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UNIVERSITY EXAMINATIONS 2024/2025

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR DOCTOR OF PHILOSOPHY IN
EDUCATION

EMM 8100: ADVANCED STATISTICAL METHODS IN EDUCATION

DATE: JANUARY 2025

TIME: 3 HOURS

INSTRUCTIONS:

*Answer Question **ONE** (Section A) and any other **THREE** Questions from section B.*

Start each question on a fresh page

Use of scientific calculators is permitted.

Statistical tables and Formulae are provided.

SECTION A

QUESTION ONE – (24 MARKS)

a) Use appropriate examples to explain the following concepts:

- i. Point estimate
- ii. Test of normality
- iii. Multicollinearity
- iv. Non-parametric tests
- v. Effect size for dependent samples

(5 marks)

b) In a survey of 1020 adults, 44% said they wash their hands after using public transportation.

- a) Identify the sample and population
- b) Is the value of 44% a statistic or a parameter?
- c) What is the level of measurement of the value 44%?
- d) Are the numbers of subjects in such surveys discrete or continuous? (5 Marks)

c) As an overall evaluation of students' fitness in a school, an experiment was conducted to determine the average exercise capacity for newly admitted students. A random sample of 35 students exercised using a bicycle. The exercise capacities (mean time, in minutes) for the 35 students are given below:

23	19	36	12	41	43	19
28	14	44	15	46	36	25
35	25	29	17	51	33	47
42	45	23	29	18	14	48
21	49	27	39	44	18	13

- i. Use the data to construct a 95% confidence interval for μ (average exercise capacity for the students). Interpret your findings.
- ii. How would your answer in (a) above change if you used a 99% confidence interval? (14 Marks)

SECTION B

QUESTION TWO - (12 MARKS)

Social scientists have produced convincing evidence that parental divorce is negatively associated with the educational success of their children. The paper “Maternal Cohabitation and Educational Success” in *Sociology of Education* 78 (2005): 144 –164 describes a study that addresses the impact of cohabitating mothers on the success of their children in graduating from high school. The following table displays the educational outcome by type of family for 1,168 children.

HighSch Grad.	Type of Family					Total
	Two Parent		Single-Parent		Step-Parent	
	Always	Divorce	No Cohab.	With Cohab.		
Yes	407	61	231	124	193	1,016
No	45	16	29	11	51	152
Total	452	77	260	135	244	1,168

Is there significant evidence that the proportion of students who graduate from high school is different across the various family types? Use χ^2 to test the hypothesis.

(12 marks)

QUESTION THREE – (12 MARKS)

The following data relates to the number of minutes students stay in the waiting room to see three teachers:

Teacher A	15	23	28	22	25	30	35
Teacher B	18	10	25	23	26	32	34
Teacher C	40	36	28	21	42	25	10

Using the Kruskal-Wallis test, can it be inferred that the samples have come from identical populations? (Use the 0.01 level of significance). (12 Marks)

QUESTION FOUR – (12 MARKS)

a) Represent the output below using the regression equation and report the findings in APA format. (4 Marks)

Model Summary					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
1	.898 ^a	.806	.783	2.39633	

a. Predictors: (Constant), Outgoing personality, Social support

ANOVA ^a					
Model		Sum of Squares	df	Mean Square	F
1	Regression	405.329	2	202.664	35.293
	Residual	97.621	17	5.742	
	Total	502.950	19		

a. Dependent Variable: Contentment at work
b. Predictors: (Constant), Outgoing personality, Social support

Coefficients ^a							
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B
		B	Std. Error	Beta			
1	(Constant)	-.288	1.721		-.167	.869	-3.919 3.343
	Social support	.832	.126	.728	6.599	<.001	.566 1.098
	Outgoing personality	.319	.094	.376	3.409	.003	.122 .516

a. Dependent Variable: Contentment at work

b) The table below gives scores of measures of reading achievement for a group of teenagers when they were in grade 7 and grade 8.

Grade	80	72	65	90	72	88	67	73	65	82
Grade	88	70	62	85	85	90	62	62	60	81
Grade										

Compute the two regression equations and estimate:

i) The reading achievement level of a grade 8 teenager whose score was 93 in grade 7.

ii) The reading achievement level of grade 7 teenager whose resilience level is 72 in grade 8. (8 Marks)

QUESTION FIVE – (12 MARKS)

a) Explain the phrase ‘significance of the sample mean’. (2 Marks)

b) One group of students were taught using the face-to-face lecture method and another group was taught online through video conferencing. An achievement test was administered to determine which was the better teaching method. The results obtained are summarised below:

Face to face Lecture Method	Online video conferencing
$N_1 = 12$	$N_2 = 16$
$\sigma = 15.5$	$\sigma = 1.22$
$M_1 = 140$	$M_2 = 120$

Explain from the results whether there is a significant difference in performance between the two groups. (10 Marks)