

STATISTICS (A) UNIT 1**TEST PAPER 6**

1. (a) Briefly explain what is meant by a sample space. (2 marks)
 (b) State two properties which a function $f(x)$ must have to be a probability function. (2 marks)
2. A company makes two cars, model A and model B . The distance that model A travels on 10 litres of petrol is normally distributed with mean 109 km and variance 72.25 km^2 . The distance that model B travels on 10 litres of petrol is normally distributed with mean 108.5 km and variance 169 km^2 .
- In a trial, one of each model is filled with 10 litres of petrol and sent on a journey of 110 km. Find which model has the greater probability of completing this journey, and state the value of this probability. (8 marks)

3. A , B and C are three events such that $P(A) = x$, $P(B) = y$ and $P(C) = x + y$. It is known that $P(A \cup B) = 0.6$ and $P(B|A) = 0.2$.
- (a) Show that $4x + 5y = 3$. (2 marks)
- It is also known that B and C are mutually exclusive and that $P(B \cup C) = 0.9$
- (b) Obtain another equation in x and y and hence find the values of x and y . (4 marks)
 (c) Deduce whether or not A and B are independent events. (2 marks)

4. The discrete random variable X has the following probability distribution :

x	0	1	2	3	4	5
$P(X=x)$	0.11	0.17	0.2	0.13	p	p^2

- (a) Find the value of p . (4 marks)
 (b) Find (i) $P(0 < X \leq 2)$, (ii) $P(X \geq 3)$. (3 marks)
 (c) Find the mean and the variance of X . (3 marks)
 (d) Construct a table to represent the cumulative distribution function $F(x)$. (2 marks)
5. The following marks out of 50 were given by two judges to the contestants in a talent contest:

Contestant	A	B	C	D	E	F	G	H
Judge 1 (x)	43	32	40	21	47	11	29	38
Judge 2 (y)	39	25	40	22	36	13	27	32

Given that $\sum x = 261$, $\sum x^2 = 9529$ and $\sum xy = 8373$,

- (a) calculate the product-moment correlation coefficient between the two judges' marks. (5 marks)

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- (b) Find an equation of the regression line of x on y . (4 marks)

Contestant I was awarded 45 marks by Judge 2.

- (c) Estimate the mark that this contestant would have received from Judge 1. (2 marks)
- (d) Comment, with explanation, on the probable accuracy of your answer. (2 marks)
6. 1000 houses were sold in a small town in a one-year period. The selling prices were as given in the following table:

Selling Price	Number of Houses	Selling Price	Number of Houses
Up to £50 000	60	Up to £150 000	642
Up to £75 000	227	Up to £200 000	805
Up to £100 000	305	Up to £500 000	849
Up to £125 000	414	Up to £750 000	1000

- (a) Name (do not draw) a suitable type of graph for illustrating this data. (1 mark)
- (b) Use interpolation to find estimates of the median and the quartiles. (6 marks)
- (c) Estimate the 37th percentile. (2 marks)
- Given further that the lowest price was £42 000 and the range of the prices was £690 000,
- (d) draw a box plot to represent the data. Show your scale clearly. (4 marks)
- In another town the median price was £149 000, and the interquartile range was £90 000.
- (e) Briefly compare the prices in the two towns using this information. (2 marks)

7. The random variable X , which can take any value from $\{1, 2, \dots, n\}$, is modelled by the discrete uniform distribution with mean 10.

- (a) Show that $n = 19$ and find the variance of X . (4 marks)
- (b) Find $P(3 < X \leq 6)$. (2 marks)

The random variable Y is defined by $Y = 3(X - 10)$.

- (c) State the mean and the variance of Y . (3 marks)

The model for the distribution of X is found to be unsatisfactory, and in a refined model the probability distribution of X is taken to be

$$f(x) = \begin{cases} k(x+1) & x = 1, 2, \dots, 19, \\ 0 & \text{otherwise.} \end{cases}$$

- (d) Show that $k = \frac{1}{209}$. (3 marks)
- (e) Find $P(3 < X \leq 6)$ using this model. (3 marks)