

**2.** A farmer sells boxes of eggs.

The eggs are sold in boxes of 6 eggs and boxes of 12 eggs in the ratio  $n:1$ .

A random sample of three boxes is taken.

The number of eggs in the first box is denoted by  $X_1$   
The number of eggs in the second box is denoted by  $X_2$

The number of eggs in the second box is denoted by  $X_2$ ,  
 The number of eggs in the third box is denoted by  $X_3$ .

The random variable  $T \equiv X + X + X$

Given that  $P(T = 18) = 0.729$

(a) show that  $n = 9$

(2)

(b) find the sampling distribution of  $T$

(4)

The random variable  $R$  is the range of  $X_1, X_2, X_3$

(c) Using your answer to part (b), or otherwise, find the sampling distribution of  $R$

(2)



4. A sweet shop produces different coloured sweets and sells them in bags.

The proportion of green sweets produced is  $p$

Each bag is filled with a random sample of  $n$  sweets.

The mean number of green sweets in a bag is 4.2 and the variance is 3.57

(a) Find the value of  $n$  and the value of  $p$

(4)

The proportion of red sweets produced by the shop is 0.35

(b) Find the probability that, in a random sample of 25 sweets, the number of red sweets exceeds the expected number of red sweets.

(3)

The shop claims that 10% of its customers buy more than two bags of sweets. A random sample of 40 customers is taken and 1 customer buys more than two bags of sweets.

(c) Test, at the 5% level of significance, whether or not there is evidence that the proportion of customers who buy more than two bags of sweets is less than the shop's claim. State your hypotheses clearly.

(4)



6. In a local council, 60% of households recycle at least half of their waste. A random sample of 80 households is taken.

The random variable  $X$  represents the number of households in the sample that recycle at least half of their waste.

(a) Using a suitable approximation, find the smallest number of households,  $n$ , such that  $P(X \geq n) < 0.05$  (6)

The number of bags recycled per family per week was known to follow a Poisson distribution with mean 1.5

Following a recycling campaign, the council believes the mean number of bags recycled per family per week has increased. To test this belief, 6 families are selected at random and the total number of bags they recycle the following week is recorded.

The council wishes to test, at the 5% level of significance, whether or not there is evidence that the mean number of bags recycled per family per week has increased.

(b) Find the critical region for the total number of bags recycled by the 6 families. (2)

