

# Geometric Distribution

## Question Paper 4

<b>Level</b>	A Level
<b>Subject</b>	Maths
<b>Exam Board</b>	OCR
<b>Module</b>	Statistics 1
<b>Topic</b>	Discrete Random Variables
<b>Sub Topic</b>	Geometric Distribution
<b>Booklet</b>	Question Paper - 4

**Time Allowed:** 60 minutes

**Score:** /50

**Percentage:** /100

**Grade Boundaries:**

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

- 1 Ann, Bill, Chris and Dipak play a game with a fair cubical die. Starting with Ann they take turns, in alphabetical order, to throw the die. This process is repeated as many times as necessary until a player throws a 6. When this happens, the game stops and this player is the winner.

Find the probability that

- (i) Chris wins on his first throw, [1]
- (ii) Dipak wins on his second throw, [3]
- (iii) Ann gets a third throw, [2]
- (iv) Bill throws the die exactly three times. [4]

- 2 (i) A clock is designed to chime once each hour, on the hour. The clock has a fault so that each time it is supposed to chime there is a constant probability of  $\frac{1}{10}$  that it will not chime. It may be assumed that the clock never stops and that faults occur independently. The clock is started at 5 minutes past midnight on a certain day. Find the probability that the first time it does not chime is

- (a) at 0600 on that day, [3]
- (b) before 0600 on that day. [3]

- (ii) Another clock is designed to chime twice each hour: on the hour and at 30 minutes past the hour. This clock has a fault so that each time it is supposed to chime there is a constant probability of  $\frac{1}{20}$  that it will not chime. It may be assumed that the clock never stops and that faults occur independently. The clock is started at 5 minutes past midnight on a certain day.

- (a) Find the probability that the first time it does not chime is at either 0030 or 0130 on that day. [2]
- (b) Use the formula for the sum to infinity of a geometric progression to find the probability that the first time it does not chime is at 30 minutes past some hour. [3]

- 3 In a factory, an inspector checks a random sample of 30 mugs from a large batch and notes the number,  $X$ , which are defective. He then deals with the batch as follows.
- If  $X < 2$ , the batch is accepted.
  - If  $X > 2$ , the batch is rejected.
  - If  $X = 2$ , the inspector selects another random sample of only 15 mugs from the batch. If this second sample contains 1 or more defective mugs, the batch is rejected. Otherwise the batch is accepted.

It is given that 5% of mugs are defective.

- (i) (a) Find the probability that the batch is rejected after just the first sample is checked. [3]
- (b) Show that the probability that the batch is rejected is 0.327, correct to 3 significant figures. [5]
- (ii) Batches are checked one after another. Find the probability that the first batch to be rejected is either the 4th or the 5th batch that is checked. [3]
- 4 A game is played with a token on a board with a grid printed on it. The token starts at the point  $(0, 0)$  and moves in steps. Each step is either 1 unit in the positive  $x$ -direction with probability 0.8, or 1 unit in the positive  $y$ -direction with probability 0.2. The token stops when it reaches a point with a  $y$ -coordinate of 1. It is given that the token stops at  $(X, 1)$ .
- (i) (a) Find the probability that  $X = 10$ . [2]
- (b) Find the probability that  $X < 10$ . [3]
- (ii) Find the expected number of steps taken by the token. [2]
- (iii) Hence, write down the value of  $E(X)$ . [1]

- 5 Each day Harry makes repeated attempts to light his gas fire. If the fire lights he makes no more attempts. On each attempt, the probability that the fire will light is 0.3 independent of all other attempts. Find the probability that

- (i) the fire lights on the 5th attempt, [2]
- (ii) Harry needs more than 1 attempt but fewer than 5 attempts to light the fire. [3]

If the fire does not light on the 6th attempt, Harry stops and the fire remains unlit.

- (iii) Find the probability that, on a particular day, the fire lights. [3]
- (iv) Harry's week starts on Monday. Find the probability that, during a certain week, the first day on which the fire lights is Wednesday. [2]