

1. Twelve observations are made of a random variable X . This set of observations has mean 13 and variance 10.2.

Another twelve observations of X are such that $\sum x = 164$ and $\sum x^2 = 2372$.

Find the mean and the variance for all twenty-four observations. **(8 marks)**

2. Given that $P(A) = \frac{3}{5}$, $P(B) = \frac{5}{8}$, $P(A \cap B) = \frac{7}{20}$, $P(A \cup C) = \frac{7}{10}$ and $P(C|A) = \frac{1}{3}$,

(a) determine whether A and B are independent events. **(2 marks)**

(b) Find $P(A \cap B')$. **(2 marks)**

(c) Find $P((A \cap C)')$. **(3 marks)**

(d) Find $P(A|C)$. **(4 marks)**

3. The frequency distribution for the lengths of 108 fish in an aquarium is given by the following table. The lengths of the fish ranged from 5 cm to 90 cm.

Length (cm)	5 - 10	10 - 20	20 - 25	25 - 30	30 - 40	40 - 60	60 - 90
Frequency	8	16	20	18	20	14	12

(a) Calculate estimates of the three quartiles of the distribution. **(6 marks)**

(b) On graph paper, draw a box and whisker plot of the data. **(4 marks)**

(c) Hence describe the skewness of the distribution. **(1 mark)**

(d) If the data were represented by a histogram, what would be the ratio of the heights of the shortest and highest bars? **(2 marks)**

4. A botanist believes that the lengths of the branches on trees of a certain species can be modelled by a normal distribution.

When he measures the lengths of 500 branches, he finds 55 which are less than 30 cm long and 200 which are more than 90 cm long.

(a) Find the mean and the standard deviation of the lengths. **(9 marks)**

(b) In a sample of 1000 branches, how many would he expect to find with lengths greater than 1 metre? **(4 marks)**

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5. Two spinners are in the form of an equilateral triangle, whose three regions are labelled 1, 2 and 3, and a square, whose four regions are labelled 1, 2, 3 and 4. Both spinners are biased and the probability distributions for the scores X and Y obtained when they are spun are respectively:

x	1	2	3
$P(X=x)$	0.2	0.4	p

Y	1	2	3	4
$P(Y=y)$	0.2	0.5	q	q

- (a) Find the values of p and q . (2 marks)
- (b) Find the probability that, when the two spinners are spun together, the sum of the two scores is (i) 5, (ii) less than 4. (5 marks)
- (c) State an assumption that you have made in answering part (b) and explain why it is likely to be justifiable. (2 marks)
- (d) Calculate $E(X + Y)$. (4 marks)
6. In a survey for a computer magazine, the times t seconds taken by eight laser printers to print a page of text were compared with the prices $\pounds p$ of the printers. The data were coded using the equations $x = t - 10$ and $y = p - 150$, and it was found that
- $$\sum x = 42.4, \quad \sum x^2 = 314.5, \quad \sum y = 560, \quad \sum y^2 = 60\,600, \quad \sum xy = 1592.$$
- (a) Find the mean time and the mean price for the eight printers. (4 marks)
- (b) Find the variance of the times. (3 marks)
- (c) Find the equation of the regression line of p on t . (9 marks)
- (d) Estimate the price of a printer which takes 11.3 seconds to print the page. (1 mark)