



BONDO UNIVERSITY COLLEGE

UNIVERSITY EXAMINATION 2011

**FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE
DEGREE OF MASTER OF EPIDEMIOLOGY AND
BIOSTATISTICS**

KISUMU LEARNING CENTRE

COURSE CODE: HMP 5114

TITLE: BIOSTATISTICS

DATE: 20/12/2012 TIME: 8.00-11.00AM

DURATION: 3 HOURS

INSTRUCTIONS

- 1. This paper contains SIX (6) questions**
- 2. Answer question 1 and ANY other 3 Questions**
- 3. Write all answers in the booklet provided**

QUESTION 1 (COMPULSORY)

- a) What is the Gaussian distribution? What is unique about the measures of central tendency for this distribution? (3 marks)
- b) Briefly, distinguish between the following:
 - a. Nominal and ordinal variables (2 marks)
 - b. Discrete and continuous variables (2 marks)
 - c. Measures of central tendency and dispersion (2 marks)
 - d. Mean and mode (2 marks)
 - e. Range and interquartile range (2 marks)
- c) What is statistic inference? (2 marks)

QUESTION 2

- a) Explain the meaning of the equation $P(\text{event}) = A/N$ in terms of probability, given that A is the number of desirable events and N is the total number of trials during which the event may occur (3 marks)
- b) State (write the equation) showing the multiplicative or product rule when calculating the probabilities of at least two **independent** events occurring together. (3 marks)
- c) What is the probability of rolling two successive 6s in a row with a single unbiased die, given that the events are independent, and we know that we can expect to roll a 6 one out of every six times, on average.? (5 marks)
- d) State (write the equation) showing the multiplicative or product rule when calculating the **conditional** probabilities of at least two events that are **not independent** events occurring together. (4 marks)

QUESTION 3

A study investigated the use of the ice-water test in 80 patients with detrusor over-activity in Siaya District Hospital. Of these, 60 had bladder instability and 20 had **detrusor hyper-reflexia** (DH). Their results are shown in the table below.

		DH (+)	DH (-)	Total
Test result	+ve	True +ve 39	False -ve 3	42
	-ve	False -ve 21	True -ve 17	38
	Total	60	20	80

Note: Please, show your work.

Compute the following:

- a) The sensitivity of the test (3 marks)
- b) The specificity of the test (3 marks)

- c) The positive predictive value of the test (3 marks)
- d) The negative predictive value of the test (3 marks)
- e) The likelihood ratio LR+ of the test (3 marks)

QUESTION 4

- a) Briefly, describe what is the null hypothesis? (2 marks)
- b) What does it mean if the null hypothesis is rejected or accepted? (2 marks)
- c) Briefly, outline the steps in hypothesis testing. (5 marks)
- d) What is a type I error and α (alpha)? (2 marks)
- e) What does the *p*-value measure? (2 marks)
- f) Explain what is power, and how is it calculated? (2 marks)

QUESTION 5

- a) List two normal probability distributions. (3 marks)
- b) How is the standard error calculated for a single sample mean? (3 marks)
- c) What are degrees of freedom for a one-sample calculation? (3 marks)
- d) Calculate the 95% confidence interval about the mean of a single sample, given a sample size of $n = 18$, mean $\bar{X} = 42$, standard deviation $s = 6.3$. Note: Since $df = 18 - 1 = 17$, the 95% confidence coefficient = 2.110. (3 marks)
- e) How does the width of a confidence interval vary and affect its usefulness? (3 marks)

QUESTION 6

The table below shows the steady-state haemoglobin levels recorded from patients with different types of sickle cell disease at Lwak Hospital.

Type of sickle cell disease	No. of patients (n _i)	Haemoglobin (g/decilitre)		
		Mean (X _i)	SD (s _i)	Individual values
Hb SS	10	8.67	0.896	7.2, 7.7, 8.1, 8.4, 8.5, 8.7, 9.1, 9.1, 9.8, 10.1

Hb SC	8	12.1	1.023	10.7, 11.3, 11.6, 11.8, 12.0, 12.3, 13.3, 13.8
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- a) Construct analysis of variance table (show your working) **(12 Marks)**
- b) Given that the F-distribution tabulated value at 5% at (1, 16) degrees of freedom is 4.54, is there evidence to suggest that the mean steady-state haemoglobin levels differ between patients with different types of sickle cell disease? **(3 marks)**