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1. (a) Explain what you understand by a census. (1)

Each cooker produced at GT Engineering is stamped with a unique serial number. GT Engineering produces cookers in batches of 2000. Before selling them, they test a random sample of 5 to see what electric current overload they will take before breaking down.

(b) Give one reason, other than to save time and cost, why a sample is taken rather than a census. (1)

(c) Suggest a suitable sampling frame from which to obtain this sample. (1)

(d) Identify the sampling units. (1)

(Total 4 marks)

Q1



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- 3. (a) State two conditions under which a Poisson distribution is a suitable model to use in statistical work. (2)

The number of cars passing an observation point in a 10 minute interval is modelled by a Poisson distribution with mean 1.

- (b) Find the probability that in a randomly chosen 60 minute period there will be
 - (i) exactly 4 cars passing the observation point,
 - (ii) at least 5 cars passing the observation point.(5)

The number of other vehicles, other than cars, passing the observation point in a 60 minute interval is modelled by a Poisson distribution with mean 12.

- (c) Find the probability that exactly 1 vehicle, of any type, passes the observation point in a 10 minute period. (4)



4. The continuous random variable Y has cumulative distribution function $F(y)$ given by

$$F(y) = \begin{cases} 0 & y < 1 \\ k(y^4 + y^2 - 2) & 1 \leq y \leq 2 \\ 1 & y > 2 \end{cases}$$

(a) Show that $k = \frac{1}{18}$. (2)

(b) Find $P(Y > 1.5)$. (2)

(c) Specify fully the probability density function $f(y)$. (3)



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7. (a) Explain what you understand by

(i) a hypothesis test,

(ii) a critical region.

(3)

During term time, incoming calls to a school are thought to occur at a rate of 0.45 per minute. To test this, the number of calls during a random 20 minute interval, is recorded.

(b) Find the critical region for a two-tailed test of the hypothesis that the number of incoming calls occurs at a rate of 0.45 per 1 minute interval. The probability in each tail should be as close to 2.5% as possible.

(5)

(c) Write down the actual significance level of the above test.

(1)

In the school holidays, 1 call occurs in a 10 minute interval.

(d) Test, at the 5% level of significance, whether or not there is evidence that the rate of incoming calls is less during the school holidays than in term time.

(5)

Lined area for student answers.



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8. The continuous random variable X has probability density function $f(x)$ given by

$$f(x) = \begin{cases} 2(x-2) & 2 \leq x \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Sketch $f(x)$ for all values of x . (3)

- (b) Write down the mode of X . (1)

Find

- (c) $E(X)$, (3)

- (d) the median of X . (4)

- (e) Comment on the skewness of this distribution. Give a reason for your answer. (2)



