



Date: 02-05-2025

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A

Answer ANY FOUR of the following

4 x 10 = 40 Marks

1. Explain the various data measurement in statistics with examples.
2. A researcher is studying the number of customer complaints received at a call centre. Based on past data, the average number of complaints per day is believed to be $\lambda = 4$. However, after implementing a new customer service policy, the researcher wants to test whether the average number of complaints has increased. A random sample of $n = 10$ days is taken, and the number of complaints recorded per day is as follows: $X_1=6, X_2=5, X_3=7, X_4=4, X_5=5, X_6=6, X_7=3, X_8=5, X_9=6, X_{10}=7$. Use the **Score Test** to determine whether there is significant evidence to reject H_0 at $\alpha = 0.05$ significance level.
3. Explain the following with examples:
 - a). Case-Control study
 - b). Cohort Study
 - c). Clinical Trails
 - d) Cross-Sectional Study.
4. Describe the components of GLMs (Random component, systematic component and link function).
5. A clinical trial records the response (Success = 1, Failure = 0) of 100 patients before and after receiving a new drug. The results are:

Response Before	Response After	Count
Recovery	Recovery	50
Recovery	No recovery	15
No recovery	Recovery	25
No recovery	No recovery	10

Estimate the **marginal proportion** of success before and after treatment.

6. Explain the statistical model of multinomial and ordinal logistic regression model.
7. What are the measures used for the goodness of fit in logistic regression model. Explain in detail.
8. Two judges evaluate 100 research papers as either "Accept" or "Reject." Their ratings are given in the table below:

	Judge B: Accept	Judge B: Reject	Total
Judge A: Accept	30	10	40
Judge A: Reject	15	45	60
Total	45	55	100

- (a) Calculate the **Observed Agreement**.
- (b) Calculate the **Expected Agreement** under chance agreement.
- (c) Compute Cohen's Kappa (κ) and interpret the result.

SECTION B

Answer ANY THREE of the following

3 x 20 = 60 Marks

9. a) Derive the Wald test statistic and confidence interval for Poisson distribution.
- b) A supermarket manager wants to determine whether the average number of customers arriving at the checkout counter per hour has increased from the historical average $\lambda=20$ customers per hour. In a random sample of $n=40$ hours, the total number of customers observed is $Y=900$. Test the null hypothesis $H_0: \lambda=20$ at a significance level of $\alpha=0.05$, and calculate a 95% confidence interval for λ .
10. Derive the test statistic for Likelihood Ratio test for binomial distribution and hence estimate the confidence interval.
11. Compute Concordant pairs and Discordant pairs for the following cross-classification table on job satisfaction (Y) by income (X).

Income (\$)	Job Satisfaction			
	Extremely Dissatisfied	Little Dissatisfied	Moderately Satisfied	Very Satisfied
<15000	1	3	10	6
15000 - 25000	2	3	10	7
25000 - 40000	1	6	14	12
>40000	0	1	9	11

12. a) Estimate the likelihood ratio test for multinomial distribution
- b) Estimate M.L.E of parameters of multinomial distribution.
13. Explain the following:
- a). Gamma test and its properties b) Yule's Q test and its properties.
- c) Estimate the sensitivity and specificity for the following data using KS Statistics:

Predicted Probability	0.42	0.56	0.37	0.99	0.72	0.76	0.12	0.85	0.45	0.56	0.32	0.19	0.95
Y	0	1	0	1	1	1	0	0	0	1	0	0	1

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