

Cambridge International AS & A Level

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Mathematics

9709/52

Paper 5 Probability & Statistics 1

October/November 2020

Question No (1)

1 A fair six-sided die, with faces marked 1, 2, 3, 4, 5, 6, is thrown repeatedly until a 4 is obtained.

(a) Find the probability that obtaining a 4 requires fewer than 6 throws.

On another occasion, the die is thrown 10 times.

(b) Find the probability that a 4 is obtained at least 3 times.

Solution:

②

As there are total six faces
1, 2, 3, 4, 5, 6

So

$$P(\text{obtain } 4) = p = \frac{1}{6}$$

$$P(\text{does not obtain } 4) = q = 1 - p$$

$$= 1 - \frac{1}{6}$$

$$q = \frac{5}{6}$$

an Binomial distribution

$$X \sim \text{Bin}(n, p)$$

n = Total number of trials

p = probability of success

q = probability of failure

$$P(X=x) = \binom{n}{x} p^x q^{n-x}$$

According to the condition

$$P(X < 6)$$

$$= P(X=1) + P(X=2) + P(X=3) + P(X=4) + P(X=5)$$

$$= \left(\frac{1}{6}\right) + \left(\frac{5}{6}\right)\left(\frac{1}{6}\right) + \left(\frac{5}{6}\right)^2\left(\frac{1}{6}\right) + \left(\frac{5}{6}\right)^3\left(\frac{1}{6}\right) + \left(\frac{5}{6}\right)^4\left(\frac{1}{6}\right)$$

$$= 0.598 \quad \underline{\text{Ans}}$$

Second method

$$P(\text{obtaining 4 in less than six throws}) = P(X < 6)$$

$$= 1 - \left(\frac{5}{6}\right)^5$$

$$P(X < 6) = 0.5981$$

⑥ $n = 10$, $P(\text{obtain 4}) = \frac{1}{6}$, $P(\text{not 4}) = \frac{5}{6}$
 let X no. of 4 obtain, is a function of
 Binomial distribution
 i.e. $X \sim B(10, \frac{1}{6})$ $X \sim B(n, p)$

By given condition

$$P(X \geq 3) = P(X = 3, 4, 5, 6, \dots, 10)$$

$$= 1 - P(X = 0, 1, 2)$$

$$= 1 - \left[{}^{10}C_0 \left(\frac{1}{6}\right)^0 \left(\frac{5}{6}\right)^{10} + {}^{10}C_1 \left(\frac{1}{6}\right)^1 \left(\frac{5}{6}\right)^9 + {}^{10}C_2 \left(\frac{1}{6}\right)^2 \left(\frac{5}{6}\right)^8 \right]$$

$$= 1 - 0.77522$$

$$= 0.2247$$

$$\approx 0.225 \quad (3 \text{ sf})$$

