namibia university
OF SCIENCE AND TECHNOLOGY

Faculty of Health, Applied Sciences and Natural Resources

Department Natural Resources and Agricultural Sciences

QUALIFICATION: Bachelor of Natural Resource Management Honours	
QUALIFICATION CODE: 08BNRH	**LEVEL:** 8
COURSE: Research Methods for Natural Sciences	**COURSE CODE:** RMC811S
DATE: June 2022	**SESSION:** June
DURATION: 3 (three) hours	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	Dr. T. Nzuma (Section A: Scientific Writing) Dr. M. Mbidzo (Section B: Statistics)
MODERATOR:	Dr. M. Mwale

THIS QUESTION PAPER CONSISTS OF 7 PAGES
(Excluding this front page)

INSTRUCTIONS

1. Answer ALL the questions
2. Write clearly and neatly
3. Number the answers clearly
4. The use of a calculator is permissible

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SECTION A: SCIENTIFIC WRITING

Question 1   [8]

Arrange the following steps into their expected sequence in the general research process   [8]
(ignoring the need for iterative changes).

(a)   Analyse data
(b)   Collect data
(c)   Define topic
(d)   Formulate questions
(e)   Search literature
(f)   Select design and methods
(g)   Write report
(h)   Select units of study

Question 2   [6]

List and explain 3 criteria used for evaluating scientific research   [6]

Question 3   [11]

Develop your own unique research question and answer the following questions.
(a)   Define the topic area: [2]
        In a sentence or two, describe your broad topic or area of research. (Example: "Gender
        participation in natural resource management".

(b)   Describe the problem: [2]
        In a sentence or two, describe a problem that could be addressed in your topic or area of
        research. (Example: "Participation in natural resource management is often limited
        because of complex cultural and psychological factors.")

(c)   Specify the gap and justify the investigation: *What is unknown or unresolved? Why*   [2]
        should we bother investigating it? (Example: "We do not know what combination of
        cultural and psychological factors is most often associated with participation.")

(d)   Create the research question: *Brainstorm 3 (three) questions (1 primary question and 2* [5]
        secondary questions) that relate to your research topic/problem/gap.

        Note:
        Primary - is one main question emerging.
        Secondary - sub-questions you need to help you answer the primary question

SUBTOTAL   **[25]**

SECTION B: STATISTICS

Question 1

[10]

Define the following terms. You may provide an example as part of your answer

(a)   Inferential statistics   (2)

(b)   Inductive research   (2)

(c)   Manipulative experiment   (2)

(d)   Sampling unit   (2)

(e)   Purposive sampling   (2)

## Question 2   [17]

A wildlife ecologist set up an experiment to understand the time taken (in minutes) by springbok to leave a waterhole in response to a lion sound that is played on two consecutive days. Assuming that the same springbok individuals come to drink at the waterhole, we hypothesize that experiencing a fake lion sound on the first day would affect the time springboks took to leave the waterhole on the second day. Time taken to leave the waterhole is recorded for ten known springboks and the results are contained in the provided SPSS outputs. Use these results to answer the following questions:

(a)   What statistical test or analysis is appropriate for this hypothesis?   (1)

(b)   Name the two assumptions related to the data of the test mentioned in (a)   (4)

(c)   Explain whether the assumptions mentioned in (b) are met or violated and provide   (4)
       evidence for your answers.

(d)   If your data violated any of the assumptions mentioned in (c), what alternative statistical   (1)
       test would you use to test the hypothesis that experiencing a fake lion sound on the first
       day would affect the time springboks take to leave the waterpoint?

(e)   Describe the descriptive statistics of the dataset using the SPSS outputs.   (3)

(f)   Did the fake lion sound on the first day affect the time springboks took to leave the   (4)
       waterhole on the second day?

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
difference	.201	10	.200*	.866	10	0.090

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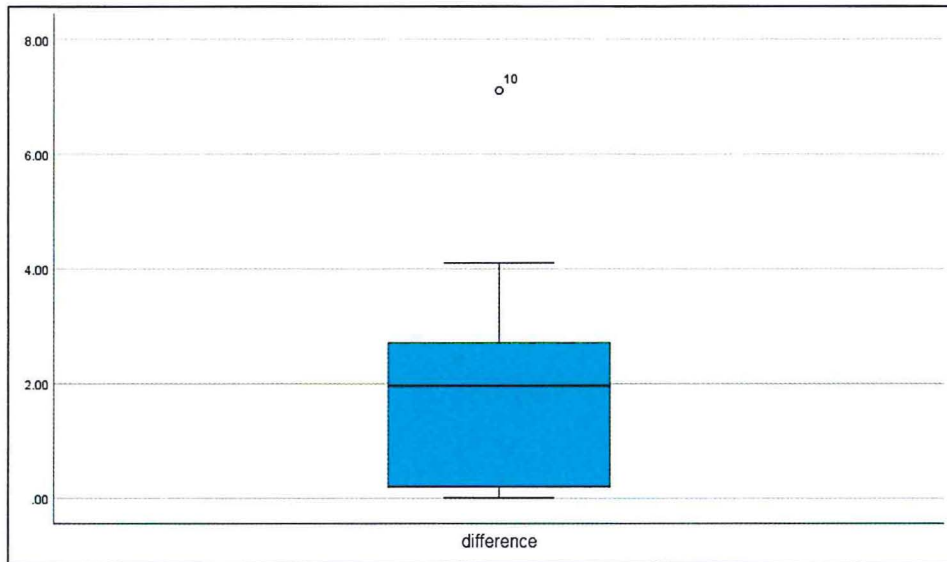
Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Time taken to leave waterhole on day 2	4.3500	10	2.16551	.68480
	Time taken in minutes to leave the watehole on day 1	2.1900	10	1.11699	.35322

Test statistics										
		Paired Differences							Significance	
					95% Confidence Interval of the Difference				One-Sided	Two-Sided
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	p	p
Pair 1	Time taken to leave waterhole on day 2 - Time taken in minutes to leave the waterhole on day 1	2.16	2.15572	.68170	.61789	3.70211	3.169	9	.006	.011

Question 3 [15]
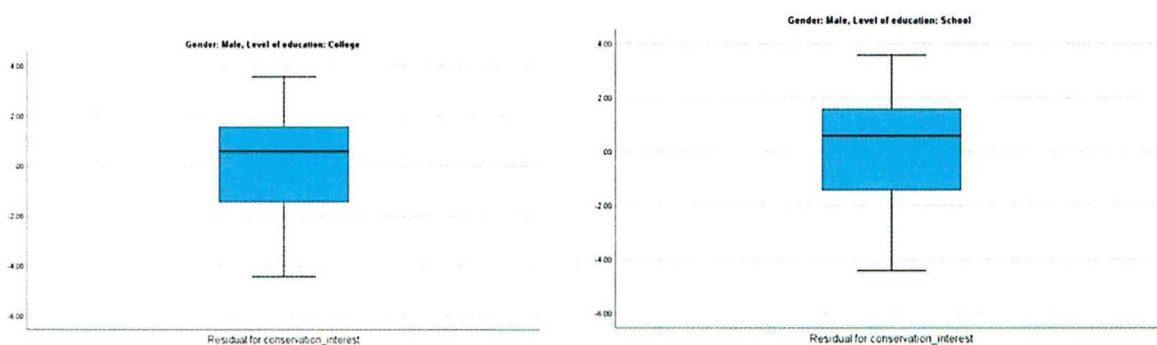
A researcher had participants complete a questionnaire that assessed their interest in conservation, using a "Conservation Interest" scale. Participants could score anything between 0 and 100, with higher scores indicating a greater interest in conservation. Specifically, the researcher wants to understand whether the effect of education level on "Conservation Interest" score was different for males and females. Use the
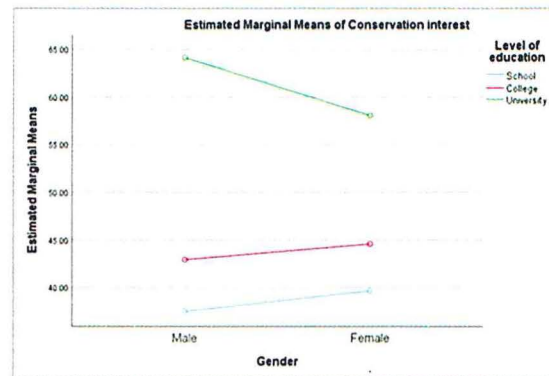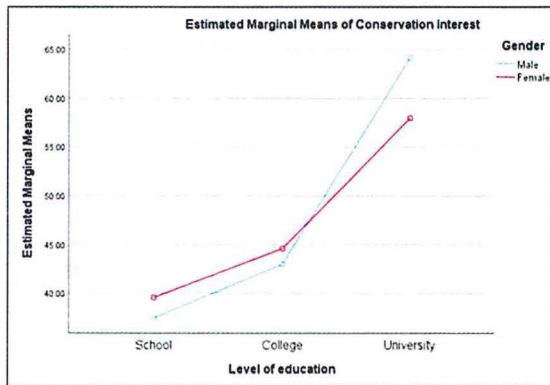
SPSS outputs provided to answer questions that follow.

(a)   What statistical test or analysis is appropriate for this research question?   (1)

(b)   Determine whether there were any outliers in the dataset and provide evidence for your answer.   (2)

(c)   Determine whether data were normally distributed and provide evidence for your answer.   (2)

(d)   Determine if there are equal variances in all combinations of groups of the two independent variables   (3)

(e)   Determine whether there is an interaction between the two independent variables (gender and level of education). Provide evidence for you answers.   (7)

Gender: Male, Level of education: College

Gender: Male, Level of education: School

Residual for conservation_interest

Tests of Normality								
			Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Gender	Level of education		Statistic	df	Sig.	Statistic	df	Sig.
Male	School	Residual for conservation_interest	.143	9	.200*	.981	9	.971
	College	Residual for conservation_interest	.157	9	.200*	.957	9	.761
	University	Residual for conservation_interest	.213	10	.200*	.915	10	.320
Female	School	Residual for conservation_interest	.112	10	.200*	.963	10	.819
	College	Residual for conservation_interest	.112	10	.200*	.963	10	.819
	University	Residual for conservation_interest	.139	10	.200*	.950	10	.668

Levene's Test of Equality of Error Variances					
		Levene Statistic	df1	df2	Sig.
Conservation interest	Based on Mean	2.269	5	52	.061
	Based on Median	2.205	5	52	.068
	Based on Median and with adjusted df	2.205	5	27.511	.083
	Based on trimmed mean	2.263	5	52	.062

Estimated Marginal Means of Conservation interest

Gender
- Male
- Female

Estimated Marginal Means

65.00
60.00
55.00
50.00
45.00
40.00

School | College | University

Level of education

Estimated Marginal Means of Conservation interest

Level of education
- School
- College
- University

Estimated Marginal Means

65.00
60.00
55.00
50.00
45.00
40.00

Male | Female

Gender

Tests of Between-Subjects Effects							
Dependent Variable: Conservation interest							
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	
Corrected Model	5645.998[a]	5	1129.200	78.538	.000	.883	
Intercept	132091.906	1	132091.906	9187.227	.000	.994	
gender	8.420	1	8.420	.586	.448	.011	
education_level	5446.697	2	2723.348	189.414	.000	.879	
gender * education_level	210.338	2	105.169	7.315	.002	.220	
Error	747.644	52	14.378				
Total	140265.750	58					
Corrected Total	6393.642	57					
a. R Squared = .883 (Adjusted R Squared = .872)							

Question 4 [13]

(a) Name three general reasons for finding outliers in your data. (3)

(b) Discuss how you would deal with outliers resulting from each of the reasons mentioned in (c). (10)

Question 5 [20]

The rates of oxygen consumption (in ml/g/hr) of birds are measured at different environmental temperatures. We want to determine whether the rate of oxygen consumption is dependent on Temperature. Use the SPSS outputs provided to answer the questions that follow.

(a) What statistical test or analysis is appropriate for this research question? (1)

(b) State the null and alternative hypotheses for the test provided in (a). (2)

(c) Assess whether there was independence of observations in the dataset. Provide evidence for your answer. (3)

(d) Describe the general relationship that exists between oxygen consumption of birds and temperature. Provide evidence for your answer. (2)

(e) Did the data meet the assumption of homoscedasticity? Explain your answer. (4)

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(f) What proportion of the variance in the response variable is explained by the predictor variable? Explain fully. (2)

(g) Determine whether the regression model results in a statistically significantly better prediction of the dependent variable than if we just used the mean of the dependent variable. Provide evidence for your explanation (3)

(h) Compute a regression equation using the SPSS output provided below to estimate the rate of oxygen consumption at 25°C? (3)

Simple Scatter of Oxygen consumption by Temperature

Scatterplot
Dependent Variable: Oxygen consumption
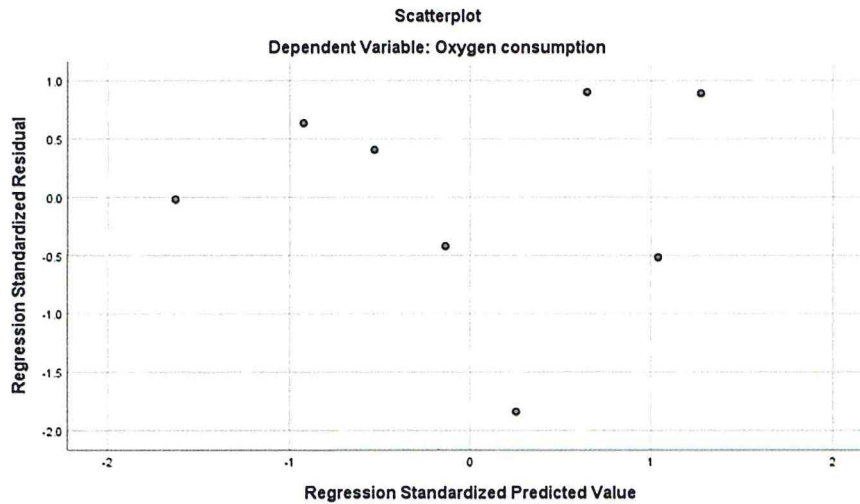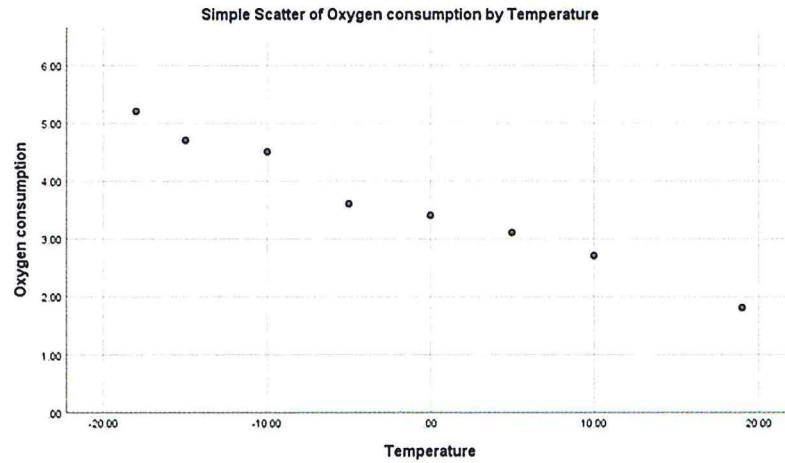
ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.745	1	8.745	308.933	.000[b]
	Residual	.170	6	.028		
	Total	8.915	7			
a. Dependent Variable: Oxygen consumption						
b. Predictors: (Constant), Temperature						

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.990[a]	.981	.978	.16825	2.448

a. Predictors: (Constant), Temperature

b. Dependent Variable: Oxygen consumption

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.471	.060		57.738	.000
	Temperature	-.088	.005	-.990	-17.576	.000

a. Dependent Variable: Oxygen consumption

SUBTOTAL [75]

TOTAL PAPER MARKS 100