NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF ACCOUNTING, ECONOMICS AND FINANCE

QUALIFICATION: BACHELOR OF ECONOMICS	
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COURSE CODE: ECM712S	COURSE NAME: ECONOMETRICS
SESSION: JUNE 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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INSTRUCTIONS
1. Answer ALL the questions in section A and B
2. Write clearly and neatly.
3. Number the answers clearly.

PERMISSIBLE MATERIALS

1. Scientific calculator
2. Pen and Pencil
3. Ruler

THIS QUESTION PAPER CONSISTS OF _8_ PAGES (Including this front page)

SECTION A

MULTIPLE CHOICE QUESTIONS

1. After estimating by OLS a two regression model, the resulting residuals:
    a) Add up to zero if a constant term was included in the model.
    b) Are orthogonal to the model regressors only if a constant term was included in the model.
    c) Have constant variances and null covariances whenever the model errors have these properties.
    d) None of the above

2. What is the difference between R^2 and the adjusted R^2?
    a) the adjusted R^2 always increases as more independent variables are added to the model
    b) the adjusted R^2 is smaller in this case because the constant term is negative
    c) the adjusted R^2 adjusts explanatory power by the degrees of freedom
    d) None of the above

Use the following to answer questions 3-5:

Eight students are selected randomly and their present graduate GPA is compared to their undergraduate GPA and scores on standardized tests.

The data are shown below:

Present GPA	Undergraduate GPA	Standard Scores
3.89	3.77	700
3.03	2.75	460
3.34	3.11	550
3.85	3.75	690
3.93	4	720
3.06	2.92	420
3.69	3.7	670
3.91	3.88	670

SUMMARY OUTPUT

Regression Statistics				
Multiple R	0.992759			
R Square				
Adjusted R Square	0.9798			
Standard Error	0.05485			
Observations	8			

ANOVA

	df	SS	MS	F
Regression	2	1.027507	0.513754	170.7665
Residual	5	0.015043	0.003009	
Total	7			

	Coefficients	Standard Error	t Stat	P-value
Intercept	1.106574	0.205921	5.373784	0.003005
Undergr GPA	0.477483	0.162989	2.929546	0.03265
Std Scores	0.001339	0.000669	2.000745	0.101843

3. Write the regression equation, letting undergraduate GPA be variable 1 and standard scores be variable 2.

   a) $Y = 0.4775 X_1 + 0.0013392 X_2$

   b) $Y = 0.2059 + 0.1630 X_1 + 0.0006693 X_2$

   c) $Y = 1.1066 + 0.4775 X_1 + 0.0013392 X_2$

   d) none of the above is correct

4. At the 5% level of significance, are undergraduate scores and standard scores significant?

   a) both are significant

   b) neither are significant

   c) only undergraduate GPA is significant

   d) only standard scores are significant

5. Compute R^2.

   a) 99.4%

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b) 98.6%

c) 20.8%

d) very close to 100%

6. Dummy variables are used when:

    a) qualitative variables are involved in the model

    b) quantitative variables are involved in the model

    c) doing residual analysis

    d) making transformations of quantitative variables

7. Suppose you obtain the following fitted model: $\widehat{bwght} = \hat{\beta}_0 + \hat{\beta}_1 cigs + \hat{\beta}_2 faminc$, where *bwght* is child birth weight in ounces, *cigs* is the average daily number of cigarettes smoked per day by the mother during pregnancy, and *faminc* is family income measured in dollars. $\hat{\beta}_0$ is an estimate of

    a) how many cigarettes a day it takes to lower birth weight by 1 ounce, on average

    b) how many ounces an extra cigarette a day lowers birth weight, on average.

    c) how many ounces the average baby weighs, when cigs=0 and faminc=0.

    d) the standard error of cigs.

8. The interpretation of the slope coefficient in the model $lnY_i = \beta_0 + \beta_1 \ln X_i + u_i$ is as follows: a

    a) change in X by one unit is associated with a 100 % change in Y.

    b) 1% change in X is associated with a % change in Y.

    c) 1% change in X is associated with a change in Y of 0.01

    d) change in X by one unit is associated with a change in Y.

9. What will be the properties of the OLS estimator in the presence of multicollinearity?

    a) It will be consistent, unbiased and efficient

    b) It will be consistent and unbiased but not efficient

    c) It will be consistent but not unbiased

    d) It will not be consistent

10. Which one of the following statements best describes a Type II error?

    a) It is the probability of incorrectly rejecting the null hypothesis

    b) It is equivalent to the power of the test

    c) It is equivalent to the size of the test

    d) It is the probability of failing to reject a null hypothesis that was wrong

SECTION B [80 MARKS]

QUESTION ONE [25 MARKS]

A researcher is using data for a sample of 13 consumers to investigate the relationship between the annual consumption Y_i (measured in thousands of dollars per year) and annual income X_i (measured in thousands of dollars per year).

Year	Y(Consumption)	X(Income)
2003	3081.5	4620.3
2004	3240.6	4803.7
2005	3407.6	5140.1
2006	3566.5	5323.5
2007	3708.7	5487.7
2008	3822.3	5649.5
2009	3972.7	5865.2
2010	4064.6	6062
2011	4132.2	6136.3
2012	4105.8	6079.4
2013	4219.8	6244.4
2014	4343.6	6389.6
2015	4486	6610.7

a) $\sum_{i=1}^{N} Y_i = ?$; $\sum_{i=1}^{N} X_i = ?$; $\sum_{i=1}^{N} Y_i^2 = ?$; $\sum_{i=1}^{N} X_i^2 = ?$; $\sum_{i=1}^{N} X_i Y_i = ?$; $\sum_{i=1}^{N} x_i^2 = ?$; $\sum_{i=1}^{N} y_i^2 = ?$; $\sum_{i=1}^{N} x_i y_i = ?$ and $\sum_{i=1}^{N} \hat{y}_i^2 = ?$ [18 marks]

b) Use the information in part a) to compute OLS estimates of the intercept coefficient of β_1 and the slope of coefficient β_2. [4 marks]

c) Interpret the slope coefficient estimate you calculated in part (b) -- i.e., explain in words what the numeric value you calculated for β₂ means [2 marks]

d) Compute the value of R^2, the coefficient of determination for the estimated OLS sample regression equation. Briefly explain what the calculated value of R^2 means. [1 marks]

QUESTION TWO [30 MARKS]

a) Summary output table of $\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_i$ where y hat is the estimated consumption and x is consumer level of income

Multiple R	0.998906
R Square	i)
Adjusted R Square	0.997614
Standard Error	21.14699
Observations	13

ANOVA

	df	SS	MS	F	Significance F
Regression	1	2244134	2244134	5018.24	5.51E-16
Residual	11	iv)	447.1954		
Total	12	2249053			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	-158.409	56.99757	ii)	0.017929	-283.86
X(Income)	iii)	0.009905	70.83953	5.51E-16	0.679847

Use the information above to answer the following questions:

i) Calculate R^2 of this model [3 marks]

ii) Calculate the t statistics of the intercept [3 marks]

iii) Calculate slope coefficient or income parameter [3 marks]

iv) Calculate residual sum of square (RSS) [3 marks]

v) Is this model supposed to be an intercept present model or intercept absent model if adjusted $R^2 = 0.916624$ of the absent intercept model? [6 marks]

b) Given the following two summary output tables

Summary output table 1 [$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_i + \hat{\beta}_3 GD_i$]

Regression Statistics					
Multiple R	0.999074				
R Square	0.998149				
Adjusted R Square	0.987779				
Standard Error	20.40407				
Observations	13				

	df	SS	MS	Significance F	
Regression	2	2244890	1122445	2.17E-14	
Residual	10	4163.263	416.3263		
Total	12	2249053			

	Coefficients	Standard Error	t Stat	Lower 95%	Upper 95%
Intercept	-155.853	55.02788	-2.83226	-278.463	-33.2437
Xi	0.700197	0.009617	72.80746	0.678769	0.721626
GDi	0.000272	0.000202	1.347446	-0.00018	0.000723

Summary output table 2 [$\hat{Y}_i = \hat{\beta}_1 + \hat{\beta}_2 X_i$]

Multiple R	0.998906				
R Square	0.997813				
Adjusted R Square	0.999914				
Standard Error	21.14699				
Observations	13				

	df	SS	MS	Significance F	
Regression	1	2244134	2244134	5.5104E-16	
Residual	11	4919.149	447.1954		
Total	12	2249053			

	Coefficients	Standard Error	t Stat	Lower 95%	Upper 95%
Intercept	-158.409	56.99757	-2.77923	-283.86022	-32.9586
Xi	0.701647	0.009905	70.83953	0.67984663	0.723447

Did we make a mistake by including government debt (GD) in the model? Use evidence from the two summaries out table to justify your answer. [12 marks]

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QUESTION THREE   **[25 MARKS]**

a) With proper examples draw a distinction between mathematical and econometric model?

[4 marks]

b) Discuss the two types of error that arise in hypothetical conclusions   [4 marks]

c) Explain four differences between model with intercept and model without intercept

[8 marks]

d) Given $\hat{Y}_i = 7.6182 + 0.08145X_i$ and $\bar{Y} = 29$, $\bar{X} = 262.5$. Use elasticity of expenditure to interpret the model above.   [4 marks]

e) What do we mean by a linear regression model in parameters?   [5 marks]

All the best