# MACHAKOS UNIVERSITY

**University Examinations for 2016/2017 Academic Year**

**SCHOOL OF BUSINESS AND ECONOMICS**

**DEPARMENT OF ECONOMICS**

**THIRD YEAR FIRST SEMESTER EXAM FOR BACHELOR OF SCIENCE IN STATISTICS AND PROGRAMMING**

**SST 300: ECONOMETRICS I**

**DATE: 4/8/2017** **TIME: 11:00 – 1:00 PM**

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**INSTRUCTIONS:**

***Answer question One and other TWO Questions***

**QUESTION ONE (COMPULSORY) (30 MARKS)**

(a) Enumerate four characteristics of a good estimator (4 marks)

(b) Suppose in a simple regression that $\hat{\beta}_1 = \frac{\sum Y_1 X_1}{\sum X_i^2}$ where $x_i$ is in deviation form.

Verify that $\hat{\beta}_1$ is an unbiased estimator of $B_1$ (show your working clearly).

(8 marks)

(c) Define the following terms and briefly explain two consequences for each term.

i Heteroscedasticity (4 marks)

ii. Autocorrelation (4 marks)

d) The following table gives the output in tons Q, The labour input in worker-hours L, and the capital input in machine K, of 15 firms in an industry.

| K | L | Q | Firm |
|---|---|---|---|
| 1570 | 2334 | 2350 | 1 |
| 1850 | 2470 | 2470 | 2 |
| 1150 | 2230 | 2110 | 3 |
| 1940 | 2463 | 2560 | 4 |
| 2450 | 2565 | 2650 | 5 |
| 1340 | 2278 | 2240 | 6 |
| 1700 | 2360 | 2430 | 7 |
| 1860 | 2437 | 2530 | 8 |
| 1880 | 2446 | 2550 | 9 |
| 1790 | 2403 | 2450 | 10 |
| 1480 | 2301 | 2290 | 11 |
| 1240 | 2253 | 2160 | 12 |
| 1660 | 2367 | 2400 | 13 |
| 1850 | 2430 | 2490 | 14 |
| 2000 | 2470 | 2590 | 15 |

Fit a Cobb-Douglas function production function of the form $Q = AL^{\alpha}K^{\beta}$ to the (10 marks)

**QUESTION TWO (20 MARKS)**

The following table gives the bushels of corn per acre (Y), resulting from the use of various amounts of fertilizer X1 and the insecticides X2, and both in pounds per acre from 2001 to 2010.

| Year | Corn (Y) | Fertilizer ($X_1$) | Insecticide ($X_2$) |
|---|---|---|---|
| 1 | 40 | 6 | 4 |
| 2 | 44 | 10 | 4 |
| 3 | 46 | 12 | 5 |
| 4 | 48 | 14 | 7 |
| 5 | 52 | 16 | 9 |
| 6 | 58 | 18 | 12 |
| 7 | 60 | 22 | 14 |
| 8 | 68 | 24 | 20 |
| 9 | 74 | 26 | 21 |
| 10 | 80 | 32 | 24 |

i. Find the Ordinary Least Square (OLS) regression equation for the data above (6 marks)

ii. Stating the null and the alternative hypothesis, test at 5% of significance the overall significance of the OLS regression estimated above. (6 marks)

iii. For the OLS regression equation, find the partial correlation coefficients and interpret your results. (8 marks)

**QUESTION THREE (20 MARKS)**

a) Highlight the three problems that are likely to arise from the violation of one or more of the basic ordinary least square assumptions. (3 marks

b) With the use of graphical method, illustrate the presence of heteroskedasticity. (3 marks)

c) White's general test is one of the most commonly used tests of heteroskedasticity. Explain the steps as stipulated by this test. (4 marks)

d) (i) Define multicollinearity (1 mark)

(ii) Highlight any four consequences of multicollinearity (2 marks)

e) (i) Define autocorrelation (1 mark)

(ii) State the Durbin-Waston (DW) Test statistic (1 mark)

(iii) Clearly explain the steps used to test for autocorrelation using the Breausch-Pagan-Godfrey. (5 marks)

**QUESTION FOUR (20 MARKS)**

a) State the Gauss Markov theorem (2 marks)

b) Proof that compared to other estimators ( $\hat{\beta}$ ), OLS estimator $\hat{\beta}_1$ have the minimum variance. That is $Var\ (\hat{\beta}_1) > Var\ (\beta_1)$ is less than the variance of any other estimator (10 marks)

c) Distinguish between following (8 marks)

i) Goodness of fit Vs. Test significance

ii) Analysis of Variance Vs. Regression Analysis

iii) Standard deviation Vs Standard error

iv) Partial regression coefficients Vs Homoscedasticity

**QUESTION FIVE (20 MARKS)**

a) The variances of least square estimates become infinitely large in presence of multicolliniearity . True or False proof the statement mathematically (3 marks)

b) What is meant by specification bias? What does it involve? (5 marks)

c) Consider an ANOVA table for a regression equation given as $Y = \beta_0 + X_1B_1 + X_2B_2 + U$

For a sample of 30 observations

| **Source** | **SS** | **df** | **mss** | **F-ration** |
|---|---|---|---|---|
| **Regression** | 320 | b | e | g |
| **Residual** | 80 | c | f | |
| **Total** | a | d | | |

i) Find the values of a to g (7 marks)

ii) Calculate goodness of fit (5 marks)