BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT: CURRICULUM AND EDUCATIONAL MANAGEMENT STUDIES

PROGRAMME: MASTER OF SCIENCE EDUCATION IN MEASUREMENT, ASSESSMENT AND EVALUATION

COURSE CODE: MAE503 (1). **NARRATION: STATISTICS FOR EDUCATIONAL RESEARCH**

DURATION: 3 HOURS. **TOTAL MARKS:** 300

AUG 2023

INSTRUCTIONS TO CANDIDATES

- Answer any **three** questions.
- Each question carries 100 marks.
- Begin each question on a separate answer sheet.
- Relate your answers and examples to your subject of specialisation in the education context.

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1. Measures of central tendency and dispersion
    a. Explain the difference between central tendency and dispersion?
    b. Describe three measures of central tendency?
    c. Describe any **three** measures of dispersion?
    d. Identify measures of central tendency and dispersion that become available only at the interval/ratio level of measurement?
    e. Use the data array below
    3, 7, 5, 13, 20, 23, 39, 23, 40, 23, 14, 12, 56, 23, 29
        i. Determine measures of central tendency (See 1b.)
        ii. Calculate range, standard deviation and variance

2. In an undergraduate statistics class, n = 30 females reported their heights (cm), and also measured their left forearm length (cm), left foot length (cm), and head circumference (cm).
    a. Determine the standard deviation if the variance height is 8.74.
    b. Calculate the variance for the left foot measurement if the standard deviation was 1.381.
    c. The correlation between height and left arm was found to be 0.66. Interpret.
    d. Explain any **two** factors that affect correlation values, and suggest an alternative way to better understand the association between variables.

e. Co-variance (s) is a measure of association between variables. What is the meaning of
   i. $S = 0$
   ii. $S > 0$
   iii. $S < 0$

f. Compute the coefficient of determination using the correlation coefficient in 2c above. What does your value mean?

[Total = 100 marks]

3. Pearson Correlation
   a. State **four** assumptions of a Pearson Correlation.
   b. Explain how to deal with any **two** violations of the assumptions.
   c. What are some of the pitfalls and misinterpretations of correlation coefficients
   d. The data below shows hours students spent studying in preparation of an examination (X), and the marks they got in the examination (Y).
      i. Copy and complete the table
      ii. Compute Pearson Correlation Coefficient
      iii. Interpret the statistic in d (ii) above.

Table 1: Computing Pearson Correlation

X	X^2	Y	Y^2	XY
8		98		
2		74		
6		87		
4		82		
2		72		
$\Sigma X =$	$\Sigma X^2 =$	$\Sigma Y =$	$\Sigma Y^2 =$	$\Sigma XY =$

4. One sample t-tests
   a. Describe one sample t-test
   b. Explain the statistical constraints (assumptions) for t-tests.
   c. Explain how to deal with data that violates the assumptions in 3(a). above
   d. Describe steps to conduct a hypothesis test using the t-statistic method.
   e. Perform a t-test to assess whether the following data set has been drawn from a population with a mean value, μ, that is not equal to 54
      56 62 59 55 67

[Total = 100 marks]

5. Non-parametric test
   a. Describe a one-sample Wilcoxon test.
   b. State the null and hypothesis for
      i. 1-tailed Wilcoxon test
      ii. 2-tailed Wilcoxon test
   c. Discuss **three** rules that should be observed when calculating rank values in a one-sample Wilcoxon test.

d. In a survey to assess whether 18 trainees found a particular exercise regime useful, they were asked to reply on a scale from -5 (not at all useful) to +5 (very useful. Their score are shown below

3	5	-3	5	4	-2	2	4	-1
0	5	0	-4	-2	3	0	1	3

Use a 1-tailed Wilcoxon test to test whether the results show that the regime was considered to be useful (that is, the median, *m,* score is greater than 0).

i. Determine the median attitude
ii. Create table and complete as shown below using all the 18 trainees
iii. Find the test statistic, W(-)
iv. Use statistical tables to get the 'lower critical value', W_L
v. Draw a conclusion

Table 3: Rankings for attitude data

Attitude (m)	**Median (m_o)**	**Differences *($m - m_o$)***	**Rank (ignoring sign)**	**Sign**
3				
5				
-3				
5				
4				
-2				
2				
4				
-1				
0				
5				
0				
-4				
-2				
3				
0				
1				
3				

[Total = 100marks]

END OF PAPER