



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: 3rd AUGUST 2026

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

SECTION A: ANSWER ALL QUESTIONS (25 MARKS)

Question 1

A health facility manager recorded the number of patients attended to by 20 community health workers during an outreach programme. The data are presented below.

12, 15, 10, 14, 13, 16, 11, 15, 12, 14, 13, 15, 16, 12, 14, 13, 11, 15, 14, 12

Using the data above, calculate and interpret the following statistical measures:

- a) Mode (2 marks)
- b) Median (2 marks)
- c) Mean (5 marks)
- d) Standard deviation (6 marks)

Question 2

A health systems researcher is interested in determining whether stronger leadership competencies among health facility managers are associated with better service delivery performance. Ten health facility managers were assessed using standardized leadership and service delivery performance evaluation tools, and the scores obtained are presented in the table below.

Manager	Leadership	Service Delivery
1	92	90
2	80	82
3	88	86
4	95	94
5	75	74
6	90	91
7	72	70
8	97	96
9	84	83
10	86	87

- i) Calculate the Spearman Rank Correlation Coefficient. (8 marks)
- ii) Interpret the result in the context of health systems management. (2 marks)

SECTION B: ANSWER ANY THREE (3) QUESTIONS. EACH QUESTION IS 25 MARKS

Question 3

A hospital administrator wishes to determine whether the number of management supervision visits influences percentage improvement in service delivery.

Visits (X)	Improvement (Y)
1	4
2	7
3	9
4	12
5	14
6	17
7	19
8	22
9	25
10	27

- a) Determine the regression equation. (15 marks)
- b) Interpret the slope and intercept of the regression line. (5 marks)
- c) Predict improvement for 7.5 visits. (5 marks)

Question 4

A county health department introduced two different management approaches for improving employee productivity. After six months, the following employee performance scores were obtained.

Management Strategy A: $n = 15$, Mean = 82.5, SD = 6.2

Management Strategy B: $n = 14$, Mean = 77.8, SD = 5.5

Assuming that the population variances are equal, perform an independent samples t-test at the 95% confidence level to determine whether there is a statistically significant difference in the mean employee performance scores between Management Strategy A and Management Strategy B. (25 marks)

Question 5

(a) A researcher compares patient waiting times between two hospitals.

Hospital A:

- $n = 40$
- Mean waiting time = 42 minutes
- Standard deviation = 8 minutes

Hospital B:

- $n = 45$
- Mean waiting time = 47 minutes
- Standard deviation = 10 minutes

i) Construct a 95% confidence interval for the difference in the population mean waiting times of Hospital A and Hospital B. (10 marks)

ii) Interpret the confidence interval. (3 marks)

(b) A quality improvement programme was introduced in two hospitals.

- Hospital A: Out of 220 patients, 176 reported satisfactions with services.
- Hospital B: Out of 200 patients, 142 reported satisfaction.

i) Construct a 95% confidence interval for the difference in patient satisfaction proportions. (10 marks)

ii) Interpret your findings. (2 marks)

Question 6

A county health department is evaluating the consistency of outpatient service utilization in two public hospitals. Monthly outpatient attendance data were collected over a ten-month period to determine whether there is a significant difference in the variability of outpatient attendance between the two hospitals. The data are presented below.

Hospital A attendance: 120,125,130,118,135,128,132,126,124,131

Hospital B attendance: 140,150,148,145,152,147,149,151,146,153

Use the F-test to determine whether the variances differ at the 95% confidence level. (25 marks)

Question 7

A hospital management team recently introduced two communication platforms, Email and WhatsApp, to improve internal communication among staff. To determine whether employees' preferred communication channel is associated with their department, a survey was conducted among staff from three departments. The results are presented below.

Department	Email	WhatsApp	Total
Clinical Services	42	18	60
Finance	30	20	50
Administration	38	12	50
Total	110	50	160

Using the data above, perform a Chi-square test of independence at the 95% confidence level to determine whether there is a statistically significant association between employees' department and their preferred communication channel.

- Clearly state the null and alternative hypotheses (4 marks)
- Calculate the Chi-square test statistic (15 marks)
- Determine the critical value (3 marks)
- Draw an appropriate conclusion. (3 marks)