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: July 2022	**SESSION:** July
DURATION: 3 (three) hours	**MARKS:** 100

SECOND OPPORTUNITY/ SUPPLEMENTARY 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

SECTION A: SCIENTIFIC WRITING

Question 1 **[6]**

What is the importance of scientific writing?

Question 2 **[4]**

How do you avoid plagiarism?

Question 3 **[15]**

What are the common errors made in literature review?

SUBTOTAL **[25]**

SECTION B: STATISTICS

Question 1 **[10]**

What statistical procedure would you use for the following research questions and/or scenarios?

(a) You want to understand the interaction of adult lions with young ones. Based on an overall interaction score, you want to determine if sex of adult lion has an influence on their interaction with cubs. (1)

(b) A researcher determined the presence of a specific intestinal parasite in each animal from a random selection of mice of each of two species. You want to determine if there is a relationship between mice species and occurrence of the parasite. (1)

(c) You take a sample of the weights of 20 male elephant tusks from Etosha National Park (ENP) and a sample of 18 male elephant tusks from the Bwabwata National Park (BNP). You want to test if there is a difference in tusk weights between elephants from ENP and BNP. *Note: You find that the tusk weights for BNP were not normally distributed and that there were significant outliers in the data.* (1)

(d) A researcher is interested in investigating if wing lengths of sparrows is a function of sparrow age. Twenty sparrows we sampled; their wing lengths and ages were recorded. The question is: Is there a relationship between sparrow wing length and age? (1)

(e) Interest in conservation is believed to be influenced by level of education. Participants were classified into three groups according to their highest level of education; "high school", "college" or "university", in that order; The researcher is interested in determining whether the effect of education level on interest in conservation was different depending on gender. (1)

(f) Concentrations of nitrogen oxides was determined in two urban suburbs. You want to test the hypothesis that the air pollutant was present in the same concentrations in the two suburbs. (1)

(g) A researcher wants to determine if there is a relationship between soil moisture content and nitrogen mineralization rates. (1)

(h) A researcher wishes to analyse how gender influences participation of local communities in natural resource decision making. Specifically, individual's attendance of meetings was determined. (1)

(i) Based on an anxiety score, students are divided into three groups: "low-stressed students", "moderately-stressed students" and "highly-stressed student. Exam performance is measured from 1 to 100. You want to test the hypothesis that exam performance differs based on exam anxiety levels amongst students? Assume that the data violates the assumptions of a parametric test (1)

(j) Trace metals in drinking water affect the flavour and an unusually high concentration can pose a health hazard. Ten pairs of data were taken measuring zinc concentration in bottom water and surface water (each pair of surface & bottom water samples are taken at the same location). You want to test whether the data suggest significant differences in average zinc concentration in bottom and surface water? (1)

Question 2 **[18]**

The diameters of nineteen *Baikiaea plurijuga* (Zambezi Teak) trees were measured in four areas. The number of trees measured ranged between 4 and 5 individuals per area. We want to ask whether tree diameters are the same in all four areas. Use the SPSS outputs provided to answer the questions that follow.

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

(b) Name the three 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 evidence for your answers. (6)

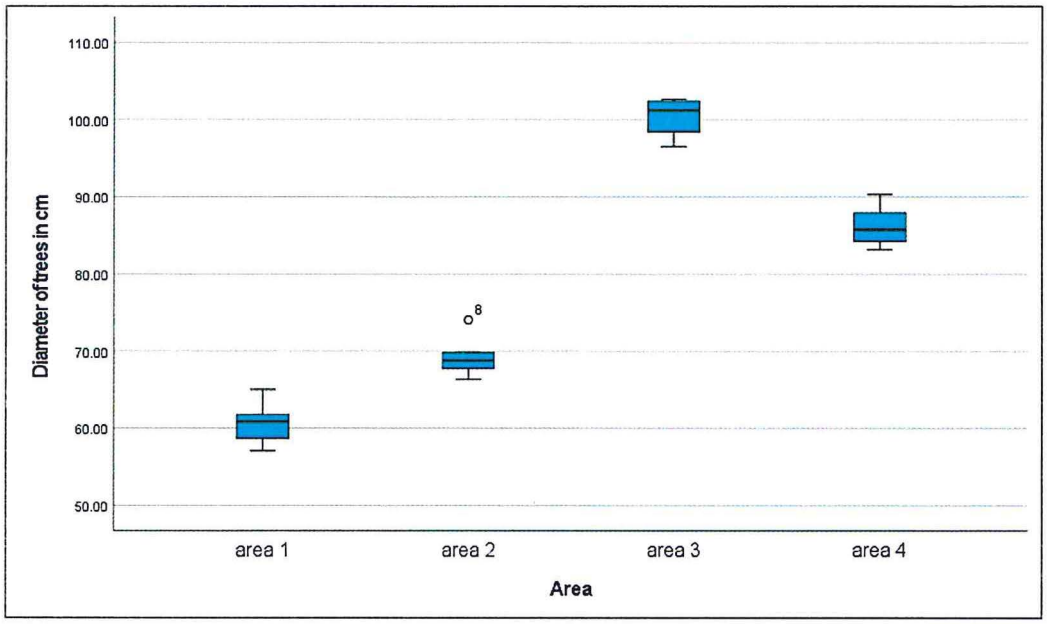
(d) If your data violated any of the assumptions mentioned in (c), what common alternative non-parametric statistical test would you use to answer whether *Baikiaea plurijuga* diameters are the same in all four areas? (1)

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

(f) Did the area where samples were taken affect the diameter of *Baikiaea plurijuga* trees? Explain which areas were significantly different in terms of tree diameters. (6)

Tests of Normality

		Kolmogorov-Smirnov			Shapiro-Wilk		
	Region	Statistic	df	Sig.	Statistic	df	Sig.
Diameter of trees in cm	area 1	.162	5	.200*	.979	5	.931
	area 2	.232	5	.200*	.923	5	.552
	area 3	.236	4	.	.885	4	.360
	area 4	.174	5	.200*	.961	5	.815



Statistics								
Diameter of trees in cm								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
area 1	5	60.6200	3.06464	1.37055	56.8148	64.4252	57.00	65.00
area 2	5	69.3000	2.92660	1.30882	65.6661	72.9339	66.30	74.00
area 3	4	100.3500	2.76707	1.38353	95.9470	104.7530	96.50	102.60
area 4	5	86.2400	2.89620	1.29522	82.6439	89.8361	83.10	90.30
Total	19	78.0105	15.55402	3.56834	70.5137	85.5073	57.00	102.60

Tests of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
Diameter of trees in cm	Based on Mean	.034	3	15	.991
	Based on Median	.024	3	15	.995
	Based on Median and with adjusted df	.024	3	14.638	.995
	Based on trimmed mean	.035	3	15	.991

ANOVA					
Diameter of trees in cm					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4226.348	3	1408.783	164.642	<.001
Within Groups	128.350	15	8.557		
Total	4354.698	18			

Multiple Comparisons							
Dependent Variable: Diameter of trees in cm							
			Mean Difference			95% Confidence Interval	
	(I) Area	(J) Area	(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Tukey HSD	area 1	area 2	-8.68000*	1.85005	.001	-14.0121	-3.3479
		area 3	-39.73000*	1.96227	<.001	-45.3856	-34.0744
		area 4	-25.62000*	1.85005	<.001	-30.9521	-20.2879
	area 2	area 1	8.68000*	1.85005	.001	3.3479	14.0121
		area 3	-31.05000*	1.96227	<.001	-36.7056	-25.3944
		area 4	-16.94000*	1.85005	<.001	-22.2721	-11.6079
	area 3	area 1	39.73000*	1.96227	<.001	34.0744	45.3856
		area 2	31.05000*	1.96227	<.001	25.3944	36.7056
		area 4	14.11000*	1.96227	<.001	8.4544	19.7656
	area 4	area 1	25.62000*	1.85005	<.001	20.2879	30.9521
		area 2	16.94000*	1.85005	<.001	11.6079	22.2721
		area 3	-14.11000*	1.96227	<.001	-19.7656	-8.4544

Question 3 **[16]**

An entomologist is studying the vertical distribution of a fly species in a forest and obtains five collections from each of three different vegetation layers: herb, shrub, and tree. It turns out that the fly abundance data was not normally distributed and there were significant outliers in the data. Use the SPSS output provided to answer the questions that follow.

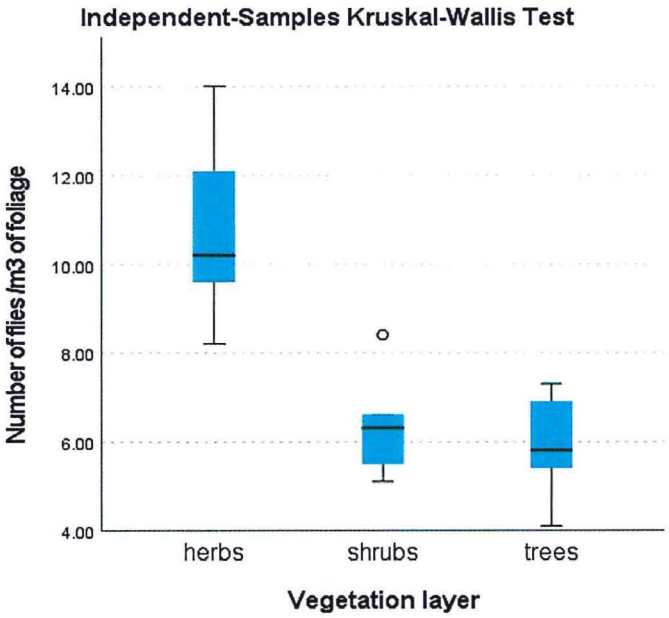
(a) What statistical test or analysis is appropriate for this hypothesis? (1)

(b) Determine whether the distributions of fly abundance for the different vegetation layers are similar in shape. Provide evidence for your answer (2)

(c) Determine whether the distributions of fly abundance were statistically different between groups. Fully explain your answer. (8)

(d) Determine which vegetation layers are statistically different from each other in terms of fly abundance. (5)

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Number of flies /m3 of foliage is the same across categories of Vegetation layer.	Independent-Samples Kruskal-Wallis Test	.013	Reject the null hypothesis.



Test Statistics	
	Number of flies /m3 of foliage
Kruskal-Wallis H	8.720
df	2
Asymp. Sig.	.013

Ranks			
	Vegetation layer	N	Mean Rank
Number of flies /m3 of foliage	herbs	5	12.80
	shrubs	5	6.00
	trees	5	5.20
	Total	15	

Pairwise Comparisons of Vegetation layer					
Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
trees-shrubs	.800	2.828	.283	.777	1.000
trees-herbs	7.600	2.828	2.687	.007	.022
shrubs-herbs	6.800	2.828	2.404	.016	.049

Question 4 **[16]**

A researcher determined the presence of a specific intestinal parasite in each animal from a random selection of mice of each of two species. The study aim is to determine if there is a relationship between mice species and occurrence of the parasite. Use the SPSS outputs provided to answer questions that follow.

(a) State the null and alternative hypotheses for the research question (2)

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

(c) Name two assumptions of the test mentioned in (b) related to the study design (2)

(d) Name one assumption of the test in (b) that relates to how your data fits the test (1)

(e) Determine whether the assumption mentioned in (d) is met or violated. Provide evidence for your answer (2)

(f) Determine whether a relationship between mice species and occurrence of the parasite exists. Explain your answer fully. (8)

Species * Parasite Crosstabulation

			Parasite		
			Yes	No	Total
Species	Species 1	Count	12	3	15
		Expected Count	9.0	6.0	15.0
		% within Species	80.0%	20.0%	100.0%
		% within Parasite	66.7%	25.0%	50.0%
		% of Total	40.0%	10.0%	50.0%
	Species 2	Count	6	9	15
		Expected Count	9.0	6.0	15.0
		% within Species	40.0%	60.0%	100.0%
		% within Parasite	33.3%	75.0%	50.0%
		% of Total	20.0%	30.0%	50.0%
Total		Count	18	12	30
		Expected Count	18.0	12.0	30.0
		% within Species	60.0%	40.0%	100.0%
		% within Parasite	100.0%	100.0%	100.0%
		% of Total	60.0%	40.0%	100.0%

Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.000[a]	1	.025		
Continuity Correction[b]	3.472	1	.062		
Likelihood Ratio	5.178	1	.023		
Fisher's Exact Test				.060	.030
Linear-by-Linear Association	4.833	1	.028		
N of Valid Cases	30				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.00.					
b. Computed only for a 2x2 table					

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Phi	.408	.025
	Cramer's V	.408	.025
N of Valid Cases		30	

Question 5 **[15]**

(a) What does it mean to have data that are non-parametric? (3)

(b) What are the two main drawbacks of non-parametric tests? (4)

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

(d) Discuss how you would deal with outliers resulting from any two of the reasons mentioned in (c) (5)

SUBTOTAL **75**

PAPER TOTAL MARKS **100**