

25/5/24



DOON UNIVERSITY, DEHRADUN UTTARAKHAND, INDIA  
End-term Examination, Academic Year: 2023-2024(Even Semester).  
Department of Phys. /Chem. /Comp. Science -Under  
Department of Mathematics, School of Physical Sciences,  
Academic Programme: Integrated M.Sc. 1<sup>st</sup> Year, 2<sup>nd</sup> semester  
Course code and Paper title: MAG-152 Generic Mathematics (Econometrics).

151

Time Allowed: 1:30 Hours

Maximum Marks: 50

Note: Attempt all five questions in Section A. Each question carries 2 mark.  
Attempt any four questions in Section B. Each question carries 5 marks.  
Attempt any two questions in Section C. Each question carries 10 marks.

SECTION: A

(Very Short Answer Type Questions)

(Marks:5X2=10)

1. What is Gauss-Markov theorem.
2. What does mean by sampling distribution of mean?
3. Write the equation of the multiple regression linear model for the case of 2 and k independent or explanatory variables.
4. Write short note on t-test.
5. Define partial correlation coefficients and write their formulas for two explanatory variables  $X_1$ ,  $X_2$  and one Dependent variable  $Y$ .

SECTION: B

(Short Answer Type Questions)

(Marks: 4X5=20)

6. Let  $x$  be a random variable having probability density function as  $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$ ,  $-\infty < x < \infty$ . Find the mean and variance of the  $x$ ; and show that the area under the normal curve is one .
7. State each of the five assumptions of the classical regression model (OLS) and give an intuitive explanation of the meaning of them.
8. Find  $R^2$  and hence  $r$  for the OLS regression equation estimated in Problem using  $\sum \hat{y}_i^2 = 3568.7428$ ,  $\sum y_i^2 = 3684$ .
9. Write short notes on multicollinearity, heteroscedasticity.

10. Determine whether the following models are linear in the parameters, or the variables, or both. Which of these models are linear regression models?

Model	Descriptive Title
a. $Y_i = \beta_1 + \beta_2(1/X_i) + u_i$	Reciprocal
b. $Y_i = \beta_1 + \beta_2 \ln X_i + u_i$	Semilogarithmic
c. $\ln Y_i = \beta_1 + \beta_2 X_i + u_i$	Inverse semilogarithmic
d. $\ln Y_i = \ln \beta_1 + \beta_2 \ln X_i + u_i$	Logarithmic or double logarithmic
e. $\ln Y_i = \beta_1 - \beta_2(1/X_i) + u_i$	Logarithmic reciprocal

SECTION: C  
(Long Answer Type Questions)

(Marks: 2X10=20)

11. A random sample of  $n = 10$  flashlight batteries with a mean operating life  $\bar{X} = 5h$  and a sample standard deviation  $s = 1h$  is picked from a production line known to produce batteries with normally distributed operating lives. find the 95% confidence interval for the unknown mean of the working life of the entire population of batteries. The value of  $\pm t_{0.025}$  so that 2.5% of the area is within each tail for  $n - 1 = 9$  df (degrees of freedom) =  $\pm 2.262$ .
12. Define the coefficient of determination. Show that  $TSS = ESS + RSS$ , and prove that  $R^2 = 1 - \frac{RSS}{TSS}$ .
13. Following table gives the bushels of corn per acre,  $Y$ , resulting from the use of various amounts of fertilizer  $X_1$ , and insecticides  $X_2$  both in pounds per acre, from 1971 to 1980.

Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
$Y$	40	44	46	48	52	58	60	68	74	80
$X_1$	6	10	12	14	16	18	22	24	26	32
$X_2$	4	4	5	7	9	12	14	20	21	24

Find the estimators  $\hat{\beta}_1$ ,  $\hat{\beta}_2$ ,  $\hat{\beta}_0$ , and three variable linear regression model.