



AMREF INTERNATIONAL UNIVERSITY
SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF COMMUNITY HEALTH
MASTER OF PUBLIC HEALTH/ MASTER OF SEXUAL AND REPRODUCTIVE
HEALTH RIGHTS AND POLICY

SPECIAL/ SUPPLEMENTARY EXAMINATION AUGUST 2026

UNIT CODE: MPH/ MSR 712 Biostatistics

DATE: August, 2026

TIME: Three Hours

Start: 1730 Hours

Finish 2030 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. Show ALL working clearly. Marks are awarded for correct procedure, not only the final answer.
4. All final numerical answers must be reported to 2 decimal places unless otherwise stated.
5. A non-programmable scientific calculator is permitted.
6. Statistical tables (Z, t, and Chi-square) are provided at the end of this paper.

SECTION A: COMPULSORY (25 Marks)

QUESTION ONE (25 MARKS)

1. A study was conducted among 12 MPH students to examine their Systolic Blood Pressure (SBP) in mmHg

Student	1	2	3	4	5	6	7	8	9	10	11	12
Sex	M	F	M	F	M	F	M	F	M	F	M	F
SBP (mmHg)	100	118	140	110	125	132	118	145	135	120	118	128

- Calculate the mean of SBP (mmHg) (2mks)
 - Determine the median SBP and interquartile range of SBP (mmHg) (2mks)
 - Compute the variability of SBP (mmHg) among individual students (2mks)
 - Compute the precision of the sample mean? (2mks)
 - Calculate the coefficient of variation of SBP (mmHg). (2mks)
2. Three patients are tested for a disease. Each test result is Positive (P) or Negative (N).
- Write the complete sample space. (2mks)
 - Define the random variable X and list all possible values of X. (2mks)
 - If probability of a positive test is 0.3 and tests are independent, construct the full probability distribution of X. (3mks)
 - State whether X follows a known probability distribution. (1mk)
3. The number of live births by weight and prenatal care in a region were as follows:

Prenatal care		
Birth weight	Yes	No
≤2.5Kg	3,307	234
>2.5Kg	46,471	1461

- What is the probability of a baby weighing less than 2.5Kgs (2mks)

- ii. Determine the probability of a baby weighing less than 5.5Kgs, given that the child received no prenatal care? (2mks)
4. Consider a study which examined the association between apnea, as measured by the apnea-hypopnea index (AHI) and diabetes, as measured by fasting insulin levels in the blood. Describe statistical method will you use to analyze the data? (2mks)

SECTION B

ANSWER ANY THREE (3) QUESTIONS (75 Marks)

QUESTION TWO

1. A hospital has 5 doctors and 4 nurses. A committee of 3 people is selected at random.
- Calculate the total number of committees that can be formed (2mks)
 - Determine the probability the committee consists of exactly 2 doctors and 1 nurse? (3mks)
 - Explain why order does or does not matter in this selection. (1mk)
 -
2. Among admitted patients, $P(\text{Diabetes}) = 0.25$; $P(\text{Hypertension}) = 0.40$ and $P(\text{Both}) = 0.15$
- Compute:
 - $P(D \cup H)$ (2mks)
 - $P(D | H)$ (2mks)
 - State whether the conditions are independent. (1mk)
3. A treatment known to have 85% chances of success was used on 20 patients.
- Determine the probability that exactly 5 patients got well after that treatment? (2mks)
 - Show that at least four of the patients got well after treatment (3mks)
 - Construct a 95% confidence interval (3mks)
4. Critical patients are sometimes put on mechanical ventilators to assist or replace the function of breathing. A serious side-effect of this procedure is ventilator-associated pneumonia (VAP). In one study of patients who were mechanically ventilated in the intensive care units of six different hospitals, researchers found that 63 out of 472 patients developed VAP.

- i. Calculate a 95% CI for the proportion of all mechanically ventilated patients who will develop VAP. (4mks)
- ii. Interpret the 95% CI (2mk)

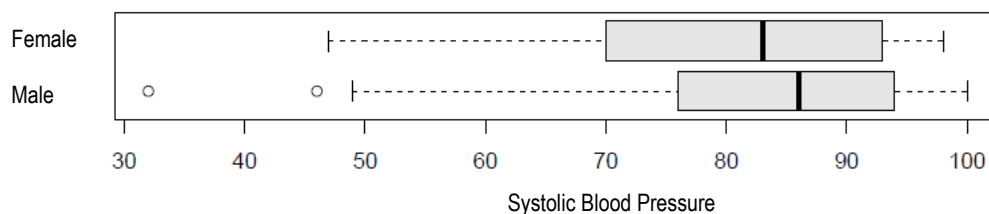
QUESTION THREE

1. Differentiate clearly between Parameter and Statistic (2mks)
2. Suppose systolic BP in a population is normally distributed with mean, $\mu = 130$ mmHg and variance $\sigma^2 = 144$ mmHg
 - i. Determine the proportion of adults have SBP above 150 mmHg? (3mks)
 - ii. A sample of 36 adults is selected. What is the probability the sample mean exceeds 135 mmHg? (3mks)
3. A study compares mean BMI between two groups:

Residence	n	Mean	SD
Urban	25	28	6
Rural	25	25	5

- i. State appropriate hypotheses (2mks)
- ii. Conduct test for difference in means. (4mks)
- iii. Interpret Type I and Type II errors in this context. (4mks)
- iv. Suppose the residence variable had a third category semi-urban, will you have concerns with your analyses in (i) and (ii) above? (2mks)

4. Below is a box plot of patients' SBP values



- i. Compare the median systolic blood pressure (SBP) between males and females. Which group has the higher median SBP? (1mk)
- ii. Based on the box plot, compare the mean score of males and the median score of females. Which group has the higher central tendency? (1mk)
- iii. Using the box plot, compare the distribution of SBP between males and females in terms of centre, spread, variability, and potential outliers. State at least two observations. (2 mks)
- iv. From the box plot, can you determine whether any participant had an SBP of exactly 100 mmHg? Justify your answer. (1mk)

QUESTION FOUR

1. A study reports:

	Disease +	Disease –
Symptomatic	6	14
Not Symptomatic	2	18

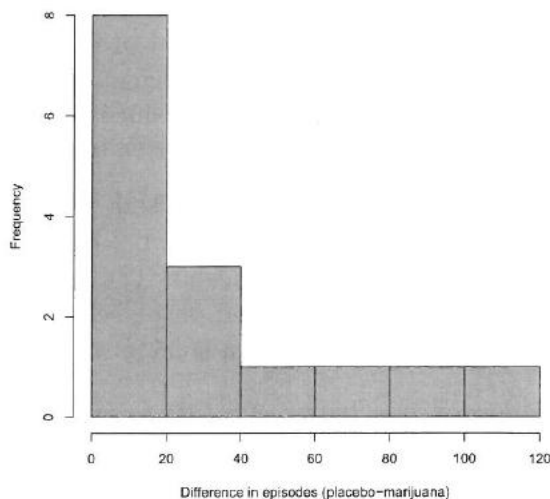
- i. Test association using Chi-square. (4mks)
 - ii. Explain when Fisher's Exact Test would be more appropriate. (1mk)
2. According to child health and development study, the average pregnancy length is 279 days, with a standard deviation of 16 days. Furthermore, the distribution is approximately normal. Calling day 279 the "due date"
 - i. What percent of women go into labour more than 4 weeks early (28 days before their due date)? (3mks)
 - ii. What percent of women go into labor within 3 days of their due date? (3mks)
 - iii. If five women are pregnant, what is the probability that at least 1 of them will give birth within 3 days of their due date? (4mks)
 - iv. If five women are pregnant, what is the probability that the average length of that pregnancies will be within 3 days of the national average? (5mks)
 - v. A researcher proposes to call a baby "overdue" if the length of the mother's pregnancy is greater than the 95th percentile of pregnancy lengths. What cutoff is this researcher proposing? (5mks)

QUESTION FIVE

1. A district hospital recorded the length of hospital stay (in days) for patients admitted with severe malaria. The grouped data are shown below. It is known that the total number of patients was 40 and the mean length of stay was 11.5 days.

Length of Stay (Days)	0 – 4	5 – 9	10 – 14	15 – 19	20 – 24
Frequency	6	10	f	8	4

- i. Determine the missing frequency f . (6 marks)
 - ii. Using the completed table:
 - a. Calculate the estimated standard deviation of length of stay. (6 marks)
 - b. Calculate the coefficient of variation (CV). (2 marks)
 - iii. If the hospital administrator claims that “most patients stay less than 10 days,” comment statistically using the grouped data. (2 marks)
2. Nausea and vomiting are frequent side effects of cancer chemotherapy, which can contribute to the decreased ability of patients to undergo long-term chemotherapy schedules. Fifteen patients were first assigned to receive marijuana treatment and later on also given Placebo treatment. The outcome of interest was the number of vomiting that each subject experienced. The patients averaged 6.2 episodes while on marijuana treatment and 38.1 episodes while on the placebo. The mean difference was 31.9 and the standard deviation was 35.9
 - i. Perform the appropriate hypothesis test to address whether or not the observed change in episode could be due to chance (4mks)
 - ii. Obtain a 95% confidence interval (3mks)
 - iii. Below is a histogram of the differences in the number of episodes between the treatment and placebo for each patient. Do you have any concerns about how you analyzed the data above? (2mks)



QUESTION SIX

1. In a random sample of 25 patients from a certain hospital, a researcher found that the average time a patient would wait before seeing a doctor was 36 minutes with a standard deviation of 9 minutes.

- Find the probability that a patient visiting the same hospital will wait for more than 20 minutes (4mks)
- Construct 95% confidence interval for the waiting time (5mks)
- Interpret (ii) above (2mks)

2. A study investigates the relationship between number of chronic conditions (X) and quality of care score (Y) measured on a 100-point scale (0 = worst, 100 = best). The following data were collected from 10 patients:

Number of Chronic Conditions (X)	0	1	2	3	4	5	6	2	4	3
Quality of Care Score (Y)	56	58	60	63	64	67	69	59	65	62

- Obtain the slope and the intercept (8mks)
- Graph the correlation between quality of care and number of chronic conditions and indicate whether positive or negative (Answer in (i) can assist) (2mks)
- What is the predicted quality of care for a patient with no chronic conditions? (2mks)
- What is the predicted quality of care for a patient with 2 chronic conditions? (2mks)