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Probability

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Problem Statement:

A die marked 1, 2, 3 in red and 4, 5, 6 in green is tossed. Let A be the event, 'the number is even, ' and B be the event, ' the number is red '. Are A and B independent?

Solution:

Given, a die marked 1,2,3 in red and 4,5,6 in green is tossed.

$$\text{S} = \{1, 2, 3, 4, 5, 6\}$$

Let two events be

E : the number is even
R : the number in red
G : the number in green

Now, two events A and B are independent if,

$$\boxed{P(A, B) = P(A).P(B)}$$

$$\text{E} = \{2, 4, 6\}$$
$$\text{R} = \{1, 2, 3\}$$
$$\text{G} = \{4, 5, 6\}$$

$$P(E, R) = \frac{1}{6} \tag{1}$$

$$P(E) = \frac{3}{6} \tag{2}$$

$$P(E) = \frac{1}{2} \tag{3}$$

$$P(R) = \frac{3}{6} \tag{4}$$

$$P(R) = \frac{1}{2} \tag{5}$$

Now, for the two events A and B to be independent,

$$P(A).P(B) = P(A, B)$$

from (3) and (5)

$$P(E).P(R) = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right) \tag{6}$$

$$P(E).P(R) = \frac{1}{4} \tag{7}$$

from (1) and (7), it is cleare that

$$\frac{1}{6} \neq \frac{1}{4} \tag{8}$$

$$\boxed{P(E, R) \neq P(E).P(R)}$$

$\therefore$ Therefore, the events E and R are not independent.