



**MURANG'A UNIVERSITY COLLEGE**

*A constituent college of Jomo Kenyatta University of Agriculture and Technology*

**University Examination 2015/2016**

**END OF SEMESTER SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF  
BACHELOR OF APPLIED STATISTICS WITH COMPUTING -YEAR 1 SEMESTER 2**

**AMS 2109: INTRODUCTION TO BIOSTATISTICS**

**DATE: 28<sup>TH</sup> JUNE 2016**

**TIME: 2 HOURS**

**Instructions:** Attempt question **One** and **Two** other questions

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**QUESTION 1(30 MARKS)**

- a) Differentiate the following terms as used in statistics
- (i) population and sample [2marks]
  - (ii) Estimator and estimate [2marks]
- b) The median and standard deviation of 100 observations are 30 and 8 respectively. Find the coefficient of skewness if the sum of the observations is 2000. Comment on your answer. [4marks]
- c) Aircrew escape system are powered by a solid propellant. The burning rate of this propellant is an important product characteristic. Specifications require that the mean burning rate must be 50 centimeters per second. We know that the standard deviation of burning rate is  $\sigma = 2$  centimeters per second. The experimenter decides to specify a type I error probability or significant level of  $\alpha = 0.05$  and selects a random sample of  $n = 25$  and obtains a sample average burning rate of  $\bar{x} = 51.3$  centimeters per second. What conclusion should be drawn. [4marks]
- d) Explain any two properties of a good estimator [4marks]
- e) Ten measurement of impact energy (J) on specimens of A 288 steel cut at  $60^{\circ}$  are as follows Construct a 95% CI for  $\mu$ , the mean impact energy. Assume the impact energy is normally distributed with  $\sigma = 1J$ , construct a 95% CI for  $\mu$ , the mean impact energy [4marks]
- f) Let  $x$  be a binomial random variable with parameter  $n$  (known) and  $p$  (unknown). Given a random sample of  $n$  observation of  $x$ , compute using the method of moment the estimator for  $p$ . [6marks]
- g) The data below shows the distribution of ages of volunteers in a medical self- help project.

Age (years)	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Volunteer	7	21	18	5	6	2	1

Compute the range of the middle 50% of the ages

[6marks]

### QUESTION 2 (20 MARKS)

The table below shows the mathematics examination marks for a class of one hundred students in Murang'a University College.

Marks out 70	10-19	20-29	30-39	40-49	50-59	60-69
Number of students	4	8	x	22	y	6

The mean mark of the students was 46.5

- Show that the values of x and y are 8 and 22 respectively [6marks]
- Using 34.5 as the assume mean, determine the variance and standard deviation of the above distribution [7marks]
- calculate the mode and median for the above data [7marks]

### QUESTION 3 (20 MARKS)

- Differentiate between a parameter and a statistic as used in estimation [4marks]
- Let  $x_1, x_2, \dots, x_n$  be a random sample from

$$f(x) = \begin{cases} \frac{2}{\theta^2}(\theta - x), & 0 < x < \theta \\ 0, & \text{elsewhere} \end{cases}$$

Obtain by the method of moments the estimator for k. [8marks]

- Let  $x_1 x_2 \dots x_n$  be a random sample from a Bernoulli population with parameter p.

$$f(x) = \begin{cases} p^x(1-p)^{1-x}, & x = 0, 1; 0 < p < 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the maximum likelihood estimator of p. [8marks]

### QUESTION 4 (20 MARKS)

- Differentiate the following terms as used in test of hypothesis
  - Null and alternative hypothesis [2marks]
  - Type I and Type II errors [2marks]
  - Simple and composite hypothesis [2marks]
- The quality department of a wire manufacturing department periodically selects a sample of syringe specimen in order to test for breaking strength. Past experience has shown that the breaking strength of a certain type of syringe is normally distributed with standard deviation of 450kg. A random sample of 64 specimens gave a mean of 550kg. Find out the population mean at 95% confidence level. [5marks]
- Given the general linear model  $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$   $i = 1, 2, \dots, n$  where  $E(\varepsilon_i) = 0$ ,  $var(\varepsilon_i) = \sigma^2$ ,  $cov(\varepsilon_i \varepsilon_j) = 0$   $i \neq j$ 
  - Obtain the normal equations [4marks]
  - Find the estimate of  $\beta_0$  and  $\beta_1$  [5marks]

**QUESTION 5 (20 MARKS)**

For the following frequency distribution shown in the table below

Class	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89
Frequency	35	103	192	263	214	130	46	17

Using 72 as the assumed mean calculate the

- a) mean and standard deviation [9marks]
- b) determine the first and second Pearson measure of skewness [4marks]
- c) percentile coefficient of Kurtosis and comment on your results. [7marks]