AMREF INTERNATIONAL UNIVERSITY

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF COMMUNITY HEALTH

MASTER OF PUBLIC HEALTH

END OF SEMESTER EXAMINATION - APRIL 2026

HSM 712/HPE 715/ MPH712: BIOSTATISTICS

DATE: 9th April 2026

TIME: Three Hours **Start:** 5:00 pm **Finish**: 8:00 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

1. Consider the following salaries of 11 employees in a hospital.

45300, 52500, 48200, 54700, 47200, 51000, 46500, 52500, 60000, 49100, 45300

Calculate the following measures of central tendency and dispersion

a) Mode (2 marks)
b) Median (2 marks)
c) Mean (2 marks)
d) Standard deviation (4 marks)

2. Ten students got the following scores in exams of Anatomy and Physiology.

Student	Anatomy Score	Physiology Score
1	90	85
2	78	80
3	85	82
4	92	95
5	76	75
6	88	87
7	70	65
8	95	92
9	80	79
10	83	84

Using the data provided above, calculate the Pearson correlation coefficient and interpret the result (10 marks)

3. Explain five areas where the normal distribution can be applied (5 marks)

SECTION B: ANSWER ANY THREE (3) QUESTIONS (75 Marks)

4. A researcher is studying the relationship between the number of hours spent exercising per week and the reduction in blood pressure (in mmHg) in a sample of 10 patients. The data collected is as follows:

Hours of Exercise per Week (X)	Reduction in Blood Pressure (Y)
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
10	20

a) Find the equation of the best-fit line (the regression line) for the given data. (15 marks)

b) Interpret the meaning of the slope and the intercept in the context of the study. (5 marks)

c) Predict the reduction in blood pressure for someone who exercises 8.5 hours per week. (5 marks)

5. A researcher wants to compare the effectiveness of two different drugs, Drug A and Drug B, in lowering blood pressure. Two groups of patients are randomly assigned to receive either Drug A or Drug B. After 4 weeks, the decrease in systolic blood pressure (in mmHg) is recorded.

The data are as follows:

- Drug A ($n_1 = 10$): Mean = 12.5 mmHg, Standard deviation = 4.0 mmHg
- Drug B ($n_2 = 12$): Mean = 9.0 mmHg, Standard deviation = 3.5 mmHg

Assuming the variances of the two groups are equal, test at 95% confidence level whether there is a significant difference in the mean blood pressure reduction between the two drugs (25 marks)

6. a) A community health worker screens 10 individuals for tuberculosis. The probability that a person tests positive is 0.3.
    i. State the sampling distribution of the number of positive cases. (2 marks)
    ii. Find the mean and standard deviation of this distribution. (4 marks)
    iii. Calculate the probability that exactly 4 individuals test positive? (4 marks)
    iv. Interpret the result in context. (2 marks)

    b) A researcher wants to compare the effectiveness of two diets in promoting weight loss. She randomly assigns 30 participants to Diet A and 35 participants to Diet B. After 8 weeks, the average weight loss for the Diet A group is 8.5 kg with a standard deviation of 2.1 kg, while the Diet B group has an average weight loss of 7.1 kg with a standard deviation of 2.5 kg. Assuming the weight losses in both groups are normally distributed and independent,

    i. Construct a 95% confidence interval for the difference in population means (Diet A – Diet B). (10 marks)
    ii. Interpret the result (3 marks)

7. a) A clinical trial is conducted to compare the effectiveness of two treatments for high blood pressure. Out of 200 patients receiving Treatment A, 130 experienced a significant reduction in blood pressure. Out of 180 patients receiving Treatment B, 99 experienced a significant reduction.
    i. Construct the 95% confidence interval for the difference in proportions of patients who experienced significant reduction between Treatment A and Treatment B. (10 marks)
    ii. Interpret the result (3 marks).

    b) Explain three types of regression analysis that you can apply in your study giving relevant examples (12 marks)

8. a) Consider the data below from two groups on the number of prenatal check-ups conducted in two different regions (Region A and Region B). Test whether there is a significant difference in

the variances of prenatal check-ups between the two regions at 95% confidence level. Use the F-test for equality of variances. (16 marks)

Here is the data:

Region A:

a. Prenatal check-ups: 5, 4, 6, 5, 7, 8, 5, 4, 6, 7

Region B:

b. Prenatal check-ups: 9, 8, 9, 7, 10, 8, 8, 9, 10, 9

b) In Statistics, explain the role of each of the following graphical tools

i. Histogram (3 marks)
ii. Scatter plot (3 marks)
iii. Box plot (3 marks)

9. a) A company wants to analyze whether there is an association between the department (Sales, Marketing, and Operations) and the preference for a new software tool (Tool A and Tool B) among employees. A survey was conducted, and the following data was collected:

Department	**Tool A**	**Tool B**	**Total**
Sales	30	20	50
Marketing	40	10	50
Operations	35	15	50
Total	105	45	150

Use the chi-square to test whether there is a significant association between the department and the preference for the software tool at 95% confidence level. (15 marks)

b) Explain five properties of the Poisson distribution (10 marks)