1. Given that $P(A \cup B) = 0.65$, $P(A \cap B) = 0.15$ and $P(A) = 0.3$, determine, with explanation, whether or not the events A and B are

   (a) mutually exclusive, **(1 mark)**

   (b) independent. **(3 marks)**

2. (a) Give one example in each case of a quantity which could be modelled as

      (i) a discrete random variable,

      (ii) a continuous random variable. **(2 marks)**

   (b) Name one discrete distribution and one continuous distribution, stating clearly which is which. **(2 marks)**

3. A regular tetrahedron has its faces numbered 1, 2, 3 and 4. It is weighted so that when it is thrown, the probability of each face being in contact with the table is inversely proportional to the number on that face. This number is represented by the random variable X.

   (a) Show that $P(X = 1) = \dfrac{12}{25}$ and find the probabilities of the other values of X. **(5 marks)**

   (b) Calculate the mean and the variance of X. **(5 marks)**

4. The random variable X is normally distributed with mean 17. The probability that X is less than 16 is 0.3707.

   (a) Calculate the standard deviation of X. **(4 marks)**

   (b) In 75 independent observations of X, how many would you expect to be greater than 20? **(6 marks)**

5. The students in a large Sixth Form can choose to do exactly one of Community Service, Games or Private Study on Wednesday afternoons. The probabilities that a randomly chosen student does Games and Private Study are $\dfrac{3}{8}$ and $\dfrac{1}{5}$ respectively. It may be assumed that the number of students is large enough for these probabilities to be treated as constant.

   (a) Find the probability that a randomly chosen student does Community Service. **(2 marks)**

   (b) If two students are chosen at random, find the probability that they both do the same activity. **(3 marks)**

   (c) If three students are chosen at random, find the probability that exactly one of them does Games. **(3 marks)**

Two-fifths of the students are girls, and a quarter of these girls do Private Study.

   (d) Find the probability that a randomly chosen student who does Private Study is a boy. **(5 marks)**

6. Two variables x and y are such that, for a sample of ten pairs of values,

$$\sum x = 104 \cdot 5, \quad \sum y = 113 \cdot 6, \quad \sum x^2 = 1954 \cdot 1, \quad \sum y^2 = 2100 \cdot 6.$$

The regression line of x on y has gradient $0 \cdot 8$. Find

(a) $\sum xy$, **(4 marks)**

(b) the equation of the regression line of y on x, **(5 marks)**

(c) the product moment correlation coefficient between y and x. **(3 marks)**

(d) Describe the kind of correlation indicated by your answer to (c). **(1 mark)**

7. The following table gives the weights, in grams, of 60 items delivered to a company in a day.

Weight (g)	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 80
No. of items	2	11	18	12	9	6	2

(a) Use interpolation to calculate estimated values of (i) the median weight,

(ii) the interquartile range, (iii) the thirty-third percentile. **(7 marks)**

Outliers are defined to be outside the range from $2 \cdot 5Q_1 - 1 \cdot 5Q_3$ to $2 \cdot 5Q_3 - 1 \cdot 5Q_1$.

(b) Given that the lightest item weighed 3 g and the two heaviest weighed 65 g and 79 g, draw on graph paper an accurate box-and-whisker plot of the data. Indicate any outliers clearly. **(5 marks)**

(c) Describe the skewness of the distribution. **(1 mark)**

The mean weight was $32 \cdot 0$ g and the standard deviation of the weights was $14 \cdot 9$ g.

(d) State, with a reason, whether you would choose to summarise the data by using the mean and standard deviation or the median and interquartile range. **(2 marks)**

On another day, items were delivered whose weights ranged from 14 g to 58 g; the median was 32 g, the lower quartile was 24 g and the interquartile range was 26 g.

(e) Draw a further box plot for these data on the same diagram. Briefly compare the two sets of data using your plots. **(6 marks)**