Mid-term examination, Spring-2022
Department of Economics & Banking

Mid-term examination, Spring-2022 Program: BSS (Hons) in Economics & Banking
Course Code: ECON-4802 Course Title: Econometrics: Methods and Applications
Time: 1.5 hours *Full Marks: 30*

[Answer any Three of the following questions. All parts of a question must be answered sequentially. Figures in the right margin indicate full marks.]

QN	Description of Questions	Marks
1(a).	Explain the meanings of the assumptions for the multiple regression models.	3.0
1(b).	Consider the following multiple regression model	7.0

$$y_i = \alpha_1 + \alpha_2 x_{2i} + \alpha_3 x_{3i} + e_i$$

with the three observations on y_i, x_{2i}, and x_{3i} given in Table. Use your hand calculator to answer the following questions:

i) Find least squares estimates.
ii) Find the least squares residuals.
iii) Find the variance estimate $\hat{\sigma}^2$.
iv) Find the standard error for $\hat{\alpha}_2$.

Table

y	x_2	x_3
1	1	2
3	2	1
8	3	-3

2(a). Consider the following model that relates the proportion of a household's budget spent on crude oil COIL to total expenditure TOTEXP, number of family member NM, and the number of automobiles in the household NA. 3+2+2+3

$$COIL = \alpha + \beta \ln(\text{TOTEXP}) + \gamma \text{NM} + \delta \text{NA} + e$$

Note that only households with one or two automobiles are being considered. Thus, NA takes only the values one or two. Output from estimating this equation appears in following table:

Dependent Variable: COIL
Included observations: 1519

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.092	0.182		0.634
ln(TOTEXP)	2.867		0.663	0.000
NM		0.0004	0.1650	0.8690
NA	0.2723	0.0723	3.7673	0.0002

R-squared		Mean dependent var	0.060
S.E. of regression 0.0633			S.D. dependent var
Sum squared resid	5.752896		

Fill in the following blank spaces that appear in this table.

(i) The t-statistic for $\hat{\alpha}$

(ii) The standard error for $\hat{\beta}$

(iii) The estimate $\hat{\gamma}$

(iv) R^2

(b) **Interpret** each of the estimated coefficients.

(c) **Estimate** a 95% interval estimate for δ. What does this interval tell you?

(d) **Test** the hypothesis that the budget proportion for crude oil does not depend on the number of members in the household. Can you suggest a reason for the test outcome?

3(a). **Distinguish** between t-test and F-test. 2.0

3(b). **Explain** the properties of the restricted least squares estimator. In particular, how do its bias and variance compare with those of the unrestricted least squares estimator? 3.0

3(c). From a sample of 45 firms, a researchers obtained the following regression results: 5.0

$$\widehat{log(salary)} = 4.32 + 0.28\log(sales) + 0.0174roe + 0.00024ros$$

Se = (0.32) (0.035) (0.0041) (0.00054)

SSE = 989.830 and S_y = 13.45222

Where, sales = salary of CEO

roe = return on equity in present

ros = return on firm's stock

and where figures in the parentheses are the estimated standard errors.

i) **Interpret** the estimated coefficient. Can you interpret the coefficient of roe and ros as elasticity coefficients? Why or why not?

ii) **Test** the overall significance of the model.

4(a). **Identify** the issues that need to be considered when choosing a regression model. 3.0

4(b) Consider the following regressions result: 7.0

$$\widehat{FI} = -7755 + 3212\,HE + 4777\,WE - 14311\,KL6$$

(se) =(11163) (797) (1061) (5004)

$$\widehat{FI} = -5534 + 3132\,HE + 4523\,WE$$

(se) =(11230) (803) (1066)

Where, FI= annual family income

HE= husband's years of education

WE= wife's years of education

KL6= number of children less than six years old

And where figures in the parentheses are the estimated standard errors.

Here, N = 35 observations. RESET applied to the second model yields F-values of 17.98 (for $\widehat{FI}^2$) and 8.72 (for $\widehat{FI}^2$ and $\widehat{FI}^3$). The correlation between HE and KL6 is 0.105 and WE and KL6 is 0.129. **Estimate** the following questions:

i) Perform the RESET test for the second model.

ii) Should KL6 be included in the model?

iii) What can you say about omitted-variable bias?

iv) What can you say about the existence of collinearity?