

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

1. (a) Briefly describe the difference between a census and a sample survey. **(1 mark)**
 (b) Illustrate the difference by considering the case of a village council which has to decide whether or not to build a new village hall. **(2 marks)**
 Given that the council decides to use a sample survey,
 (c) suggest suitable sampling units. **(1 mark)**
2. The number of copies of *The Statistician* that a newsagent sells each week is modelled by a Poisson distribution. On average, he sells 1.5 copies per week.
 (a) Find the probability that he sells no copies in a particular week. **(1 mark)**
 (b) If he stocks 5 copies each week, find the probability he will not have enough copies to meet that week's demand. **(2 marks)**
 (c) Find the minimum number of copies that he should stock in order to have at least a 95% probability of being able to satisfy the week's demand. **(3 marks)**
3. A die is rolled 60 times, and results in 16 sixes.
 (a) Use a suitable approximation to test, at the 5% significance level, whether the probability of scoring a six is $\frac{1}{6}$ or not. State your hypotheses clearly. **(6 marks)**
 (b) Describe how you would change the test if you wished to investigate whether the probability of scoring a six is greater than $\frac{1}{6}$. Carry out this modified test. **(4 marks)**
4. A continuous random variable X has the cumulative distribution function
- $$F(x) = \begin{cases} 0 & x < 4, \\ \frac{1}{84}(x^2 - 16) & 4 \leq x \leq 10, \\ 1 & x > 10. \end{cases}$$
- (a) Find the median value of X . **(2 marks)**
 (b) Find the interquartile range for X . **(4 marks)**
 (c) Find the probability density function $f(x)$ of X . **(3 marks)**
 (d) Sketch the graph of $f(x)$ and hence write down the mode of X , explaining how you obtain your answer from the graph. **(3 marks)**

STATISTICS 2 (A) TEST PAPER 1 Page 2

5. Lupin seeds are sold in packets of 15. On average, 9 seeds in a packet are green and 6 are red. Find, to 2 decimal places, the probability that in any particular packet there are
- (a) less than 2 red seeds, (3 marks)
- (b) more red than green seeds. (2 marks)
- The seeds from 10 packets are then combined together.
- (c) Use a suitable approximation to find the probability that the total number of green seeds is more than 100. (7 marks)

6. Patients suffering from 'flu are treated with a drug. The number of days, t , that it then takes for them to recover is modelled by the continuous random variable T with the probability density function

$$f(t) = \frac{3t^2(4-t)}{64} \quad 0 \leq t \leq 4,$$

$$f(t) = 0 \quad \text{otherwise.}$$

- (a) Find the mean and standard deviation of T . (7 marks)
- (b) Find the probability that a patient takes more than 3 days to recover. (4 marks)
- (c) Two patients are selected at random. Find the probability that they both recover within three days. (2 marks)
- (d) Comment on the suitability of the model. (1 mark)

7. In a certain field, daisies are randomly distributed, at an average density of 0.8 daisies per cm^2 . One particular patch, of area 1 cm^2 , is selected at random.

Assuming that the number of daisies per cm^2 has a Poisson distribution,

- (a) find the probability that the chosen patch contains
- (i) no daisies, (1 mark)
- (ii) one daisy. (1 mark)

Ten such patches are chosen. Using your answers to part (a),

- (b) find the probability that the total number of daisies is less than two. (4 marks)
- (c) By considering the distribution of daisies over patches of 10 cm^2 , use the Poisson distribution to find the probability that a particular area of 10 cm^2 contains no more than one daisy. (3 marks)
- (d) Compare your answers to parts (b) and (c). (2 marks)
- (e) Use a suitable approximation to find the probability that a patch of area 1 m^2 contains more than 8 100 daisies. (6 marks)