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Muhammed Asif

Q1

(a) Mean and variance of binomial distribution is 4 and find n and p .

Mean:

Formula:

$$\mu = E(x) = np$$

$$n = 4$$

$$p = 4$$

$$\mu = E(x) = 4 \times 4 = 16$$

$$\boxed{\mu = 16}$$

Variance:

Formula:

$$\sigma^2 = \text{var}(x) = np(1-p)$$

$$= 4 \times 4(4-4)$$

$$= 16(-3)$$

$$\boxed{\sigma^2 = -48}$$

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c) Define critical region.

Ans A critical region, also known as the rejection region, is a set of values for the test statistic for which the null hypothesis is rejected. i.e. if the observed test statistic is in the critical region then we reject the null hypothesis and accept the alternative hypothesis.

(d) Write the properties of t-distribution.

The t-distribution has the following properties:

- * The mean of the distribution is equal to 0.
- * The variance is equal to $v/(v-2)$, where v is the degree of freedom (see last section) and $v \geq 2$.
- * The variance is always greater than 1, although it is close to 1 when there are many degree of freedom.

(e) Write a short note on analysis of variance.

Ans Analysis of variance, or ANOVA, is a statistical method that separates observed variance data into different

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Components to use for additional tests.

A one-way ANOVA is used for three or more groups of data, to gain information about the relationship between the dependent and independent variables.

If no true variance exists between the groups, the ANOVA's F -ratio should equal close to 1.

(P) Define R.B.D.

Ans. Specifically, a randomized block design, (R.B.D) or RBD splits up experimental units into groups, or blocks, of equal size, and then assigns a treatment to each group randomly.

(Q) Define statistical quality control.

Ans. Statistical quality control, the use of statistical methods in the monitoring and maintaining of the quality of products and services. One method, referred to as acceptance sampling, can be used when a decision must be made to accept or reject a group of parts or items based on the quality found in a sample.

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(h) Define the terms "chance causes and assignable causes".

Ans: Chance Causes:-

A process that is operating with only chance causes of variation present is said to be in statistical control. In other words, the chance causes are an inherent part of the process.

Assignable Causes:-

Assignable Causes is an identifiable specific cause of variation in a given process or measurement.

(i) Define traffic intensity?

Ans: $a = \lambda \cdot T$

where

λ = number of carried connections per unit.

T = mean duration of a connection or holding time.

Traffic intensity is a bare number but in order to emphasize the context, one often writes as its "unit" Erlang (E. erl).

(j) Write the characteristics of queuing theory.

Ans: Distribution of time between arrivals

Distribution of service time

Number of parallel servers.

Maximum number of customers a system can accommodate.

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Q2

(i) Derive mean and variance of binomial distribution.

1) Let "x" be a random variable with the binomial distribution $b(x; n, p)$. Then its mean is given by

$$E(x) = \mu = np$$

(ii) Let "x" be a random variable with the bi-nomial distribution $b(x; n, p)$. Then its variance is given by

$$\text{var}(x) = \sigma^2 = npq$$

(iii) Let "x" be a random variable with the bi-nomial distribution $b(x; n, p)$, then its standard deviation is given by

$$\sigma = \sqrt{npq}$$

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Q2

(b)

Ans

Let x denote number of cars which are hired out per day.
for poisson distribution mean $= m = 1.5$

$$P(X = x) = \frac{e^{-m} \cdot m^x}{x!} = \frac{e^{-1.5} \cdot 1.5^x}{x!}$$

1) $P(\text{neither car is used})$

$$P(x=0) = \frac{e^{-1.5} \cdot 1.5^0}{0!} \\ \approx 0.2231$$

2) $P(\text{some demand is refused}) = P(\text{Demand is more than 2 cars per days})$

$$P(x > 2)$$

$$= 1 - P(x \leq 2)$$

$$= 1 - [P(x=0) + P(x=1) + P(x=2)]$$

$$= 1 - \left[\frac{e^{-1.5} \cdot 1.5^0}{0!} + \frac{e^{-1.5} \cdot 1.5^1}{1!} + \frac{e^{-1.5} \cdot 1.5^2}{2!} \right]$$

$$= 1 - e^{-1.5} \left[1 + 1.5 + \frac{2.25}{2} \right] = 0.1912$$

Proportion of day on which neither car is used $= 0.2231 = 22.31\%$

And Proportion of day on which some demand is refused $= 0.1912 = 19.12\%$

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Q3

Suitable chart:

