

Binomial Distribution

Question Paper 1

Level	A LEVEL
Exam Board	Edexcel
Subject	Mathematics
Module	Mechanics and Statistics
Topic	Statistical distributions
Sub-Topic	Binomial Distribution
Booklet	Question Paper 1

Time Allowed: 45 minutes

Score: /41

Percentage: /100

Grade Boundaries:

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

1. The owner of a small restaurant decides to change the menu. A trade magazine claims that 40% of all diners choose organic foods when eating away from home. On a randomly chosen day there are 20 diners eating in the restaurant.

(a) Assuming the claim made by the trade magazine to be correct, suggest a suitable model to describe the number of diners X who choose organic foods. (2)

(b) Find $P(5 < X < 15)$. (4)

(Total 6 marks)

2. A farmer noticed that some of the eggs laid by his hens had double yolks. He estimated the probability of this happening to be 0.05. Eggs are packed in boxes of 12.

Find the probability that in a box, the number of eggs with double yolks will be

(a) exactly one, (3)

(b) more than three. (2)

A customer bought three boxes.

(c) Find the probability that only 2 of the boxes contained exactly 1 egg with a double yolk. (3)

(Total 8 marks)

3. The random variable R has the binomial distribution $B(12, 0.35)$.

Find $P(R \geq 4)$.

(2)

(Total 2 marks)

4. From company records, a manager knows that the probability that a defective article is produced by a particular production line is 0.032.

A random sample of 10 articles is selected from the production line.

Find the probability that exactly 2 of them are defective.

(3)

(Total 3 marks)

5. A disease occurs in 3% of a population.
- (a) State any assumptions that are required to model the number of people with the disease in a random sample of size n as a binomial distribution. (2)
- (b) Using this model, find the probability of exactly 2 people having the disease in a random sample of 10 people. (3)

(Total 5 marks)

6. In a town, 30% of residents listen to the local radio station. Four residents are chosen at random.

(a) State the distribution of the random variable X , the number of these four residents that listen to local radio.

(2)

(b) On graph paper, draw the probability distribution of X .

(3)

(c) Write down the most likely number of these four residents that listen to the local radio station.

(1)

(Total 6 marks)

7. In an experiment a group of children each repeatedly throw a dart at a target. For each child, the random variable H represents the number of times the dart hits the target in the first 10 throws.

Peta models H as $B(10, 0.1)$

(a) State two assumptions Peta needs to make to use her model. **(2)**

(b) Using Peta's model, find $P(H \geq 4)$ **(1)**

For each child the random variable F represents the number of the throw on which the dart first hits the target.

Using Peta's assumptions about this experiment,

(c) find $P(F = 5)$ **(2)**

Thomas assumes that in this experiment no child will need more than 10 throws for the dart to hit the target for the first time. He models $P(F = n)$ as

$$P(F = n) = 0.01 + (n-1) \times \alpha$$

where α is a constant.

(d) Find the value of α **(4)**

(e) Using Thomas' model, find $P(F = 5)$ **(1)**

(f) Explain how Peta's and Thomas' models differ in describing the probability that a dart hits the target in this experiment. **(1)**

(Total 11 marks)