

M. SC. (APPLIED STATISTICS)
(MSCAST)

Term-End Examination

December, 2025

MST-017 : APPLIED REGRESSION ANALYSIS

Time : 3 Hours

Maximum Marks : 50

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **four** questions from the remaining question nos. 2 to 6.*

(iii) *Use of scientific calculator (non-programmable) is allowed.*

(iv) *Symbols have their usual meanings.*

-
-
1. State whether the following statements are True or False. Give reasons in support of your answers : 5×2=10

- (a) The model $Y = \beta_0 + \beta_1^2 X_1 + \beta_2^3 X_2 + \varepsilon$ is a linear model.
- (b) If there exists a perfect multicollinearity, $|X'X| = 1$.
- (c) The identity link function is used to model the binary response variable.
- (d) We define 5 indicator variables for a qualitative explanatory variable with 6 categories.
- (e) A data point whose removal from the dataset causes a large change in the estimated model parameters, that point is known as a leverage point.
2. (a) For a simple linear regression model, the following values are given :
- $$n = 15, p_0 = 80, \beta_1 = 1.5, \bar{x} = 32,$$
- $$SS_x = 400, \text{ and } \sigma^2 = 0.80$$
- (i) Determine the standard errors of β_0 and β_1 .

- (ii) Test the significance of β_0 and β_1 at 5% level of significance. (Given

$$t_{(13)}, 0.025 = 2.160) \quad 7$$

- (b) Mention the assumptions of a simple linear regression model. 3

3. The following data shows the total sales (in ₹) and price of a product (in ₹) of 12 products : 10

S. No.	Sales	Price
1	75	12800
2	32	4600
3	112	17500
4	45	7600
5	64	12000
6	170	20840
7	150	19800
8	212	23100
9	135	19200
10	235	23500
11	274	25000
12	295	25800

- (i) Fit a simple linear regression model.
 - (ii) Apply the logarithmic transformation to linearise the model.
 - (iii) Draw scatter plots for both models and interpret them.
4. The observed (y) and predicted ($\hat{y}$) values of the response variable are given in the following table : 10

y_i	$\hat{y}_i$
85.4	92.79
94.2	92.32
95.3	93.93
94.7	93.05
89.4	93.49
99.5	94.33
99.8	91.84
90.9	93.26
89.2	93.53
92.7	92.98
94.8	92.87
94.1	92.98
91.6	94.66
87.1	92.98
101.3	94.99

Obtain the autocorrelation ρ^* . Test the autocorrelation of the residuals for the fitted regression model using the Durbin-Watson test.

[Given that $d_L = 1.08$ and $d_U = 1.36$]

5. (a) For a fitted simple logistic model, the following information is provided :

Amount of Dose (x_i)	Number of cured patients (y_i)	Total number of patients (n_i)	π_i
5	24	60	0.40
10	18	48	0.35
15	12	40	0.31
20	20	80	0.27
25	26	104	0.24

Test the significance of fitted logistic model at 5% level of significance. (Given

$$\chi^2_{(3)} 0.05 = 7.8).$$
 7

(b) Explain the Poisson Regression with example. 3

6. Differentiate between the following with examples : 4+6

- (i) Influence and leverage points.
- (ii) Baseline and adjacent categories logit models.

× × × × ×