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RST-004

**Ph. D. IN STATISTICS
(PHDSTAT)**

Term-End Examination

June, 2022

RST-004 : ADVANCES IN STATISTICS

Time : 3 Hours

Maximum Marks : 100

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

(ii) *Attempt any **four** questions from Q. Nos. 2 to 7.*

(iii) *Non-programmable scientific calculator is allowed.*

(iv) *Symbols have their usual meanings.*

1. (a) State whether the following statements are True or False. Give reasons in support of your answer : 5×2=10

(i) The test statistic for testing the significance of regression coefficient

$$"b" \text{ is } F = \frac{\hat{b}}{\text{SE}(\hat{b})} .$$

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- (ii) Residual in regression analysis is the absolute difference between the observed value of the response variable and the predicted value of the response variable.
 - (iii) Uniform priors come under the category of non-informative priors.
 - (iv) Posterior distribution provides prior information about the parameter.
 - (v) In residual plot, the residual values are plotted against the observed values of the response variable.
- (b) Write short notes on the coefficient of determination (R) and adjusted R^2 . 10
2. Describe various methods of selection of variable in regression model. 20
3. (a) Let X_1, X_2, \dots, X_n be a random sample taken from normal distribution with mean μ and variance σ^2 . Find Jeffrey's prior. 15
- (b) Describe inversion method of generating random numbers. 5

4. (a) Describe accept-reject method of generating observations. Also write its algorithm. 10
- (b) Differentiate between classical and Bayesian approaches. 5
- (c) Define prior and posterior distributions in Bayesian analysis. 5
5. Let X_1, X_2, \dots, X_n be a random sample taken from Poisson distribution with parameter λ . If prior distribution of λ follows gamma distribution with parameters α and β , then find : 20
- (i) posterior distribution of λ
- (ii) Bayes estimate of λ under SELF and LINEX loss functions.
6. A company wants to test the effect of age and gender on the productivity (in terms of units produced by the employee per month). The HR manager has taken a random sample of 10 employees and collect information as follows :

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Employee	Productivity (in units)	Age (in years)	Gender (0 for female and 1 for male)
1	35	40	1
2	26	34	0
3	25	28	0
4	36	34	1
5	21	26	1
6	26	31	1
7	36	38	1
8	27	31	1
9	25	31	0
10	30	38	0

Fit a regression model. Also estimate productivity of a male employee of 35 years.

7. Write short notes on the following : 20
- (i) Residual plot
 - (ii) Multiple linear regression
 - (iii) Assumptions of regression analysis