

International Islamic University Chittagong  
Department of Economics & Banking  
Semester End Examination  
Program: BSS(Hons.) in E&B  
Semester: Spring-2023

Course Title **Econometrics: Methods and Applications**  
Course Code: **ECON-4802**

Time: 2.5 Hours  
Full Marks: 50

[NB: Answer the following questions. All parts of a question must be answered serially. Figures in the right margin indicate full marks.]

QN	Description of Question	Marks	CLOs & PLOs	Cognitive Learning
1(a)	<p>Consider the following regression model</p> $y_i = \beta_1 + \beta_2 educ + \beta_3 male + \beta_4 female + e_i$ <p>Where, male and female are the dummy variables. Can you estimate the above regression model? Why or why not? Suggest a possible regression model to estimate the equation.</p>	3	CLO-3 PLO-6	Analyze
1(b)	<p>What is reference group including a dummy explanatory variable in regress analysis?</p>	1		Remember
1(c)	<p>Using data from 200 workers, we estimated the following regression equation:</p> $WAGE = -3.79 + 0.93EDUC + 0.11EXPER - 2.41FEMALE + e$ <p style="text-align: center;">T-stat    =(-6.12)    (11.69)    (6.15)    (-6.12)</p> <p>Note that education and experience are measured in years and wage is measured in taka. Female is a dummy variable that takes a value 1 for female and 0 otherwise.</p> <p>i. Interpret the estimated coefficient of the dummy variable female in the above regression and test if the estimated coefficient is statistically significant at the 1% level of significance.</p> <p>ii. Consider the following wage equation</p> $WAGE = \alpha + \beta_1 EDUC + \beta_2 EXPER + \delta Female + e$ <p>Define the slope dummy variables with respect to Female and incorporate these slope dummy variable in equation stated above. Interpret the coefficients of the slope dummy variables.</p>	6		Evaluate
2(a)	<p>Explain the ways to capture the nonlinear relationships in a regression model.</p>	3		Understand
2(b)	<p>Consider the following wage equation:</p> $WAGE = \beta_0 + \beta_1 EDUC + \delta_1 BLACK + \delta_2 Female + \gamma(BLACK * FEMALE) + e$ <p>Where Black and female are the dummy variables. Now you are asked to examine whether there is a wage differential between south and the rest of the country. Now</p> <p>(i) Formulate the new regression model to test the wage differentials</p> <p>(ii) Formulate the null and alternative hypothesis to test either wage differential exist or not.</p> <p>(iii) Compute the relevant test to examine the equivalence of two regressions that are formulated in (i). (Note that <math>SSE_R=29308</math>, <math>SSE_U=29101</math> and <math>N=10</math>)</p> <p>(iv) Comment on your findings.</p>	7	CLO-3 PLO-6	Apply

- 3(a) Explain the meaning of heteroskedasticity with example. Interpret the two consequences of heteroscedasticity. 4 CLO-3 PLO-6 Evaluate
- 3(b) Consider a linear model to explain monthly food consumption: 2 Analyze
- $$food = \beta_0 + \beta_1 income + e$$
- Where the  $e_i$  are independent errors with  $E(e_i) = 0$  and  $var(e_i) = \sigma^2 x_i^2$ . Write the transformed regression equation that has a homoskedastic error term.
- 3(c) Explain the ways to detect the heteroskedasticity with appropriate examples. 4 Analyze
- OR**
- 3(a) In a regression of average wage (W, Tk), on the number of employees (N) for a random sample of 30 firms, the following regression results were obtained: 4 CLO-4 PLO-4 Evaluate
- $$\widehat{W} = 7.5 + 0.09N$$
- $$\widehat{W}/N = 0.08 + 7.8(1/N)$$
- i) How do you interpret the two regression?  
 ii) What is the author assuming in going from first equation to second one? Was he/she worried about heteroskedasticity? How do you know?  
 iii) Can you relate the slopes and intercepts of the two models?
- 3(b) "GLS estimators can be viewed as weighted least squares estimator". Explain the statement with an appropriate example. 2 Analyze
- 3(c) State with brief reason whether the following statements are true, false or uncertain: 4 Analyze
- Heteroskedasticity does not destroy the unbiasedness and best properties of OLS estimators.
  - If heteroskedasticity is present, the conventional t and F tests are still valid.
- 4(a) What is dynamic relation? How can you introduce the dynamic relation on your regression model? Illustrate with proper example. 3 Evaluate
- 4(b) Describe the properties of an AR(1) error. 5 CLO-5 PLO-5 Evaluate
- 4(c) Write the consequences of autocorrelation. 2 Understand
- 5(a) The following least squares residuals come from a sample of size T = 12 8 CLO-5 PLO-5 Analyze
- | t           | 1    | 2    | 3     | 4    | 5     | 6    | 7    | 8     | 9     | 10   | 11    |
|-------------|------|------|-------|------|-------|------|------|-------|-------|------|-------|
| $\hat{e}_t$ | 0.38 | -0.2 | -0.05 | 0.35 | -0.09 | 0.07 | 0.39 | -0.03 | -0.65 | 0.95 | -0.85 |
- Use a hand calculator to compute the sample autocorrelations  $r_1, r_2, r_3$ .
- Test whether  $r_1, r_2$ , and  $r_3$  is significantly different from zero. Sketch the first three bars of the correlogram. Include the significance bounds.
- 5(b) Find the D-W test statistic d from your answer of 5(a). Comment on your answer. 2 CLO-5 PLO-5 Analyze
- OR**
- 5(a) How can you transform a model with AR(1) error in a non-linear regression model to remove the autocorrelation. 3 Analyze
- 5(b) 'The AR(1) model can be viewed as a special case of ARDL model'. Do you agree with this statement? Justify your answer. 3 Analyze
- 5(c) Illustrate any two tests to detect autocorrelation. 4 Analyze