1 Two people with the same occupation were asked to give ratings out of 100 for each of five different aspects of their job. Their ratings are given in the table below.

Aspect	A	B	C	D	E
Person 1	71	63	84	57	64
Person 2	12	62	20	85	31

(i) Calculate Spearman's rank correlation coefficient for the above data. [4]

(ii) Explain what your answer to part **(i)** tells you about the two people's ratings. [1]

2 A child's game uses five bricks. One is blue, one is green, one is yellow and two are white. The five bricks are arranged in a line.

(i) How many different possible arrangements of the colours are there? [2]

(ii) Assuming that all the arrangements in part **(i)** are equally likely, find the probability that the two white bricks are at the ends of the line. [3]

3 Paul plays a game in which a fair coin is spun 4 times. If the number of heads is 0 or 1, Paul loses £5, if the number of heads is 2, Paul wins £5 and if the number of heads is 3 or 4, Paul wins £10. Let £W be the amount which Paul wins in one randomly chosen game.

(i) Show that $\mathrm{P}(W = -5) = \frac{5}{16}$. [2]

(ii) Copy and complete the table below to show the probability distribution of W. [2]

w	-5	5	10
$\mathrm{P}(W = w)$	$\frac{5}{16}$		

(iii) Show that $\mathrm{E}(W) = \frac{55}{16}$. [2]

(iv) Find $\mathrm{Var}(W)$. [3]

4 A student was experimenting with an electrical circuit in which the resistance of one component could be varied. The student increased the resistance in fixed steps from 10 units to 100 units and measured the voltage drop when a fixed current was passed through it. The table below gives the student's results.

Resistance, x units	10	20	30	40	50	60	70	80	90	100
Voltage drop, y units	149	202	253	307	353	407	443	451	550	602

$[n = 10,\ \Sigma x = 550,\ \Sigma y = 3717,\ \Sigma x^2 = 38\,500,\ \Sigma y^2 = 1\,576\,075,\ \Sigma xy = 244\,260.]$

(i) The student wished to use his experimental data to estimate the resistance which would be needed for the voltage drop to be 220 units. Calculate the equation of the appropriate regression line and use it to estimate the resistance, x, which would correspond to $y = 220$. [6]

(ii) Calculate the product moment correlation coefficient for the data and use it to comment on the reliability of the estimate found in part **(i)**. [3]

5 Andy plays a lottery game once a week for 10 weeks. He knows that he has a probability of $\frac{1}{57}$ of winning each time he plays. Let X be the number of weeks out of 10 in which Andy wins.

(i) State the distribution of X, giving the values of any parameters, and state one assumption required to use this distribution as a suitable model. [3]

(ii) Calculate

(a) $P(X = 2)$, [3]

(b) $P(X > 2)$. [3]

(iii) Write down the value of $E(X)$. [1]

6 The table below refers to the mass, m kg, of each of a sample of 60 dogs examined in a vet's surgery.

Mass, m kg	$0 \leqslant m < 5$	$5 \leqslant m < 10$	$10 \leqslant m < 15$	$15 \leqslant m < 20$	$20 \leqslant m < 30$	$30 \leqslant m < 50$
Frequency	2	7	17	19	8	7

(i) Draw a cumulative frequency graph for the data in the table. [3]

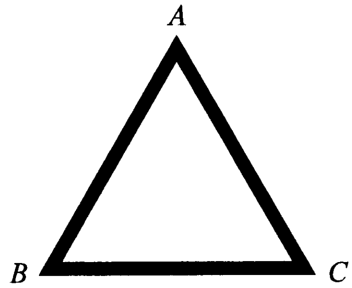
(ii) Use your cumulative frequency graph to estimate the median and the interquartile range for the data. [3]

(iii) You are now given that the minimum mass in the sample of 60 dogs was 4 kg and the maximum was 47 kg. Use your estimates from part **(ii)** to draw a box-and-whisker plot of the data. [3]

(iv) Give one feature of the data which you can deduce from a box-and-whisker plot more easily than from a cumulative frequency graph. [1]

[Question 7 is printed overleaf.]

7 Siân is involved in a game in which she runs along three paths in the form of a triangle, as in the diagram below.



When she arrives at a corner, she chooses her subsequent direction according to the following rules.

- When she is at A, she chooses path AB with probability $\frac{2}{3}$ and she chooses path AC with probability $\frac{1}{3}$.
- When she is at B, she chooses path BA with probability $\frac{3}{4}$ and she chooses path BC with probability $\frac{1}{4}$.
- When she is at C, she chooses path CA with probability $\frac{4}{5}$ and she chooses path CB with probability $\frac{1}{5}$.
- Once she has chosen a particular path she runs to the other end of the path.
- She starts at A.

(i) Show that the probability that she returns to A after choosing two paths is $\frac{23}{30}$. [3]

(ii) Find the probability that she returns to A after choosing three paths. [4]

(iii) Find the probability that she is at B after four choices. [5]