

**STATISTICS (A) UNIT 1****TEST PAPER 2**

1. (a) Explain briefly what is meant by a **discrete random variable**. (1 mark)

A family has 3 cats and 4 dogs. Two of the family's animals are to be chosen at random. The random variable  $X$  represents the number of dogs chosen.

- (b) Copy and complete the table to show the probability distribution of  $X$ :

$x$	0	1	2
$P(X=x)$			

(4 marks)

- (c) Calculate (i)  $E(X)$ , (ii)  $\text{Var}(X)$ , (iii)  $\text{Var}(2X)$ . (5 marks)

2. The discrete random variable  $X$  can take any value in the set  $\{1, 2, 3, 4, 5, 6, 7, 8\}$ .

Arthur, Beatrice and Chris each carry out trials to investigate the distribution of  $X$ .

Arthur finds that  $P(X=1) = 0.125$  and that  $E(X) = 4.5$ .

Beatrice finds that  $P(X=2) = P(X=3) = P(X=4) = p$ .

Chris finds that the values of  $X$  greater than 4 are all equally likely, with each having probability  $q$ .

- (a) Calculate the values of  $p$  and  $q$ . (7 marks)

- (b) Give the name for the distribution of  $X$ . (1 mark)

- (c) Calculate the standard deviation of  $X$ . (3 marks)

3. The marks obtained by ten students in a Geography test and a History test were as follows:

Student	A	B	C	D	E	F	G	H	I	J
Geography ( $x$ )	34	57	49	21	84	53	10	77	61	85
History ( $y$ )	40	49	55	40		71	39	47	65	73

- (a) Given that  $\sum y = 547$ , calculate the mark obtained by student  $E$  in History. (1 mark)

Given further that  $\sum x^2 = 34\,087$ ,  $\sum y^2 = 31\,575$  and  $\sum xy = 31\,342$ , calculate

- (b) the product moment correlation coefficient between  $x$  and  $y$ , (4 marks)

- (c) an equation of the regression line of  $y$  on  $x$ , (4 marks)

- (d) an estimate of the History mark of student  $K$ , who scored 70 in Geography. (2 marks)

- (e) State, with a reason, whether you would expect your answer to part (d) to be reliable. (2 marks)

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4. The random variable  $X$  is normally distributed with mean  $\mu$  and variance  $\sigma^2$ .

(a) If  $2\mu = 3\sigma$ , find  $P(X < 2\mu)$ . **(5 marks)**

(b) If, instead,  $P(X < 3\mu) = 0.86$ ,

(i) find  $\mu$  in terms of  $\sigma$ , **(4 marks)**

(ii) calculate  $P(X > 0)$ . **(4 marks)**

5. The stem-and-leaf diagram shows the values taken by two variables  $A$  and  $B$ .

$A$		$B$
8, 7, 4, 1, 0	1	1, 1, 2, 5, 6, 8, 9
9, 8, 7, 6, 6, 5, 2	2	0, 3, 4, 6, 7, 7, 9
9, 7, 6, 4, 2, 1, 0	3	1, 4, 5, 5, 8
8, 6, 3, 2, 2	4	0, 2, 6, 6, 9, 9
6, 4, 0	5	2, 3, 5, 7
5, 3, 1	6	0, 1

Key: 3 | 1 | 2 means

$A = 13, B = 12$

(a) For each set of data, calculate estimates of the median and the quartiles. **(6 marks)**

(b) Calculate the 42nd percentile for  $A$ . **(2 marks)**

(c) On graph paper, indicating your scale clearly, construct box and whisker plots for both sets of data. **(4 marks)**

(d) Describe the skewness of the distribution of  $A$  and of  $B$ . **(2 marks)**

6. The values of the two variables  $A$  and  $B$  given in the table in Question 5 are written on cards and placed in two separate packs, which are labelled  $A$  and  $B$ . One card is selected from Pack  $A$ . Let  $A_i$  represent the event that the first digit on this card is  $i$ .

(a) Write down the value of  $P(A_2)$ . **(1 mark)**

The card taken from Pack  $A$  is now transferred into Pack  $B$ , and one card is picked at random from Pack  $B$ . Let  $B_i$  represent the event that the first digit on this card is  $i$ .

(b) Show that  $P(A_1 \cap B_1) = \frac{1}{24}$ . **(3 marks)**

(c) Show that  $P(A_6 | B_5) = \frac{4}{41}$ . **(5 marks)**

(d) Find the value of  $P(A_1 \cup B_3)$ . **(5 marks)**