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UNIVERSITY EXAMINATIONS 2024/2025

FIRST YEAR, SECOND SEMESTER SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN SANITATION

AND

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN SANITATION

ECS 7152/ 7202: RESEARCH METHODS II

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS: *Attempt **any three** questions*

QUESTION ONE - (20 MARKS)

a) Distinguish between the following terms as used in research data analysis

i. Descriptive and inferential statistics. (2 Marks)

ii. Parametric and non-parametric analytical methods. (2 Marks)

iii. Population and sample. (2 Marks)

b) i. Giving specific examples, highlight and distinguish the techniques used when sampling from finite population and when sampling from infinite population. (4 Marks)

ii. According to the 2009 current population survey conducted by the US Census Bureau, 40% of the U. S population 25 years old and above have completed bachelor's degree or more. Given a random sample of 50 people 25 years old and above, what is the expected number of people

and the standard deviation of the number of people who have completed a bachelor's degree. (4 Marks)

c) i. Define validity and Highlight the two types of validity of a research work. (3 Marks)

ii. For a survey study, explain how KMO and Bartlett's test for sample adequacy can be done in SPSS. (3 Marks)

QUESTION TWO - (20 MARKS)

a) A company appoints 4 salesmen A, B, C and D and observes their sales performance in three seasons. Summer, winter and monsoon. The figures are in Ksh. 000.

	A	B	C	D
Summer	15	16	17	14
Winter	19	16	17	15
Monsoon	13	14	15	13

At 5% level of significance, analyze the variance for the performance of the 4 salesmen and discuss your results as a consultant to this company. (12 Marks)

b) i. Discuss three random sampling techniques giving examples in each case. (6 Marks)

ii. Explain the utility of fundamental statistical measures in conducting a research study. (2 Marks)

QUESTION THREE - (20 MARKS)

a) A researcher was carrying out a study to establish the impact of the use of total energy, Electrical energy and thermal energy to the productivity of tea processed in factories.

The following tables are direct output after fitting the models in SPSS.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.775[a]	.601	.600	91979.54771

a. Predictors: (Constant), Total energy (MJ), Electrical energy (KWS), Thermal energy(GJ)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1155651762064 5.950	3	3852172540215 .316	455.327	.000[b]
	Residual	7673435137901 .664	907	8460237197.24 5		
	Total	1922995275854 7.613	910			

a. Dependent Variable: Production (KGS)

b. Predictors: (Constant), Total energy (MJ), Electrical energy (KWS), Thermal energy(GJ)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	74151.406	11845.878		6.260	.000
	Thermal energy(GJ)	-186.993	29.330	-6.766	-6.376	.000
	Electrical energy (KWS)	.016	.031	.011	.517	.605
	Total energy (MJ)	.200	.028	7.528	7.094	.000

a. Dependent Variable: Production (KGS)

Based on the output

i. Interpret the coefficient for each predictor variable in the regression model and discuss what they suggest about the relationship to the response variable. (5 Marks)

ii. Analyze the statistical significance of the predictors using the P-values and explain what the F-statistics and R-squared values suggest about the model's fit and overall significance. (5 Marks)

iii. Why is adjusted R-squared preferred than R-squared? (1 mark)

b) Distinguish the inductive and deductive approaches to theory development in research study. (4 Marks)

c) Highlight the central limit theorem and give its significance in research. Hence show that for a reasonably large samples, the sampling distribution of the sample mean is given by

$$\bar{X} \sim N\left(\mu, \frac{\delta^2}{n}\right)$$ (5 Marks)

QUESTION FOUR - (20 MARKS)

a) i) In a large manufacturing company an opinion survey was conducted regarding two types of bonus scheme. Total employees were divided into three categories; technical, Executive and non skilled. The results obtained by the opinion survey are presented in the form of contingency table as given below;

Employee category	**Bonus scheme**	
	Type 1	**Type II**
Technical	19	5
Executive	30	6
Non skilled	12	4

At 5% level of significance, test the opinion about bonus schemes is independent of types of employees (7 Marks)

ii. Explain how the above test can be done in SPSS. (3 Marks)

b) You have collected data on incidences of diabetes and participant's data. The data includes information on age, gender, BMI and glucose levels.

Using SPSS

i. Explain how you would perform a bivariate analysis to assess the relationship between BMI and blood glucose levels. (3 Marks)

ii. Fit a logistic model on diabetes incidences (response) with covariates (age, gender, BMI and blood glucose levels). (4 Marks)

c) Highlight the research design and state two (2) functions of research design. (3 Marks)

QUESTION FIVE - (20 MARKS)

a) Discuss two ethical issues you would consider when carrying out research. (4 Marks)

b) In a survey with a sample of 835 respondents, the monthly income of the respondents follows a normal distribution with mean and standard deviation as Kshs. 35,000 and Ksh. 650 respectively Determine the probability that the monthly income is

i) Less than Kshs. 27,500 (2 Marks)

ii) Between Kshs. 25,000 and Kshs. 39,000 (3 Marks)

iii) More than Kshs. 35,000 (1 Mark)

c) The sales volume of a product (y_i) depends on marketing expenditure (x_1) and other firms selling the product (x_2). A marketing research study has provided the following regression model and relevant information

$$y_i = 6.84 + 0.74x_i - 0.63\,x_2$$
$$SE \quad (4.3), \quad (0.4) \quad (0.35)$$

$$r2 = 0.72, \quad n = 25$$

(i) Explain how data can be fitted in this model using SPSS. (3 Marks)

(ii) Comment on the goodness of fit of the model (1 Marks)

(iii) Test the significance of the three regression coefficients (β_s) and comment on your results. (6 Marks)