

Cambridge International AS & A Level

Mathematics

9709/52

Paper 5 Probability & Statistics 1

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Question No (1)

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Question No (1)

Rajesh applies once every year for a ticket to a music festival. The probability that he is successful in any particular year is 0.3, independently of other years.

- (a) Find the probability that Rajesh is successful for the first time on his 7th attempt.
- (b) Find the probability that Rajesh is successful for the first time before his 6th attempt.
- (c) Find the probability that Rajesh is successful for the second time on his 10th attempt.

Solution:

(a)

probability of success, $p = 0.3$
 probability of failure, $q = 1 - p$
 $= 1 - 0.3$
 $q = 0.7$

Geometric distribution
 $P(X=k) = (1-p)^{k-1} p$

first time success on 7th attempt
 $q \ q \ q \ q \ q \ q \ p$
 $(q)^6 p$
 $(0.7)^6 (0.3)$
 $= 0.0353$

(b)

$$\text{AS } p = 0.3$$

$$q = 0.7$$

Rajesh is successful before his 6th attempt

$$P(X < 6)$$

$$P(X < 6) = P(X=1) + P(X=2) + P(X=3) + P(X=4) + P(X=5)$$

$$= p + pq + pq^2 + pq^3 + pq^4$$

$$= 0.3 + (0.3)(0.7) + (0.3)(0.7)^2 + (0.3)(0.7)^3 + (0.3)(0.7)^4$$

$$= 0.832$$

$$P(X < 6) = 0.832$$

(c)

for the second time successful on his 10th attempt, we shall use negative binomial distribution.

negative Binomial distribution

$$P(r\text{th success, } k\text{trial}) = \binom{k-1}{r-1} p^r (1-p)^{k-r}$$

As $p = 0.3$

$r = 2$ (second success)

$k = 10$ trial

$$\begin{aligned} P(X=10) &= \binom{10-1}{2-1} (0.3)^2 (1-0.3)^8 \\ &= \binom{9}{1} (0.3)^2 (0.7)^8 \end{aligned}$$

$$P(X=10) = 0.0467$$

