ASSIGNMENT-1
Probability & Random Variables

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Question

An urn contains 5 red and 2 black balls. Two balls are randomly drawn. Let X represent the number of black balls. What are the possible values of X? Is X a random variable ?

Solution

The possible values of X are 0, 1, and 2.

If both balls drawn are red, X would be 0 (no black balls).

If one red and one black ball are drawn, X would be 1 (one black ball).

If both balls drawn are black, X would be 2 (two black balls).

Therefore, X can take on the values of 0, 1, or 2.

Yes, X is a random variable since it represents a numerical outcome of a random experiment (drawing two balls from the urn) and its value depends on the outcome of the experiment.

probability distribution function (PDF) shows the probability of each possible value of X. The PDF of X is given by the binomial distribution with n = 2 and p = 2/7, where n is the number of draws and p is the probability of drawing a black ball.

The PDF of X is:

$$P(X = 0) = \left(\frac{5}{7}\right) * \left(\frac{4}{6}\right) = \left(\frac{10}{21}\right)$$

$$P(X = 1) = 2\left(\frac{2}{7}\right) * \left(\frac{5}{6}\right) = \left(\frac{10}{21}\right)$$

$$P(X = 2) = \left(\frac{2}{7}\right) * \left(\frac{1}{6}\right) = \left(\frac{1}{21}\right)$$

Variable	Value	Definition
X	0	Both balls drawn are red
X	1	One ball drawn is black and the other is red
X	2	Both balls drawn are black