AMREF INTERNATIONAL UNIVERSITY

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF COMMUNITY HEALTH

MASTER OF PUBLIC HEALTH

END OF SEMESTER EXAMINATION APRIL2023

MPH 712/HPE :   BIOSTATISTICS
DATE: 28th April 2023
TIME: Three Hours   Start: 1600 Hours   **Finish** 1900 Hours

INSTRUCTIONS
1. This exam is marked out of 100 marks
2. This Examination comprises TWO Sections
   Section A: Compulsory Question (25 marks)
   Section B: Long Answer Questions (75 marks)
3. All questions in Section A are compulsory and Answer any THREE questions in Section B
4. This online exam shall take 3 Hours
5. Late submission of the answers will not be accepted
6. Ensure your web-camera is on at all times during the examination period
7. No movement is allowed during the examination
8. Idling of your machine for 5 min or more will lead to lock out from the exam
9. The Learning Management System (LMS) has inbuilt integrity checks to detect cheating
10. Any aspect of cheating detected during and or after the exam administration will lead to nullification of your exam
11. In case you have any questions call the invigilator for this exam on Tel. 0722840012 and or the Head of Department on Tel +254720573449
12. For adverse incidences please write an email to: amiu.examinations@amref.ac.ke and jarim.omogi@Amref.ac.ke

Question 1. A researcher conducted an evaluation comparing nursing students on a regular study programme and those studying via eLearning. At Bivariate level, a Chi-square test of independence was applied to determine differences in the two groups. Output 1 represent comparison based on demographic characteristics and output 2 are comparisons on performance in a course of Fundamentals of nursing. Study the outputs and answer the following questions.

a) Write a brief summary of the demographic characteristics based on the outputs
b) Using output 1:
    i. Develop an appropriate null and alternative hypothesis (3.5 marks)
    ii. Are the assumptions of the Chi-square test violated? Explain (3 marks)
    iii. State your conclusions as regards to your hypothesis based on the outputs from the chi-square test (4 marks)

c) Using output 2:
    i. Develop an appropriate null and alternative hypothesis (3.5 marks)
    ii. Are the assumptions of the chi-square violated? Explain (3 marks)
    iii. State your conclusions as regards to your hypothesis based on the outputs from the chi-square test (4 marks)

d) Write a summary of the results from statistical analysis from the two outputs (4 marks)

OUTPUT 1: COMPARISON OF DEMOGRPAHIC CHARACTERISTICS

Sex of Student * Is student Regular or E-Learner Cross tabulation

		Is student Regular or E-Learner		
		E-Learner	Regular	Total
Sex of Student Male	Count	26	19	45
	Expected Count	22.4	22.6	45.0
	% within Sex of Student	57.8%	42.2%	100.0%
	% within Is student Regular or E-Learner	26.3%	19.0%	22.6%
	% of Total	13.1%	9.5%	22.6%

Female	Count		73	81	154
	Expected Count		76.6	77.4	154.0
	% within Sex of Student		47.4%	52.6%	100.0%
	% within Is student Regular or E-Learner		73.7%	81.0%	77.4%
	% of Total		36.7%	40.7%	77.4%
Total	Count		99	100	199
	Expected Count		99.0	100.0	199.0
	% within Sex of Student		49.7%	50.3%	100.0%
	% within Is student Regular or E-Learner		100.0%	100.0%	100.0%
	% of Total		49.7%	50.3%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.499[a]	1	.221		
Continuity Correction[b]	1.113	1	.291		
Likelihood Ratio	1.504	1	.220		
Fisher's Exact Test				.239	.146
Linear-by-Linear Association	1.492	1	.222		
N of Valid Cases	199				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 22.39.

OUTPUT 2: COMPARISON ON PERFOMANCE IN EXAMINATION FOR FUNDAMENTALS OF NURSING

Crosstab

			Is student Regular or E-Learner		Total
			E-Learner	Regular	
Fundamentals of Nursing(Practical)	Pass on first attempt	Count	63	70	133
		Expected Count	66.5	66.5	133.0
		% within Fundamentals of Nursing(Practical)	47.4%	52.6%	100.0%
		% within Is student Regular or E-Learner	63.0%	70.0%	66.5%
		% of Total	31.5%	35.0%	66.5%
	Pass after Re-sitting	Count	3	1	4
		Expected Count	2.0	2.0	4.0
		% within Fundamentals of Nursing(Practical)	75.0%	25.0%	100.0%
		% within Is student Regular or E-Learner	3.0%	1.0%	2.0%
		% of Total	1.5%	0.5%	2.0%
	N/A	Count	9	13	22
		Expected Count	11.0	11.0	22.0
		% within Fundamentals of Nursing(Practical)	40.9%	59.1%	100.0%
		% within Is student Regular or E-Learner	9.0%	13.0%	11.0%
		% of Total	4.5%	6.5%	11.0%
	No response	Count	25	16	41
		Expected Count	20.5	20.5	41.0

			61.0%	39.0%	100.0%
	% within Fundamentals of Nursing(Practical)		61.0%	39.0%	100.0%
	% within Is student Regular or E-Learner		25.0%	16.0%	20.5%
	% of Total		12.5%	8.0%	20.5%
Total	Count		100	100	200
	Expected Count		100.0	100.0	200.0
	% within Fundamentals of Nursing(Practical)		50.0%	50.0%	100.0%
	% within Is student Regular or E-Learner		100.0%	100.0%	100.0%
	% of Total		50.0%	50.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.071[a]	3	.254
Likelihood Ratio	4.138	3	.247
Linear-by-Linear Association	.595	1	.440
N of Valid Cases	200		

a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.00.

SECTION B: SELECT ANY <u>THREE</u> QUESTIONS OF YOUR CHOICE

Question 2

A study of blood alcohol levels (mg/100ml) at post mortem examination from traffic accident victims involved taking one blood sample from the leg and another from the heart. The results were:

Case	Leg	Heart
1	44	44
2	265	269
3	250	256
4	153	154
5	88	83
6	180	185
7	35	36
8	494	502
9	249	249
10	204	208
11	265	277
12	27	39
13	68	84
14	230	228
15	180	187
16	149	155
17	286	290
18	72	80
19	272	290
20	39	50

a) Calculate the mean, median and standard deviation of the blood levels obtained from;
  i.   a) The leg   b) heart

                                                                      (12 marks)

   b) Compute the coefficient of correlation (5 marks)
   c) Interpret the coefficient of correlation r, (3 marks)
   d) Use the least squares method to find the regression coefficients α and β and state the regression equation (5 marks)

Question 3

a) Distinguish between the Chi-square and Fischer's Exact test, stating the strengths and weakness of each test (5 Marks)

b) A public health student collected data from a sample of 30 students to pre-test her tool for data collection. The objective of the study was to assess utilisation of University counselling services. The results are as tabulated below

Sex of student	Utilized counselling services	Never utilized counselling
Male	8	7
Female	5	10

i) Develop an appropriate null and alternative hypothesis for this pre-test (4 marks)

ii) Use Chi-square test with Yates correction to test your hypothesis (9 marks)

iii) Write your conclusion (4 marks)

iv) Why is Yates correction preferred? (3marks)

Question 4.

a) A pharmaceutical firm claims that a new analgesic drug relieves mild pain under standard conditions for 3 hours, with a standard deviation 1 hour. Sixteen patients are tested under the same conditions and have an average pain relief time of 2.5 hours.

i. Determine a 95% and 99% confidence interval for the mean (6 marks)
ii. To ascertain the claim from the company, what would be the appropriate test? (2 mark)
iii. Develop an appropriate null and alternative hypothesis (4 marks)
iv. Set up the appropriate critical region. (2 marks)
v. Apply the appropriate test and determine the test statistics (6 marks)
vi. Based on your results in (iv) determine if the null hypothesis can be rejected and state your conclusion.(5 marks)

Question 5.

Explain the following concepts detail as used in biostatistics application of the following statistical tests in detail

a) Correlation and association (5 marks)
b) Normal distribution (4 marks)
c) Binomial distribution (4 marks)
d) Parametric tests (12 marks)

Question 6

a)   In a study of childhood obesity, we wanted to know whether children from private schools are more likely to be obese compared their counterparts in public school. We take a sample of 250 children aged between 10-12 years from private school of whom 110 were found to be obese and 301 children from public school of whom 98 were obese.

i. Calculate a 95% and 99% confidence interval for the difference in proportions of children who are classified at obese (5 marks)

ii. Based on your answer for (i) what conclusion can we draw (3 marks)

b) In a study of the effectiveness of an insecticide against a certain insect, a large area of land was sprayed. Later the area was examined for live insects by randomly selecting squares and counting the number of live insects per square. Past experience has shown the average number of live insects per square after spraying to be 0.5. If the number of live insects per square follows a Poisson distribution, find the probability that a selected square will contain;

a) Exactly one live insect (3marks)

b) No live insect (3mrks)

c) One or more live insects (5 marks)

d) Fewer than four live insects (6 marks)