Assignment 1

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1 PROBLEM

A die is thrown. If E is the event "the number appearing is a multiple of 3" and F be the event "the number appearing is even" then find whether E and F are independent ?

2 SOLUTION

Consider two discrete random variables X and Y. We say that X and Y are independent if

$$Pr(X = x, Y = y) = Pr(X = x).P(Y = y) \quad (2.0.1)$$

for all x, y
A die is thrown.
We know that the sample space is

$$\mathbf{S} = (1, 2, 3, 4, 5, 6) \quad (2.0.2)$$

Let two events be
E : the number appear is a multiple of 3 .
F : the number appearing is even.

$$E : (3, 6) \quad (2.0.3)$$

$$F : (2, 4, 6) \quad (2.0.4)$$

Bernoulli random variables Say $X1$ and $X2$
$Pr(X1 = 1)$ will refer to probability that event E occurs
$Pr(X1 = 0)$ will refer to probability that event E not occurs
Similarly,
$Pr(X2 = 1)$ will refer to probability that event F occurs
$Pr(X2 = 0)$ will refer to probability that event F not occurs

$$Pr(X1 = 1, X2 = 1) = Pr(A \in \{6\}) = \frac{1}{6} \quad (2.0.5)$$

$$Pr(X1 = 1) = Pr(A \in \{3, 6\}) = \frac{2}{6} = \frac{1}{3} \quad (2.0.6)$$

$$Pr(X2 = 1) = Pr(A \in \{2, 4, 6\}) = \frac{3}{6} = \frac{1}{2} \quad (2.0.7)$$

$$Pr(X1 = 1).Pr(X2 = 1) = \frac{1}{3}.\frac{1}{2} = \frac{1}{6} \quad (2.0.8)$$

From above Equations, we get

$$Pr(X1 = 1, X2 = 1) = Pr(X1 = 1).Pr(X2 = 1) \quad (2.0.9)$$

Therefore Event E and F are independent events.