MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

THIRD YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF ARTS IN ECONOMICS WITH INFORMATION TECHNOLOGY

CITY CAMPUS

AEC 307: ECONOMICS STATISTICS II

Date: 12th June, 2017 Time: 2.00 - 5.00 pm

INSTRUCTIONS:

- Answer question ONE and any other THREE questions.

QUESTION 1

a) State three statistical conditions for sampling distribution of $\bar{x}$ when the population is normally distributed. [3 Marks]

b) Define the central limit theorem. [2 Marks]

c) Toyota Company want to convince the Government of Kenya that the mean Nairobi city mileage is 31Km/hr. A sample of 49 mileages has a mean of 31.5531 and a standard deviation of s=0. 7992.Calculate the probability of observing a sample mean that is greater than or equal to 31.5531. [4 Marks]

d) Highlight the statistical criterion for the sampling distribution of the sample proportion ($\hat{p}$). [3 Marks]

e) Unilever Kenya one of the leading margarine producers wishes to assess whether p , the proportion of all current purchasers who would stop buying the margarine if a new spout were used is 0.10. When 1000 purchasers of the margarine are randomly selected, 84 of these purchasers say that they would stop buying the margarine if the new spout would be used.

i) Derive the sample proportion and show that its less than 0.10. [1 Mark]

ii) Compute the interval that has no zero or one for the sample proportion p. [2 Marks]

iii) Calculate the probability of obtaining a sample proportion $\hat{p}$ that is less or equal to 0.10. [4 Marks]

f) Magnate Ventures Ltd, is considering a new package design for a line of sugar. Given a random sampling of n=60 consumer ratings of this new package design. Let μ denote the mean rating of the new package design that would be given. To assess whether μ exceeds the minimum standard composite score of 25 for a successful package design, Magnate Ventures Ltd, likes to calculate a 95% confidence interval for μ. The mean and standard deviation of package design ratings are $\bar{x} = 30.35$ and $s = 3.1073$. Using the normal point $z_{\alpha/2} = z_{0.025} = 1.96$.

i) State the formula for confidence interval estimation. [2 Marks]

ii) Compute the 95% confidence interval for μ. [4 Marks]

QUESTION 2

a) Define hypothesis testing and differentiate between the null and alternative hypothesis. [3 Marks]

b) Jameni Industries Ltd is the leading trash bag manufacturer in Republic of Magogo. They are known to produce strong and reliable trash bags. They have developed a new 30 litre bag. The trash is strong and made of materials that reduced breakage or tear. This allows the Jameni Industries Ltd, to sell the new bag at a price that is 25% less than the price of the current 30 litre bag. The current bag has been extensively tested and is known to have breaking strength of that is very close to (but does not exceed) 50 pounds. Since the new bag is made with stronger and better material it means strength μ is unknown.

i) State the hypothesis statement and define the test statistic if the population sampled is normally distributed. [3 Marks]

ii) Solve for the test statistic and show the decision for acceptance or rejection. [3 Marks]

iii) Derive the statistical significance and give its practical importance. [3 Marks]

iv) Differentiate between type I and type II errors in hypothesis testing. [3 Marks]

QUESTION 3

a) Given the following simple linear regression model.

$$y = \mu_{y|x} + \varepsilon$$
$$= \beta_0 + \beta_1 x + \varepsilon$$

Define each of the parameters in the equation. [3 Marks]

b) Given the following data on fuel consumption of a new car model.

Week	Average hourly temperature, x °C	Weekly fuel consumption, y MMcf
1	28.0	12.4
2	28.0	11.7
3	32.5	12.4
4	39.0	10.8
5	45.9	9.4
6	57.8	9.5
7	58.1	8.0
8	62.5	7.5

i) Calculate the parameter b_1 and sum of squared residuals (SSE) given that:

$$b_1 = n\frac{\sum_{i=1}^{n} x_i y_i - (\sum_{i=1}^{n} x_i)(\sum_{i=1}^{n} y_i)}{n\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$

$$SSE = \sum_{i=1}^{n} e_i^2 = \sum_{i=1}^{n} (y_i - (b_0 + b_1 x_i))^2$$

[6 Marks]

ii) Derive the mean square error and the standard error in i). [4 Marks]

iii) Test the significance of the regression relationship in i). [2 Marks]

QUESTION 4

a) Highlight the basic concepts of experimental design. [2 Marks]

b) The Guruma Oil Corporation in Kenya, is developing a reasonably priced unleaded petrol. The company wants to compare the effect of three types of unleaded petrol (A, B, and C) on petrol mileage. Suppose they consider a sample of 1000 Fire-Hawk car model to represent the population of all Fire-Hawk models. Suppose they would like to use a randomized experimental design that employs a sample of 5. Subsequent, a sample for each one petrol type A, B, C is chosen from the 1000 Fire-Hawk models. Each randomly selected Fire-Hawk is test driven using appropriate petrol type (treatment) under normal conditions for a specified distance and petrol mileage for each test drive is measured. The data is shown in the table below.

	Gasoline Type A	Gasoline Type B	Gasoline Type C
	$y_{A,1} = 34.0$	$y_{B,1} = 35.3$	$y_{C,1} = 33.3$
	$y_{A,2} = 35.0$	$y_{B,2} = 36.5$	$y_{C,2} = 34.0$
	$y_{A,3} = 34.3$	$y_{B,3} = 36.4$	$y_{C,3} = 34.7$
	$y_{A,4} = 35.5$	$y_{B,4} = 37.0$	$y_{C,4} = 33.0$
	$y_{A,5} = 35.8$	$y_{B,5} = 37.6$	$y_{C,5} = 34.9$
Means	$\bar{y}_A = 34.92$	$\bar{y}_B = 36.56$	$\bar{y}_C = 33.98$
Standard deviations	$S_A = 35.8$	$S_{B,5} = 37.6$	$S_C = 34.9$

i) State the assumptions of one way analysis of variance. [1 Mark]

ii) Derive between treatment and within treatment variability. [4 Marks]

iii) Specify and compute the F test for the differences between treatment means. [4 Marks]

iv) Characterize and compute the t test for pairwise comparisons of treatment means. [4 Marks]

QUESTION 5

a) Specify the multiple linear regression model and define its parameters. [2Marks]

b) Suppose we have predictions using least squares point estimates where $b_0 = 13.1$, $b_1 = -0.0900$ and $b_2 = 0.0825$.

Week	Average Hourly Temperature x_1(°C)	Chill Index x_2	Observed Fuel Consumption y (MMcF)
1	28.0	18	12.4
2	28.0	14	11.7
3	32.5	24	12.4
4	39.0	22	10.8
5	45.9	8	9.4
6	57.8	16	9.5
7	58.1	1	8.0
8	62.5	0	7.5

i) Using the fuel consumption data derive the predicted fuel consumption and the residual. [4 Marks]

ii) Calculate the SSE. [3 Marks]

iii) Compute the multiple coefficient of determination. [3 Marks]

iv) Determine the overall F-test. [3 Marks]

QUESTION 6

a) Characterize the goodness of fit for multinomial probabilities.

[3 Marks]

b) Consider an interval data for 49 petrol mileages, with a sample mean of $\bar{x} = 31.55$ and $s = 0.8$.

Interval	Observed Frequency (n_i)
Less than 30.35	3
30.35 < 30.95	9
30.95 < 31.55	12
31.55 < 32.15	13
32.15 < 32.75	9
Greater than 32.75	3

i) Compute the p_i if the population of mileages is normally distributed and the expected frequency. [6 Marks]

ii) Calculate the χ^2 and compare it to the critical values.

[3 Marks]

c) Describe the chi-square test for independence. [3 Marks]