



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.

Tel: +254(0) 799 529 958, +254(0) 799 529 959, +254 (0)712 524 293

Website: [www.must.ac.ke](http://www.must.ac.ke) Email: [info@mucst.ac.ke](mailto:info@mucst.ac.ke)

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## UNIVERSITY EXAMINATIONS 2021/2022

FOURTH YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF  
BACHELOR OF SCIENCE IN STATISTICS

### SMS 3452: ECONOMETRICS

DATE: JANUARY 2022

TIME: 2 HOURS

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**INSTRUCTIONS: Answer Question ONE and any other TWO questions.**

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#### QUESTION ONE (30 MARKS)

- a) Differentiate between the following terms
  - i. Indirect least squares and two stage least squares. (4 Marks)
  - ii. Laspeyres price index and paasche price index. (4 Marks)
- b) State three basic functions of econometrics. (3 Marks)
- c) Define the following terms.
  - i. Econometrics (2 marks)
  - ii. Heteroskedasticity (2 Marks)
  - iii. Autocorrelation (2 Marks)
  - iv. Perfect multicollinearity (2 Marks)
  - v. Simultaneous equation system (2 Marks)
  - vi. Structural equations (2 Marks)
  - vii. Reduced –form equations (2 Marks)
- d) What is meant by a distributed lag model. (2 Marks)
- e) State three general stages involved in econometric research. (3 Marks)

## QUESTION TWO (20 MARKS)

- a) A certain clinic ordered the following items in 2019 and 2020. Prices and quantities are given as follows

Item	2019		2020	
	Price	Quantity	Price	Quantity
Syringes (dozen)	670	150	695	135
Cotton Swabs (box)	135	60	145	65
Patient record forms (pad)	510	8	625	12
Childrens's Tylenol (bottle)	450	25	495	30
Computer Paper (Realm)	1195	6	1320	8
Thermometers	790	4	900	2

- Calculate the unweighted aggregate price index for 2020 with a base year of 2019.  
(2 Marks)
  - Compute the weighted aggregate price index for 2020. Using 2019 as base year.  
(2 Marks)
  - Compute the Laspeyres price index and the paasche price index for 2020 using 2019 as the base year.  
(4 Marks)
- b) The table below gives 50kg base of maize per acre resulting from the use of various of amounts of fertilizer and pesticides per acre from 2011 to 2020.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Yields (y)	40	44	46	48	52	58	60	68	74	30
Fertilize ( $x_1$ )	6	10	12	14	16	18	22	24	26	32
Pesticide ( $x_2$ )	4	4	5	7	9	12	14	20	21	24

- i. If  $\hat{y}_i = \hat{b}_0 + \hat{b}_1 x_1 + \hat{b}_2 (x_2)$  find the values of  $\hat{b}_0$ ,  $\hat{b}_1$  and  $\hat{b}_2$  (12 Marks)

### QUESTION THREE (20 MARKS)

a) Transform the following non-linear function into linear functions.

i.  $Y = b_0 e^{b_1} e^{\mu}$  (2 Marks)

ii.  $Y = b_0 + b_1 x - b_2 x^2 + b_3 x^3 + \mu$  (2 Marks)

b) The data below gives gross domestic investment (Y) and gross national product (X) both in billions between 2011 and 2020.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Y	31	34	46	35	10	6	7	59	52	53
X	209	232	259	258	158	192	210	330	347	366

Using  $D = 1$  for the year with drought (i.e. 2015, 2016 and 2017) and  $D = 0$  for the other years and given that  $Y = b_0 + b_1 x + b_2 D + \mu$ . Find

i. The values of  $\hat{b}_0$ ,  $\hat{b}_1$  and  $\hat{b}_2$  (8 Marks)

ii. What is the slope coefficient during the years of drought and other years. (4 Marks)

iii. Find if  $\hat{b}_1$  and  $\hat{b}_2$  are significant as 5% level of significance us a t-test statistic. (4 Marks)

### QUESTION FOUR (20 MARKS)

a) Given the following data

t	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
$Y_t$	34	33	40	43	37	36	39	38	36	38	48	41	41	44	44	48

Find using Durbin – Watson test statistic if there is nay presence of first order auto-

Correlation given that  $d_u = 1.24$  and  $d_L = 0.98$  for a 2 tail test at 5% level. (15 Marks)

b) i. When can indirect least squares be used and what does it involve. (3 Marks)

ii. State two shortcomings of using indirect least squares. (2 Marks)

### QUESTION FIVE (20 MARKS)

a) The following two equations represent a simple macroeconomic model.

$$M_t = a_0 + a_1 Y_t + \mu_1 t$$

$$Y_t = b_0 + b_1 M_t + b_2 I_t + \mu_2 t,$$

Where  $M_t$  is money supply in period  $t$ ,  $Y$  is income and  $I$  is investment.

i. Find the first reduced – form equation and the second reduced – form equation.

(6 Marks)

ii. Find a unique value of the structured parameters of exactly identified M equation.

(4 Marks)

b) The data below gives average wages (Y) in thousands per month and the number of employees.

Average Wages				Workers employed
30.7	30.9	31.2	31.2	10
32.3	32.8	33.4	33.4	20
36.9	37.4	37.4	37.8	30
40.8	42.1	42.9	43.2	40

Test for the presence of heterosceclasticity at 5% level of significance using the first five and last five average wages and given that  $F_{11,11} = 2.82$  at 5% level.

(10 Marks)