



AMREF INTERNATIONAL UNIVERSITY
SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF HEALTH SYSTEMS MANAGEMENT AND DEVELOPMENT
MASTER OF SCIENCE IN HEALTH SYSTEMS MANAGEMENT
END OF SEMESTER EXAMINATION

HSM712: BIostatistics

Date: DECEMBER 2025

Duration: 3 hours Start: 5:30 pm End: 8:30 pm

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. Please do not send your answers using email. You must upload them on vas.
14. In case you have any questions call the invigilator for this exam on Tel. +254725984499 and write an email to michel.mutabazi@amref.ac.ke.
15. For adverse incidences please write an email to: amiu.examinations@amref.ac.ke

SECTION A: ANSWER ALL QUESTIONS (25 MARKS)

Question 1

Consider the data in the table below

Wages in USD	Number of employees
140 -160	12
160 -180	18
180 - 200	35
200 -220	42
220 -240	50
240 -260	45
260-280	20
280-300	8
Total	230

Compute and interpret:

- The mean (2 marks)
- The mode (2 marks)
- The median (2 marks)
- The standard deviation (5 marks)
- The coefficient of variation (2 marks)
- The coefficient of skewness (2 marks)

Question 2

Explain the shape and properties of the normal probability distribution (5 marks)

Question 3

A researcher is evaluating the impact of a new training program for nurses on their performance scores before and after the training.

- Identify an appropriate statistical test. (3 marks)
- Explain why this test is suitable. (2 marks)

SECTION B: ANSWER ANY THREE (3) QUESTIONS.

Question 4

Consider the following data

Subject	Score X	Score Y
1	2.0	1.5
2	3.0	2.0
3	4.5	3.5
4	5.0	3.5
5	6.0	3.5
6	7.0	4.0
7	7.5	3.0
8	8.5	4.5
9	9.5	4.5
10	10.0	5.0

- Calculate and interpret the Pearson Correlation Coefficient (15 marks)
- Determine the linear regression equation where X is the independent variable (10 marks)

Question 5

In order to determine the effect of a certain oral contraceptive on weight gain, nine health females were weighted prior to the start of its use and again at the end of a 3 months period.

Subject	Initial Weight in Kg	Weight after 3 months in Kg
1	48.0	49.2
MM2	56.4	57.2
3	52.0	56.0
4	60.0	58.0
5	54.0	56.0
6	56.0	57.2
7	48.0	47.2
8	56.0	56.4
9	52.0	52.8

Use t-test to establish if there is sufficient evidence to conclude that females experience gain weight following 3 months of the oral contraceptive use (25 marks)

Question 6

a) A research team is interested in the difference between serum uric acid levels in patients with and without Down's syndrome. In a large hospital for the treatment of the mentally retarded, a sample of 12 individuals with Down's syndrome yielded a mean of $\bar{x}_1 = 4.5$ mg/100 ml. In a general hospital a sample of 15 normal individuals of the same age and sex were found to have a mean value of $\bar{x}_2 = 3.4$. If it is reasonable to assume that the two populations of values are normally distributed with variances equal to 1 and 1.5, find the 95 percent confidence interval for $\mu_1 - \mu_2$. (10 Marks)

b) Researchers wish to know if the data they have collected provide sufficient evidence to indicate a difference in mean serum uric acid levels between normal individuals and individuals with Down's syndrome. The data consist of serum uric acid readings on 12 individuals with Down's syndrome and 15 normal individuals. The means are $\bar{x}_1 = 4.5$ mg/100 ml and $\bar{x}_2 = 3.4$ mg/ml. Using z-test, carry out the test at 5% level of significance assuming the data constitute two independent simple random samples each drawn from a normally distributed population with a variance equal to 1 for the Down's syndrome population and 1.5 for the normal population. (15 marks)

Question 7

a) A survey was conducted concerning cigarette smoking in public and the respondents were asked to indicate their level of agreement with the statement: 'cigarette smoking should be banned in public places and the results were as follows

Gender	Level of agreement				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Female	40	38	16	37	5
Male	16	25	11	25	11

Assuming that we have a simple random sample of males and females and on the basis of these data; use the Chi-square to test the hypothesis that males and females do not significantly differ with respect to their levels of agreement on the banning of cigarette smoking in public places at 95% confidence level. (20 marks)

b) As part of a study of Alzheimer's disease, Dusheiko reported data that are compatible with the hypothesis that brain weights of victims of the disease are normally distributed. From the reported data, we may compute a mean of 1076.80 grams and a standard deviation of 105.76 grams. If we assume that these results are applicable to all victims of Alzheimer's disease, find the probability that a randomly selected victim of the disease will have a brain that weighs less than 800 grams. (5 marks)

Question 8

a) A discrete random variable X can take the values 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Its probability distribution is given in the table below

x	0	1	2	3	4	5	6	7	8	9
$f(x)$	0.02	0.1p	0.2p	0.05	0.1	0.7p	0.2	0.9p	0.15	0.3p

Determine the value of p

(5 marks)

b) Ten competitors in a beauty contest are ranked by 3 judges in the following order

1st Judge	1	6	5	10	3	2	4	9	7	8
2nd Judge	3	5	8	4	7	10	2	1	6	9

3rd Judge	6	4	9	8	1	2	3	10	5	7
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Use the rank correlation coefficient to determine which pair of judges has the nearest approach to common tastes in beauty. (12 marks)

c) Let X be a continuous random variable.

a) Show that the function

$$f(x) = \begin{cases} \frac{1}{2}x, & 0 \leq x \leq 2 \\ 0, & \text{elsewhere} \end{cases} \quad (4 \text{ marks})$$

is the probability density function.

b) Compute $P(0.5 \leq x \leq 1)$ (4 marks)

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