No. of Printed Pages : 4

RST-004

Ph.D. IN STATISTICS
(PHDSTAT)

Term-End Examination

00175

June, 2018

RST-004 : ADVANCES IN STATISTICS

Time : 3 hours *Maximum Marks : 100*

Note : *Question no. 1 is* ***compulsory.*** *Attempt any* ***four*** *questions from questions no. 2 to 7. Non-programmable scientific calculator is allowed. Symbols have their usual meanings.*

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1. (a) State whether the following statements are *True* or *False*. Give reasons in support of your answers : *4×2=8*

(i) The form of Entropy Loss Function is

$$L(\Delta) \propto \Delta^{p+1} - \log \Delta^{p} - 1$$

where $\Delta = \hat{\theta}/\theta$.

(ii) If $X \sim \exp(\theta)$ and prior distribution of θ is Gamma (α, β) distribution, then posterior distribution of θ is Gamma

$$(n + \alpha, \sum_{i=1}^{n} x_i + \beta) \text{ distribution.}$$

(iii) In regression analysis, if SS_{Reg} = 2·82 and SS_{Res} = 4·26, then coefficient of determination is 0·398.

(iv) For testing the significance of a multiple regression model, t-test is used.

(b) Differentiate between the following, with suitable examples : *3×4=12*

(i) Forward and Backward selection methods

(ii) Residual and Normal probability plots

(iii) Linear and 0 – 1 loss functions

2. (a) Define prior and posterior distributions in Bayesian analysis. *5*

(b) Let X_1 and X_2 be random samples drawn from N(θ, 1). If prior distribution of θ is N(μ, 1), then obtain *10+5*

(i) Posterior distribution of θ.

(ii) Bayes estimator of θ under precautionary loss function.

3. (a) Explain loss function. Define *8*

(i) Squared error loss function

(ii) Linear exponential loss function

(b) Let $X_1, X_2, \ldots, X_n$ be a random sample from exp(θ) distribution and prior distribution of θ be Gamma (α, β) distribution. Obtain Bayes estimate of θ under

(i) Squared error loss function

(ii) Asymmetric loss function *12*

4. The fuel consumption and the average speed of a car were recorded from 10 trips of the same distance covered under similar road conditions using same car. The data are given below :

Trip	Petrol Consumption (in litres)	Speed (km/hr)
1	14	50
2	10	40
3	15	45
4	16	55
5	11	35
6	16	60
7	12	55
8	14	50
9	12	40
10	10	30

(a) Fit a regression model.

(b) Test whether speed has any significant effect on petrol consumption at 5% level of significance.

(c) Find 95% confidence interval for the slope.

It is given that *10+6+4*

$t_{(9),0\cdot05} = 1\cdot833$, $t_{(9),0\cdot025} = 2\cdot262$,

$t_{(8),0\cdot05} = 1\cdot860$, $t_{(8),0\cdot025} = 2\cdot306$.

5. Describe various assumptions in regression analysis. *20*

6. (a) Write any five properties of regression coefficients. *10*

   (b) Describe Jeffrey's Prior. Let $X_1, X_2, \ldots, X_n$ be a random sample from exponential distribution with mean $1/\theta$. Construct Jeffrey's Prior. *10*

7. Write detailed notes on any ***two*** of the following : *10+10*

   (a) Residual Analysis

   (b) Use of ANOVA in Regression Analysis

   (c) Bayes Theorem