OCR Additional Maths Exam Questions - Binomial Distribution

13 In a supermarket chain there are a large number of employees, of whom 40% are male.

(a) One employee is chosen to undergo training.
What assumption is made if 0.4 is taken to be the probability that this employee is male? **[1]**

(b) 6 employees are chosen at random to undergo training.

(i) Show that P(all 6 chosen are female) = 0.0467, correct to 4 decimal places. **[2]**

Find the probability that

(ii) 3 are male and 3 are female, **[4]**

(iii) there are more females than males chosen. **[5]**

4 In a game 4 fair dice are thrown.

Calculate the probability that

(i) no six is thrown, **[2]**

(ii) at least 2 sixes are thrown. **[4]**

11 Eggs are delivered to a supermarket in boxes of 6.
For each egg, the probability that it is cracked is 0.05 independently of other eggs.

Find the probability that

(i) in one box there are no cracked eggs, **[2]**

(ii) in one box there is exactly 1 cracked egg. **[4]**

The manager checks the eggs as follows.

- He takes a box at random from the delivery.
- He accepts the whole delivery if this box contains no cracked eggs.
- He rejects the whole delivery if the box contains 2 or more cracked eggs.
- If the box contains 1 cracked egg then he chooses another box at random.
- He accepts the delivery only if this second box contains no cracked eggs.

(iii) Find the probability that the delivery is rejected. **[6]**

2 A die has 6 faces numbered one to six. The die is biased so that when it is thrown the probability of obtaining a six is $\frac{1}{5}$.

The die is thrown 5 times.

Find the probability of obtaining

(i) at least 1 six, **[2]**

(ii) exactly 3 sixes. **[4]**

6 Amanda throws 3 fair dice. What is the probability that

(i) exactly 2 sixes are thrown, **[3]**

(ii) at least 1 six is thrown? **[3]**

14 Mugs are packed in boxes of 10. On average, 5% of the mugs are imperfect. A box of mugs is classified as "unsatisfactory" if it contains two or more imperfect mugs.

(i) State two conditions that must be satisfied for the number of imperfect mugs in a box to have a binomial distribution. **[2]**

(ii) Assuming that these two conditions are satisfied, calculate the probability that a box chosen at random is "unsatisfactory". **[6]**

A shop receives a delivery of a large number of boxes of mugs. The delivery is checked as follows.

A box is chosen at random.

- If there are no imperfect mugs in the box then the whole delivery is accepted.
- If the box is "unsatisfactory" then the whole delivery is rejected.
- If there is exactly one imperfect mug in the box then a second box is chosen at random. The delivery is accepted only if this box contains no imperfect mugs.

(iii) Calculate the probability that the delivery is accepted. **[4]**

12 A distributor of flower bulbs has a large number of tulip bulbs and daffodil bulbs, mixed in the ratio 1 : 3 respectively. He packs the bulbs in boxes. He puts 10 bulbs, chosen at random, into each box.

(a) Find the probability that a box, chosen at random, contains

(i) exactly 4 daffodil bulbs, **[4]**

(ii) at least 1 tulip bulb. **[3]**

(b) Two boxes of bulbs are chosen at random.

Find the probability that there is a total of 3 tulip bulbs in the two boxes. **[5]**

5 In a large batch of glasses, 14% are defective. From this batch 8 glasses are selected at random. Calculate which is more likely:

(***A***) none of the glasses is defective,

(***B***) at least two of the glasses are defective. [7]

11 It is known that 65% of all people living in the UK went abroad for a holiday last year.

A random sample of 5 people living in the UK was chosen.

Find the probability that

(i) all 5 went abroad for a holiday last year, [1]

(ii) exactly 4 went abroad for a holiday last year, [3]

(iii) at least 2 went abroad for a holiday last year. [4]

An additional random sample of 5 people living in the UK was chosen.

(iv) Find the probability that in the 10 people chosen altogether, exactly 8 went abroad for a holiday last year. [4]

12 The work-force of a large company is made up of males and females in the ratio 9 : 11. One third of the male employees work part-time and one half of the female employees work part-time.

8 employees are chosen at random.

Find the probability that

(i) all are males, [2]

(ii) exactly 5 are females, [4]

(iii) at least 2 work part-time. [6]

4 Glass marbles are produced in two colours, red and green, in the proportion 7 : 3 respectively. From a large stock of the marbles, 5 are taken at random.

Find the probability that

(i) all 5 are red, [2]

(ii) exactly 3 are red. [3]