STATISTICS (A) UNIT 1   TEST PAPER 3

1. (a) Explain briefly what is meant by a random variable. **(2 marks)**

   (b) Write down a quantity which could be modelled as

       (i) a discrete random variable,

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

2. The discrete random variable X has the probability function given by the following table:

x	0	1	2	3	4	5	6
$P(X=x)$	0·09	0·12	0·22	0·16	p	$2p$	0·2

   (a) Show that $p = 0.07$ **(2 marks)**

   (b) Find the value of $E(X+2)$. **(4 marks)**

   (c) Find the value of $Var(3X-1)$. **(5 marks)**

3. Twenty pairs of observations are made of two variables x and y, which are believed to be related. It is found that

   $$\sum x = 200, \quad \sum y = 174, \quad \sum x^2 = 6201, \quad \sum y^2 = 5102, \quad \sum xy = 5200.$$

   Find

   (a) the product-moment correlation coefficient between x and y, **(3 marks)**

   (b) the equation of the regression line of y on x. **(4 marks)**

   Given that $p = x + 30$ and $q = y + 50$,

   (c) find the equation of the regression line of q on p, in the form $q = mp + c$. **(3 marks)**

   (d) Estimate the value of q when $p = 46$, stating any assumptions you make. **(3 marks)**

4. The heights of the students at a university are assumed to follow a normal distribution. 1% of the students are over 200 cm tall and 76% are between 165 cm and 200 cm tall.

   Find

   (a) the mean and the variance of the distribution, **(9 marks)**

   (b) the percentage of the students who are under 158 cm tall. **(3 marks)**

   (c) Comment briefly on the suitability of a normal distribution to model such a population.

   (2 marks)

STATISTICS 1 (A) TEST PAPER 3 Page 2

5. In a survey of natural habitats, the numbers of trees in sixty equal areas of land were recorded, as follows:

17	12	9	23	40	32	11	5	34	22	31	8
15	45	10	52	14	13	29	43	69	30	15	47
35	6	24	13	19	26	9	31	27	18	6	20
22	18	30	51	49	35	50	25	8	10	26	31
33	29	40	37	38	44	24	34	42	38	11	23

(a) Construct a stem-and-leaf diagram to illustrate this data, using the groupings 5 - 9, 10 - 14, 15 - 19, 20 - 24, etc. **(8 marks)**

(b) Find the three quartiles for the distribution. **(4 marks)**

(c) On graph paper construct a box plot for the data, showing your scale and clearly indicating any outliers. **(4 marks)**

6. Sixteen cards have been lost from a pack, which therefore contains only 36 cards. Two cards are drawn at random from the pack. The probability that **both** cards are red is $\frac{1}{3}$.

(a) Show that r, the number of red cards in the pack, satisfies the equation

$$r(r - 1) = 420.$$ **(4 marks)**

(b) Hence or otherwise find the value of r. **(3 marks)**

(c) Find the probability that, when three cards are drawn at random from the pack,

(i) at least two are red, **(6 marks)**

(ii) the first one is red given that at least two are red. **(4 marks)**