

Assignment 1

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Download all python codes from

https://github.com/sujal100/Probability_and_Random_variable/tree/main/exercise_1/codes

and latex codes from

https://github.com/sujal100/Probability_and_Random_variable/blob/main/exercise_1/exercise_1_main_tex.tex

$Pr(X_1 = 1)$	will refer to probability that event E occurs
$Pr(X_1 = 0)$	will refer to probability that event E not occurs
$Pr(X_2 = 1)$	will refer to probability that event F occurs
$Pr(X_2 = 0)$	will refer to probability that event F not occurs

TABLE 0: Table for Bernoulli random variables.

1 PROBLEM [6.19]

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

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

for all x, y

A die is thrown. We know that the sample space is

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

Let two events be

E : the number appear is a multiple of 3 .

F : the number appearing is even.

$$E : (3, 6) \text{ \& } F : (2, 4, 6) \quad (2.0.3)$$

Bernoulli random variables Say X_1 and X_2

$$Pr(X_1 = 1, X_2 = 1) = Pr(A \in \{6\}) = \frac{1}{6} \quad (2.0.4)$$

$$Pr(X_1 = 1) = Pr(A \in \{3, 6\}) = \frac{2}{6} = \frac{1}{3} \quad (2.0.5)$$

$$Pr(X_2 = 1) = Pr(A \in \{2, 4, 6\}) = \frac{3}{6} = \frac{1}{2} \quad (2.0.6)$$

$$Pr(X_1 = 1)Pr(X_2 = 1) = \frac{1}{3} \frac{1}{2} = \frac{1}{6} \quad (2.0.7)$$

From above Equations, we get

$$Pr(X_1 = 1, X_2 = 1) = Pr(X_1 = 1)Pr(X_2 = 1) \quad (2.0.8)$$

Therefore Event E and F are independent events.