

1. A random sample of 50 salmon was caught by a scientist. He recorded the length l cm and weight w kg of each salmon.

The following summary statistics were calculated from these data.

$$\sum l = 4027 \quad \sum l^2 = 327\,754.5 \quad \sum w = 357.1 \quad \sum lw = 29\,330.5 \quad S_{ww} = 289.6$$

- (a) Find S_{ll} and S_{lw} **(3)**
- (b) Calculate, to 3 significant figures, the product moment correlation coefficient between l and w . **(2)**
- (c) Give an interpretation of your coefficient. **(1)**



Question 1 continued

Lined writing area for question 1.

Q1

(Total 6 marks)



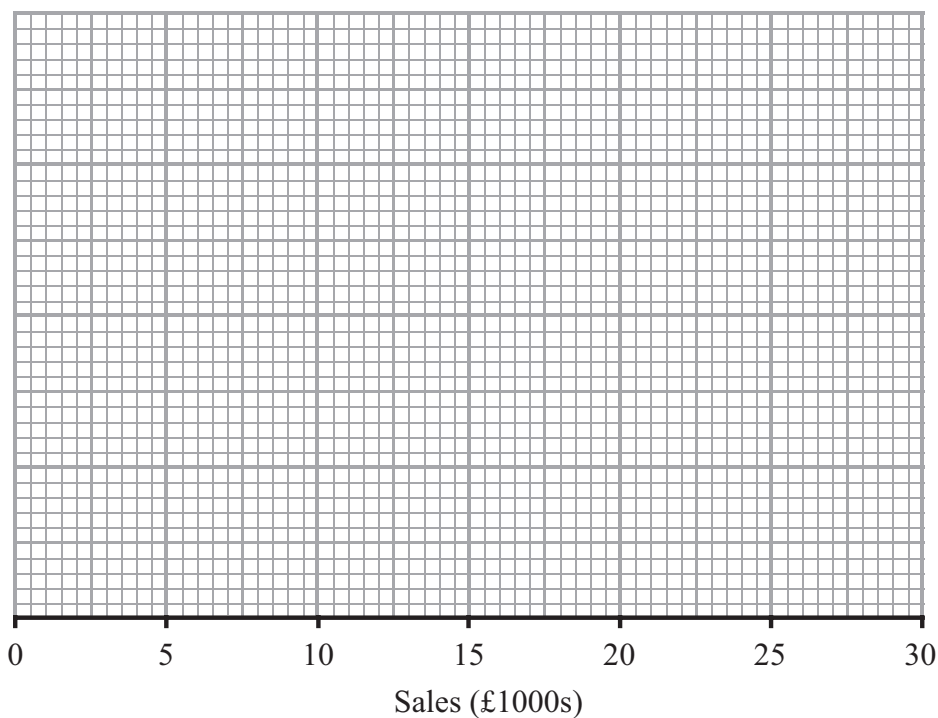
3. Over a long period of time a small company recorded the amount it received in sales per month. The results are summarised below.

	Amount received in sales (£1000s)
Two lowest values	3, 4
Lower quartile	7
Median	12
Upper quartile	14
Two highest values	20, 25

An outlier is an observation that falls either $1.5 \times$ interquartile range above the upper quartile or $1.5 \times$ interquartile range below the lower quartile.

- (a) On the graph paper below, draw a box plot to represent these data, indicating clearly any outliers.

(5)



- (b) State the skewness of the distribution of the amount of sales received. Justify your answer.

(2)

- (c) The company claims that for 75% of the months, the amount received per month is greater than £10 000. Comment on this claim, giving a reason for your answer.

(2)



4. A farmer collected data on the annual rainfall, x cm, and the annual yield of peas, p tonnes per acre.

The data for annual rainfall was coded using $v = \frac{x-5}{10}$ and the following statistics were found.

$$S_{vv} = 5.753 \quad S_{pv} = 1.688 \quad S_{pp} = 1.168 \quad \bar{p} = 3.22 \quad \bar{v} = 4.42$$

(a) Find the equation of the regression line of p on v in the form $p = a + bv$. (4)

(b) Using your regression line estimate the annual yield of peas per acre when the annual rainfall is 85 cm. (2)



5. On a randomly chosen day, each of the 32 students in a class recorded the time, t minutes to the nearest minute, they spent on their homework. The data for the class is summarised in the following table.

Time, t	Number of students
10 – 19	2
20 – 29	4
30 – 39	8
40 – 49	11
50 – 69	5
70 – 79	2

- (a) Use interpolation to estimate the value of the median. (2)

Given that

$$\sum t = 1414 \quad \text{and} \quad \sum t^2 = 69378$$

- (b) find the mean and the standard deviation of the times spent by the students on their homework. (3)
- (c) Comment on the skewness of the distribution of the times spent by the students on their homework. Give a reason for your answer. (2)



6. The discrete random variable X has the probability distribution

x	1	2	3	4
$P(X = x)$	k	$2k$	$3k$	$4k$

(a) Show that $k = 0.1$ **(1)**

Find

(b) $E(X)$ **(2)**

(c) $E(X^2)$ **(2)**

(d) $\text{Var}(2 - 5X)$ **(3)**

Two independent observations X_1 and X_2 are made of X .

(e) Show that $P(X_1 + X_2 = 4) = 0.1$ **(2)**

(f) Complete the probability distribution table for $X_1 + X_2$ **(2)**

y	2	3	4	5	6	7	8
$P(X_1 + X_2 = y)$	0.01	0.04	0.10		0.25	0.24	

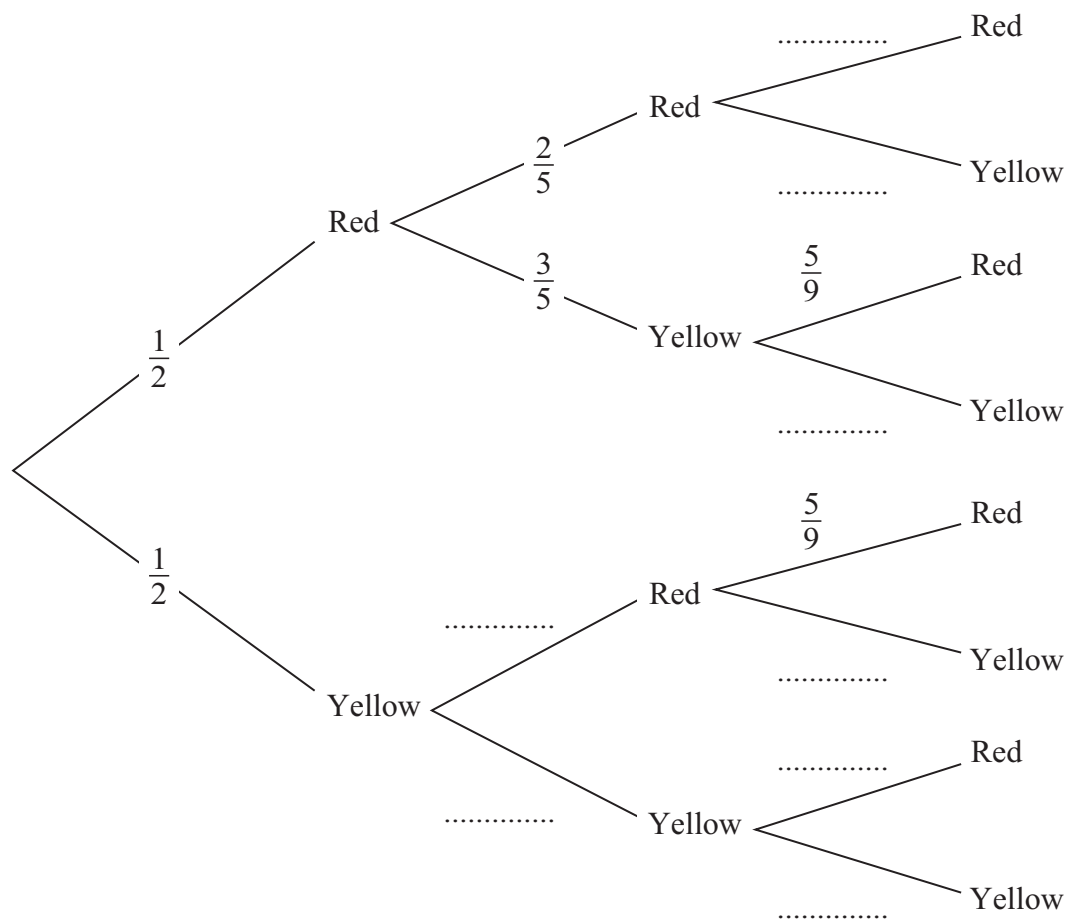
(g) Find $P(1.5 < X_1 + X_2 \leq 3.5)$ **(2)**



7. The bag P contains 6 balls of which 3 are red and 3 are yellow.
 The bag Q contains 7 balls of which 4 are red and 3 are yellow.
 A ball is drawn at random from bag P and placed in bag Q . A second ball is drawn at random from bag P and placed in bag Q .
 A third ball is then drawn at random from the 9 balls in bag Q .

The event A occurs when the 2 balls drawn from bag P are of the same colour.
 The event B occurs when the ball drawn from bag Q is red.

- (a) Complete the tree diagram shown below.



- (b) Find $P(A)$

(3)

- (c) Show that $P(B) = \frac{5}{9}$

(3)

- (d) Show that $P(A \cap B) = \frac{2}{9}$

(2)

- (e) Hence find $P(A \cup B)$

(2)

- (f) Given that all three balls drawn are the same colour, find the probability that they are all red.

(3)



8. The weight, X grams, of soup put in a tin by machine A is normally distributed with a mean of 160 g and a standard deviation of 5 g. A tin is selected at random.

- (a) Find the probability that this tin contains more than 168 g. **(3)**

The weight stated on the tin is w grams.

- (b) Find w such that $P(X < w) = 0.01$ **(3)**

The weight, Y grams, of soup put into a carton by machine B is normally distributed with mean μ grams and standard deviation σ grams.

- (c) Given that $P(Y < 160) = 0.99$ and $P(Y > 152) = 0.90$ find the value of μ and the value of σ . **(6)**



