



MURANG'A UNIVERSITY COLLEGE

A constituent college of Jomo Kenyatta University of Agriculture and Technology

University Examination 2015/2016

**END OF SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF APPLIED
STATISTICS WITH PROGRAMMING**

AMS 2108: PRINCIPLES OF STATISTICAL INFERENCE

DATE: DECEMBER 2015

TIME:

2 HOURS

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

- a) State and explain any TWO methods used in collecting primary data [2marks]
- b) Differentiate between the terms Parameter and Statistic as used in statistical inference [2marks]
- c) A random variable is normally distributed with mean of 50 and standard deviation of 10. Calculate
- (i) $P[45 \leq X \leq 62]$ [3marks]
- (ii) $P[X \geq 70]$ [2marks]
- d) State and explain any two probabilistic methods of obtaining a sample from a population. [4marks]
- e) The mean and standard deviation for the grade points of a random sample of 36 college students are calculated to be 2.6 and 0.3 respectively. Find the 95% and 99% confidence interval for the mean of the entire class. [6marks]
- f) A firm wishes to estimate with a maximum allowable error of 0.05 and a 95% level of confidence, the proportion of consumers who prefer its product. How large a sample will be required in order to make such an estimate if the preliminary sales report indicates that 25% of all consumers prefer the firm's product? [4marks]
- g) A random sample of 100 recorded deaths in Kenya during the past year showed an average lifespan of 71.8 years with a standard deviation of 8.9 years. Does this seem to indicate that the average lifespan today is greater than 70 years at 1% level of significant? [3marks]
- h) The following information has been supplied to you by two manufactures of electric bulbs to a purchasing manager of a certain company.

	Company A	Company B
Mean life (in hours)	1,300	1,248
Standard deviation (in hours)	82	93
Sample size	100	100

Which brand of bulbs are you going to purchase if you desire to take a risk of 5% [4marks]

QUESTION TWO (20 MARKS)

- a) It is suspected that a linear relationship of the form $y = bx + a + \varepsilon_i$ exist between the set of observed data $(x_1, y_1), (x_2, y_2), (x_3, y_3) \dots (x_i, y_i)$. Find the value of the unknown coefficients a and b which are the regression coefficients, that will minimize $S = \sum_{i=1}^n \varepsilon_i^2$ where $\varepsilon_i = y_i - x_i - a$, $i = 1 \dots n$

[8 marks]

- b) The following data shows masses of railway bolts in grams (X) and the corresponding lengths in cm (Y)

X	11	13	14	16	18	19	21	24
Y	11	12	14	14	15	17	18	19

- (i) Find the Karl Pearson correlation coefficient between X and Y [7marks]
(ii) Determine the least square regression of Y on X [5marks]

QUESTION THREE (20 MARKS)

- (a) State any two properties of a normal distribution [2marks]
(b) A tyre company has invented a revolutionary new product. In order to overcome consumer resistance, a mileage guarantee is offered with the tire. Road test suggests that the mean life of the tyre is 42,000 miles, with a standard deviation of, 4,000miles. The tests suggest that tyre life is normally distributed.
(i) What percentages of the tyres will last for more than 44, 000 miles? [3marks]
(ii) What percentages of the tyres will last for less than 41, 000 miles? [3marks]
(iii) What percentages of tyres will have a life between 38,000 miles and 43,000 miles? [4marks]
c) The numbers of hours which ten students, taken at random, studied for an examination are shown below.

No of hours studied(X)	8	6	11	13	10	5	18	15	2	8
Grade in examination(Y)	56	44	79	70	70	54	94	85	33	70

Calculate the Spearman's rank correlation coefficient [8 marks]

QUESTION FOUR (20 MARKS)

- a) State the procedures used in testing of hypothesis [5marks]
- b) Differentiate between Type I error and Type II error [2marks]
- c) In a certain production process it was found that the mean measurement of some characteristics of the product occasionally shifts due to slight changes in the machine setting, while the variability is seldom affected. The periodic checks up are made to ensure that the mean is not off the mark and σ is stable. Suppose that in this production process the target value of μ is $\mu = 50$ and σ is known to be 2.5. The sample measurements on a day are 43,51,50,41,53,52,47,54,51,45,48, and 47. The production manager will welcome any change of μ towards higher values, however, he will like to safeguard against decreasing values of μ . Formulate the null hypothesis and test the same.[7marks]
- d) A potential buyer of fluorescent lamp bought 50 lamps of each of two brands, that is National lamps and Kenyan brand. Upon testing these lamps, he found that the brand National had a mean life of 1,282 hours with a standard deviation of 80 hours, whereas, the Kenyan brand had a mean life of 1,208 hours with a standard deviation 94 hours. At 5% percent level of significance, can the buyer conclude that both brands have the same mean life? [6marks]

QUESTION FIVE (20 MARKS)

- a) An ordinary die is thrown 120 times and each time the number on the uppermost face is noted. The results are shown in the table below.

Number on die	1	2	3	4	5	6	Total
Frequency	14	16	24	22	24	20	20

Perform a χ^2 test at 5% level to find out whether the die is fair. [10marks]

- b) A manufacturer wants to test the hypothesis that the mean life time of two brands of machines used is equal. The life time is measured by the number of operating by the number of operating hours between the overhauls. The manufacturer keeps overhaul statistics on all his machines. A random sample of 15 machines gives the following details. Operating hours between overhauls;

Machine X	400	450	425	430	445	460	475	420	410	415	435
Machine Y	525	500	436	440	455	465	505	515	505	395	418

Using Mann- Whitney test, will you conclude that the lifetimes of two brands are equal at 5%? [10marks]