

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
FIRST SEMESTER 2022-23

COURSE NO: ECON F 241
DATE: 02 NOV 2022

COURSE TITLE: ECONOMETRIC METHODS
TIME: 90 min

MID SEMESTER TEST (REGULAR) (CLOSED BOOK)

INSTRUCTIONS:

- The exam consists of eight questions (both short answer and long answer) with sub questions. Students are required to answer ALL questions.
- Answer all questions in the exam booklet provided. Be sure your ID number and Name is written clearly on the space provided in the answer sheet.
- Highlight the final answer.
- Please write legibly and answer to the point.
- This exam is CONFIDENTIAL. This built in question answer paper must be submitted in its entirety; otherwise your exam will not be marked.
- You need to justify your answers carefully and show your work in order to get full credit.
- Unless otherwise stated, standard assumptions of the linear/multiple regression model may be used.
- Make sure to clearly state the regularity assumptions and theoretical results you are using to solve each exercise.
- Use of electronic devices, mobile phones, laptops in any form (other than calculator) is prohibited.

MARKING: The marks for each question are indicated in parentheses. Total marks for the exam equal 30.

SECTION – A - Answer the following short questions. Answer to the point.

(Question A1: 5 x 2.0: 10.0 Marks and Questions A2 to A5: 4 x 2.0 = 8.0 Marks – Total Marks: 18.0 Marks)

A1 Is the following statement true or false? Explain. **Answers without valid reasoning receive no credit.**

a) “The Econometric model $Y_i = (B_0 + B_1X_i) + u_i$ satisfies all the classical assumptions of the linear regression model.”

b) Because omitted variables cause bias, it is always recommended to include all available explanatory variables in a regression.

c) "Increasing sample size changes the sampling error variance of a regression and leads to larger standard errors for the estimated coefficients."

d) "The 95% confidence interval around the mean prediction is constructed by using the standard error of the estimated slope from the sample regression function."

e) "If I always provide an estimate of 37 for whatever sample I obtain, this estimator is the most efficient because its variance is zero."

A2 What do the no perfect multicollinearity and zero conditional mean assumption mean in the basic assumption of linear regression model? What are the consequences if they are violated?

A3 What are the four factors that affect the variance of individual slope coefficient estimators under OLS for a multiple regression model? How do they affect the variance?

A4 A prospective author of an introductory level Econometrics book is interested in the number of pages in introductory level econometrics books. A random sample of $n = 15$ introductory level econometrics books is selected yielding a sample average of 972 pages with a sample standard deviation of 85 pages. Suppose the number of pages in an introductory level Econometrics book is normally distributed.

- a) Calculate a 99% confidence interval for the mean number of pages in an introductory level Econometrics book.
- b) Does the confidence interval in part a) suggest that the mean length of an introductory level Econometrics book is more than 1000 pages? Explain

A5 Suppose that the true model is:

$$Y_t = \beta_0 + \beta_1 X_t^* + v_t$$

However, data on X_t^* are not available. Instead, you use X_t , $X_t = X_t^* + w_t$ as explanatory variable, where w_t is independent of all other variables in the model, to estimate the model with Ordinary Least Squares (OLS).

Is that the OLS estimates are biased and consistent or not? Show your work and explain your answer.

SECTION – B - Answer the following questions. (3 x 4.0 marks: 12.0 marks)

- B1 In Professor Rao's econometrics course the correlation between the students' total scores prior to the final examination and the final examination score is $r = 0.6$. The pre-exam totals for all students in the course have mean 75 and standard deviation 30. The final exam score has mean 75 and standard deviation 8. Professor Rao has lost Aditya's final exam but knows that his total before the exam was 300. He decides to predict his final exam score from his pre-exam total.
- What is the slope of the least-square regression line of final exam scores on pre-exam total scores in this course? What is the intercept?
 - Use the regression line to predict Aditya's final exam score.
 - Suppose we know (but the professor and Aditya do not know) that Aditya's true final score is 80, what is the residual in the prediction?
 - Aditya doesn't think this method accurately predicts how well he did on the final. Use r^2 to argue that his actual score could have been much higher

B2 The following sums were obtained from 10 pairs of observations on Y and X:

$$\sum X_i = 40 \quad \sum Y_i = 10 \quad \sum X_i^2 = 200 \quad \sum X_i Y_i = 60 \quad \sum Y_i^2 = 30 \quad N = 10$$

(The 95% critical value of test statistic is 2.31)

- Estimate the Ordinary Least Squares (OLS) intercept and slope coefficients of regression of Y on X.
- Calculate the residual sum of squares (RSS) and equation standard error $\hat{\sigma}$ (i.e. σ cap).
- Find the 95% confidence interval for the slope coefficient.
- Test the hypotheses that the slope coefficient is zero and one half.
- What is the best prediction of Y when X is 10? Why?

B3 An Econometrician run the multiple regressions and got the following output:

| Dependent Variable: S | | | | | |
|----------------------------|-------------|-----------------------|-------------|--------|--|
| Method: Least Squares | | | | | |
| Date: 02/28/02 Time: 10:04 | | | | | |
| Sample: 1 38 | | | | | |
| Included observations: 38 | | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. | |
| C | 9.223923 | 1.935467 | 4.765736 | 0.0000 | |
| T | -0.786568 | 0.590256 | -1.332588 | 0.1918 | |
| E | 7.906074 | 3.660143 | 2.160045 | 0.0381 | |
| P | 0.000408 | 0.000495 | 0.823516 | 0.4161 | |
| H | -0.018971 | 0.002674 | -7.094425 | 0.0000 | |
| R-squared | 0.709460 | Mean dependent var | 8.438421 | | |
| Adjusted R-squared | 0.674243 | S.D. dependent var | 2.621777 | | |
| S.E. of regression | 1.496382 | Akaike info criterion | 3.766057 | | |
| Sum squared resid | 73.89229 | Schwarz criterion | 3.981529 | | |
| Log likelihood | -66.55509 | F-statistic | 20.14541 | | |
| Durbin-Watson stat | 2.146911 | Prob(F-statistic) | 0.000000 | | |

- Your friend expects the coefficient of P to be positive. Carry out the formal hypothesis statement, test the hypothesis by using the 5% level of significance, and make your conclusion. The 5% significant level of critical test statistic value is **1.697**
- Your friend also argues that for every car at least should have 8.5 units of drag for safety in the road. Construct the confidence interval for the coefficient of E, carry out the hypothesis statement and test by using the 1% level of significance and make your conclusion. The critical value of the test statistic at 0.01, 33df is **-2.457**.
- Explain why you need to use the F test. What is your conclusion from the F hypothesis test? The critical value of $F_{(0.05, 4, 33)} = \mathbf{2.69}$.

Space for Rough Work