

$$= \frac{125}{216} \tag{0.0.3}$$

$$= 0.5787 \tag{0.0.4}$$

Similarly we have,

$$\Pr(X = 1) = 3 \times \Pr(X_1 \neq X_2)^2 \times \Pr(X_1 = X_2) \tag{0.0.5}$$

$$= 3 \times \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} \tag{0.0.6}$$

$$= \frac{75}{216} \tag{0.0.7}$$

$$= 0.34722 \tag{0.0.8}$$

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

$$\Pr(X = 2) = 3 \times \Pr(X_1 \neq X_2) \times \Pr(X_1 = X_2)^2 \tag{0.0.9}$$

$$= 3 \times \frac{5}{6} \times \frac{1}{6} \times \frac{1}{6} \tag{0.0.10}$$

$$= \frac{15}{216} \tag{0.0.11}$$

$$= 0.06944 \tag{0.0.12}$$

And lastly,

$$\Pr(X = 2) = \Pr(X_1 = X_2)^3 \tag{0.0.13}$$

$$= \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} \tag{0.0.14}$$

$$= \frac{1}{216} \tag{0.0.15}$$

$$= 0.00463 \tag{0.0.16}$$

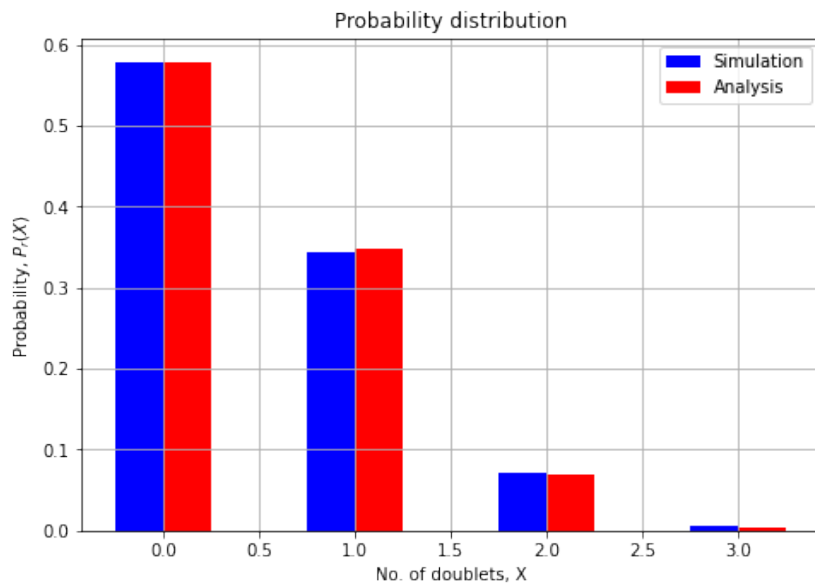The probability distribution of number of doublets in three throws of a pair of dice can be found out at figure 0.

Fig. 0: Probability distribution