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MST–017

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.

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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 :

$n = 15,\ p_0 = 80,\ \beta_1 = 1.5,\ \bar{x} = 32,$

$SS_x = 400,$ 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 $t_{(13)}, 0.025 = 2.160$) 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 (y) values of the response variable are given in the following table : 10

y_i	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 in 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.

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