1. 70% of the households in a town have a CD player and 45% have both a CD player and a personal computer (PC). 18% have neither a CD player nor a PC.

    (a) Illustrate this information using a Venn diagram.   **(3 marks)**

    (b) Find the percentage of the households that do not have a PC.   **(2 marks)**

    (c) Find the probability that a household chosen at random has a CD player or a PC but not both.   **(2 marks)**

2. The random variable X has the normal distribution $N(2, 1 \cdot 7^2)$.

    (a) State the standard deviation of X.   **(1 mark)**

    (b) Find $P(X < 0)$.   **(2 marks)**

    (c) Find $P(0 \cdot 6 < X < 3 \cdot 4)$.   **(4 marks)**

3. The discrete random variable X has probability function

    $$P(X = x) = \begin{cases} cx^2 & x = -3, -2, -1, 1, 2, 3 \\ 0 & \text{otherwise.} \end{cases}$$

    (a) Show that $c = \frac{1}{28}$.   **(3 marks)**

    (b) Calculate (i) $E(X)$,   (ii) $E(X^2)$.   **(3 marks)**

    (c) Calculate (i) $Var(X)$,   (ii) $Var(10 - 2X)$.   **(3 marks)**

4. The heights, h m, of eight children were measured, giving the following values of h:

    $$1 \cdot 20, \ 1 \cdot 12, \ 1 \cdot 43, \ 0 \cdot 98, \ 1 \cdot 31, \ 1 \cdot 26, \ 1 \cdot 02, \ 1 \cdot 41.$$

    (a) Find the mean height of the children.   **(2 marks)**

    (b) Calculate the variance of the heights.   **(3 marks)**

    The children were also weighed. It was found that their masses, w kg, were such that

    $$\sum w = 324, \qquad \sum w^2 = 13\,532, \qquad \sum wh = 403.$$

    (c) Calculate the product-moment correlation coefficient between w and h.   **(4 marks)**

    (d) Comment briefly on the value you have obtained.   **(1 marks)**

5. The ages of the residents of a retirement community are assumed to be normally distributed. 15% of the residents are under 60 years old and 5% are over 90 years old.

    (a) Using this information, find the mean and the standard deviation of the ages.   **(7 marks)**

    (b) If there are 200 residents, find how many are over 80 years old.   **(3 marks)**

6. Of the cars that are taken to a certain garage for an M.O.T. test, 87% pass. However, 2% of these have faults for which they should have been failed. 5% of the cars which fail are in fact roadworthy and should have passed.

Using a tree diagram, or otherwise, calculate the probabilities that a car chosen at random

(a) should have passed the test, regardless of whether it actually did or not, **(4 marks)**

(b) failed the test, given that it should have passed. **(3 marks)**

The garage is told to improve its procedures. When it is inspected again a year later, it is found that the pass rate is still 87% overall and 2% of the cars passed have faults as before, but now 0·3% of the cars which should have passed are failed and x% of the cars which are failed should have passed.

(c) Find the value of x. **(8 marks)**

7. The back-to-back stem and leaf diagram shows the journey times, to the nearest minute, of the commuter services into a big city provided by the trains of two operating companies.

	Company A		Company B	
(3)	4 3 1	2	0 5 6 6 8 9	(6)
(4)	9 8 6 5	3	1 3 4 7 9	(5)
(4)	8 8 6 2	4	0 1 3 5 8	( )
(6)	9 7 5 3 2 1	5	2 6 8 9 9	( )
(3)	6 5 3	6	3 4 7 7	( )
(3)	3 2 2	7	0 1 5	( )

Key : 4 | 3 | 6 means 34 minutes for Company A and 36 minutes for Company B.

(a) Write down the numbers needed to complete the diagram. **(1 mark)**

(b) Find the median and the quartiles for each company. **(6 marks)**

(c) On graph paper, draw box plots for the two companies. Show your scale. **(6 marks)**

(d) Use your plots to compare the two sets of data briefly. **(2 marks)**

(e) Describe the skewness of each company's distribution of times. **(2 marks)**