



AMREF INTERNATIONAL UNIVERSITY
SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF COMMUNITY HEALTH
MASTER OF PUBLIC HEALTH
SPECIAL/SUPPLEMENTARY EXAMINATION - MARCH 2024

MPH 712: BIostatistics

DATE: March 2024

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
3. Section A: Compulsory Question (25 marks)
4. Section B: Long Answer Questions (75 marks)
5. All questions in Section A are compulsory and Answer any THREE questions in Section B
6. This online exam shall take 3 Hours
7. Late submission of the answers will not be accepted
8. Ensure your web-camera is on at all times during the examination period
9. No movement is allowed during the examination
10. Idling of your machine for 5 min or more will lead to lock out from the exam
11. The Learning Management System (LMS) has inbuilt integrity checks to detect cheating
12. Any aspect of cheating detected during and or after the exam administration will lead to nullification of your exam
13. In case you have any questions call the invigilator for this exam on Tel. +254722774221/
+254725984499 and the Head of Department on Tel +254720573449
14. For adverse incidences please write an email
to: amiu.examinations@amref.ac.ke and jarim.omogi@Amref.ac.ke

Question 1

Consider the data below

Blood pressure (mm Hg)	Number of patients
115-124	4
125-134	5
135-144	5
145-154	7
155-164	5
165-174	4
175-184	5
Total	35

Determine and interpret the:

- Mode (3 marks)
- Median (3 marks)
- Mean (3 marks)
- Semi-interquartile range (4 marks)
- Sample variance (3 marks)
- Sample standard deviation (3 marks)
- Coefficient of variation (3 marks)
- Skewness (3 marks)

SECTION B: ANSWER ANY THREE (3) QUESTIONS

Question 2

A sample of 200 people with a particular disease was selected. Out of these, 100 were given a drug and others were not given any drug. The results are as follows.

	Drug	No drug	Total
Cured	65	55	120
Not cured	35	45	80
Total	100	100	200

Test whether the drug is effective or not using Chi-square test. (25 marks)

Question 3

a) A Hospital records the weights of every new born child at the hospital. The distribution of weights is normally shaped, has mean of 2.9 Kg, and has a standard deviation of 0.45 Kg.

Determine the following:

- i. The percentage of new borns who weighed under 2.1 Kg (7 marks)
- ii. The percentage of new borns who weighed between 1.8 Kg and 4.0 Kg (7 marks)
- iii. If 1500 babies have been born at the hospital, how many weighed less than 2.5 Kg? (5 marks)

b) Suppose that it is known that 30 percent of a certain population is immune to some disease. If a random sample of size 10 is selected from this population, what is the probability that it will contain exactly four immune persons? Use the Binomial Distribution. (6 marks)

Question 4

The following data shows the marks obtained by 10 students in Anatomy and Physiology.

% Marks in Anatomy	% Marks in Physiology
78	84
45	55
36	50
78	60

62	82
90	86
65	58
75	60
39	47
41	51

- a) Determine the Pearson's correlation coefficient. (15 marks)
- b) Determine the rank correlation coefficient. (10 marks)

Question 5

For a random sample of 31 individuals selected from the population of 12-40 years with foetal alcohol syndrome, the mean height is 147.4cm. If the true mean height is 160.0cm with a standard deviation of 6cm. Test, the claim that the mean height of this group is 160.0cm. Use 5% level of significance and show all the steps. (25 Marks).

Question 6

Derive the formula for:

- a) The test statistic for testing the null hypothesis of equal means when population variances are known. (6 marks)
- b) The test statistic for testing the null hypothesis of equal means when the population variances are unknown. (6 marks)
- c) Confidence interval for the difference between two population means. (6 marks)
- d) Confidence interval for the difference between two proportions. (7 marks)

Statistical formulas and tables may be used.

$$1. z = \frac{(x - \mu)}{\sigma}$$

$$2. \chi^2 = \sum \frac{(o - e)^2}{e}$$

$$3. \phi^2 = \frac{\chi^2}{N}$$

$$4. b = \frac{\sum_{i=1}^n X_i Y_i - n \bar{X} \bar{Y}}{\sum_{i=1}^n X_i^2 - n \bar{X}^2} \text{ and } a = \bar{Y} - b \bar{X} \text{ for the line } y = a + bx$$

$$5. r_s = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

$$6. r_{xy} = \frac{\frac{1}{n} \sum_{i=1}^n X_i Y_i - \bar{X} \bar{Y}}{\sqrt{\left(\frac{1}{n} \sum_{i=1}^n X_i^2 - \bar{X}^2 \right) \left(\frac{1}{n} \sum_{i=1}^n Y_i^2 - \bar{Y}^2 \right)}}$$

Formulas

$$\circ Z = \frac{\bar{X} - \mu_0}{\delta / \sqrt{n}}$$

$$Z = \frac{X - \mu}{\delta}$$

$$\circ s = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}}$$

$$\bar{X} = \frac{\sum X}{n}$$

$$\circ Z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\delta_1^2}{n_1} + \frac{\delta_2^2}{n_2}}};$$

$$\circ t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{s_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}, \quad s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 - 1) + (n_2 - 1)}$$

$$\circ t = \frac{\bar{X} - \mu_0}{s / \sqrt{n}};$$

$$t = \frac{\bar{X} - \mu}{s_{\bar{x}}}, \quad s_{\bar{x}} = \frac{s}{\sqrt{n-1}}$$

$$\circ t = \frac{(\bar{X}_1 - \bar{X}_2)}{S(\bar{X}_1 - \bar{X}_2)}; \text{ where, } S(\bar{X}_1 - \bar{X}_2) = \sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}}; \text{ with, } S_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

$$\circ P(X=r) = \frac{n!}{(n-r)!r!} p^r q^{n-r} \quad \text{OR} \quad P(X=r) = \binom{n}{r} p^r q^{n-r}$$

$$\circ P(x) = \frac{e^{-\lambda} \lambda^x}{x!}$$

$$\circ S_B^2 = SSB = \sum \frac{n(\bar{X} - \bar{X}_{GM})^2}{k-1}$$

$$S_W^2 = SSW = \frac{\sum (n_i - 1) S_{i^2}}{\sum (n_i - 1)}$$

$$\circ \bar{X}_{GM} = \frac{\sum X}{N}$$

$$F = \frac{SSB}{SSW} = \frac{S_B^2}{S_W^2}$$

$$\circ T = \sum \frac{T_i^2}{n_i} - \bar{X}_{GM}$$

$$T_{SS} = \sum y^2_{ij} - \bar{X}_{GM}$$

$$\circ C.I = \bar{X} \pm Z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \text{ (large sample)} \quad \text{or} \quad C.I = \bar{X} \pm t_{df, n-1} \frac{s}{\sqrt{n}} \text{ (small sample)}$$

$$\circ C.I = p_s \pm Z_{\alpha/2} \sqrt{\frac{p_s(1-p_s)}{n}} \quad \text{or} \quad (p_{s_1} - p_{s_2}) \pm Z \sqrt{\bar{p}(1-\bar{p}) \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}$$

$$\circ \text{Expected Value} = \frac{\text{Row Sum} \times \text{Column Sum}}{\text{Grand Total}};$$

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}$$