

Binomial Distribution

Question Paper 2

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Discrete random variables
Sub Topic	Binomial Distribution
Booklet	Question Paper 2

Time Allowed: 59 minutes

Score: / 49

Percentage: /100

Grade Boundaries:

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

1 Human blood groups are identified by two parts. The first part is A, B, AB or O and the second part (the Rhesus part) is + or -. In the UK, 35% of the population are group A+, 8% are B+, 3% are AB+, 37% are O+, 7% are A-, 2% are B-, 1% are AB- and 7% are O-.

(i) A random sample of 9 people in the UK who are Rhesus + is taken. Find the probability that fewer than 3 are group O+. [6]

(ii) A random sample of 150 people in the UK is taken. Find the probability that more than 60 people are group A+. [5]

2 Sanket plays a game using a biased die which is twice as likely to land on an even number as on an odd number. The probabilities for the three even numbers are all equal and the probabilities for the three odd numbers are all equal.

(i) Find the probability of throwing an odd number with this die. [2]

Sanket throws the die once and calculates his score by the following method.

- If the number thrown is 3 or less he multiplies the number thrown by 3 and adds 1.
- If the number thrown is more than 3 he multiplies the number thrown by 2 and subtracts 4.

The random variable X is Sanket's score.

(ii) Show that $P(X = 8) = \frac{2}{9}$. [2]

The table shows the probability distribution of X .

x	4	6	7	8	10
$P(X = x)$	$\frac{3}{9}$	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{2}{9}$	$\frac{1}{9}$

(iii) Given that $E(X) = \frac{58}{9}$, find $\text{Var}(X)$. [2]

Sanket throws the die twice.

(iv) Find the probability that the total of the scores on the two throws is 16. [2]

(v) Given that the total of the scores on the two throws is 16, find the probability that the score on the first throw was 6. [3]

- 3 (i) State three conditions that must be satisfied for a situation to be modelled by a binomial distribution. [2]

On any day, there is a probability of 0.3 that Julie's train is late.

- (ii) Nine days are chosen at random. Find the probability that Julie's train is late on more than 7 days or fewer than 2 days. [3]
- (iii) 90 days are chosen at random. Find the probability that Julie's train is late on more than 35 days or fewer than 27 days. [5]
- 4 Name the distribution and suggest suitable numerical parameters that you could use to model the weights in kilograms of female 18-year-old students. [2]
- 5 The mean number of defective batteries in packs of 20 is 1.6. Use a binomial distribution to calculate the probability that a randomly chosen pack of 20 will have more than 2 defective batteries. [5]
- 6 Two unbiased tetrahedral dice each have four faces numbered 1, 2, 3 and 4. The two dice are thrown together and the sum of the numbers on the faces on which they land is noted. Find the expected number of occasions on which this sum is 7 or more when the dice are thrown together 200 times. [4]
- 7 (i) The daily minimum temperature in degrees Celsius ($^{\circ}\text{C}$) in January in Ottawa is a random variable with distribution $N(-15.1, 62.0)$. Find the probability that a randomly chosen day in January in Ottawa has a minimum temperature above 0°C . [3]
- (ii) In another city the daily minimum temperature in $^{\circ}\text{C}$ in January is a random variable with distribution $N(\mu, 40.0)$. In this city the probability that a randomly chosen day in January has a minimum temperature above 0°C is 0.8888. Find the value of μ . [3]