AI1110
Assignment 8

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CBSE Probability Grade 12 Exercise 13.5 Question 4

Five cards are drawn successively with replacement from a well-shuffled deck of 52 cards. What is the probability that
(i) all the five cards are spades?
(ii) only 3 cards are spades?
(iii) none is a spade?

Let a Bernoulli random variable $X \in \{0, 1\}$ denote whether the chosen card is a spade or not.

X	**Outcome**	**Probability**
1	Spade	$p = 0.25$
0	Not a spade	$q = 0.75$

Table 1: Bernoulli distribution

Consider an experiment consisting of 5 Bernoulli trials and denote the number of spades obtained by a binomial random variable $Y \in \{0, 1, 2, 3, 4, 5\}$. This can be expressed as a binomial distribution with probability mass function given by:

$$p_Y(k) = \binom{n}{k}(1-p)^{n-k}p^k,\ 0 \leq k \leq n \tag{1}$$

where $n = 5$ and $p = 0.25$

Answer

The probability of getting 5 spades can be given as:

$$p_Y(5) = \binom{5}{5}(1-0.25)^0(0.25)^5 \tag{2}$$

$$\approx 0.97 \times 10^{-3} \tag{3}$$

Answer

The probability of getting 3 spades can be given as:

$$p_Y(3) = \binom{5}{3}(1-0.25)^2(0.25)^3 \tag{4}$$

$$\approx 0.088 \tag{5}$$

Answer

The probability of getting no spades can be given as:

$$p_Y(0) = \binom{5}{0}(1-0.25)^5(0.25)^0 \tag{6}$$

$$\approx 0.237 \tag{7}$$

Plot of the probability mass function