

Geometric Distribution

Question Paper 3

Level	A Level
Subject	Maths
Exam Board	OCR
Module	Statistics 1
Topic	Discrete Random Variables
Sub Topic	Geometric Distribution
Booklet	Question Paper - 3

Time Allowed: 56 minutes

Score: /47

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 Henry makes repeated attempts to light his gas fire. He makes the modelling assumption that the probability that the fire will light on any attempt is $\frac{1}{3}$.

Let X be the number of attempts at lighting the fire, up to and including the successful attempt.

- (i) Name the distribution of X , stating a further modelling assumption needed. [2]

In the rest of this question, you should use the distribution named in part (i).

- (ii) Calculate

(a) $P(X = 4)$, [3]

(b) $P(X < 4)$. [3]

- (iii) State the value of $E(X)$. [1]

- (iv) Henry has to light the fire once a day, starting on March 1st. Calculate the probability that the first day on which fewer than 4 attempts are needed to light the fire is March 3rd. [3]

- 2 (i) A random variable X has the distribution $\text{Geo}\left(\frac{1}{5}\right)$. Find

(a) $E(X)$, [2]

(b) $P(X = 4)$, [2]

(c) $P(X > 4)$. [2]

- (ii) A random variable Y has the distribution $\text{Geo}(p)$, and $q = 1 - p$.

(a) Show that $P(Y \text{ is odd}) = p + q^2p + q^4p + \dots$ [1]

- (b) Use the formula for the sum to infinity of a geometric progression to show that

$$P(Y \text{ is odd}) = \frac{1}{1 + q}. \quad [4]$$

- 3 Once each year, Paula enters a lottery for a place in an annual marathon. Each time she enters the lottery, the probability of her obtaining a place is 0.3. Find the probability that

- (i) the first time she obtains a place is on her 4th attempt, [3]

- (ii) she does not obtain a place on any of her first 6 attempts, [2]

- (iii) she needs fewer than 10 attempts to obtain a place, [3]

- (iv) she obtains a place exactly twice in her first 5 attempts. [3]

- 4** 30% of people own a Talk-2 phone. People are selected at random, one at a time, and asked whether they own a Talk-2 phone. The number of people questioned, up to and including the first person who owns a Talk-2 phone, is denoted by X . Find
- (i) $P(X = 4)$, [3]
 - (ii) $P(X > 4)$, [2]
 - (iii) $P(X < 6)$. [3]
- 5** The proportion of people who watch *West Street* on television is 30%. A market researcher interviews people at random in order to contact viewers of *West Street*. Each day she has to contact a certain number of viewers of *West Street*.
- (i) Near the end of one day she finds that she needs to contact just one more viewer of *West Street*. Find the probability that the number of further interviews required is
 - (a) 4, [3]
 - (b) less than 4. [3]
 - (ii) Near the end of another day she finds that she needs to contact just two more viewers of *West Street*. Find the probability that the number of further interviews required is
 - (a) 5, [4]
 - (b) more than 5. [2]