



NJORO CAMPUS

SECOND SEMESTER 2011/2012

SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURE, ANIMAL HEALTH MANAGEMENT, ANIMAL PRODUCTION, DAIRY SCIENCE, HORTICULTURE, FOOD, NUTRITION AND DIETETICS, FOOD SCIENCE AND TECHNOLOGY AND NATURAL RESOURCE MANAGEMENT

AGRO 291: STATISTICS FOR AGRICULTURE

STREAM: B.Sc. (Y2S2)

TIME: 3 HOURS

DAY:

DATE:

INSTRUCTIONS:

- 1. Answer question ONE and any other THREE*
- 2. Show all your calculations and formulae where applicable.*
- 3. Scientific calculators may be used.*
- 4. Figures in bracket indicate marks for each question.*
- 5. Statistical tables are provided/attached*

QUESTION ONE (COMPULSORY)

- (a) Define the following terminologies
- | | |
|------------------|----------|
| (i) Population | (1 mark) |
| (ii) Variable | (1 mark) |
| (iii) Hypothesis | (1 mark) |
| (iv) Experiment | (1 mark) |
| (v) Type I error | (1 mark) |

- (b) The Kenya Consumers' Organization undertook to study the impact of inflation on the consumption patterns of households. The following is a sample data of a day's purchase of meat from a butchery. Study the table and answer the questions that follow:

Table 1: Records of daily purchases of beef (kg) by different households

Amount of Meat(Kg)	0.5-0.9	1.0-1.4	1.5-1.9	2.0-2.4	2.5-2.9	3.0-3.4
Cumulative frequency of No. of households	22	60	74	86	96	100

- (i) Complete the relative frequency distribution table **(4 marks)**
 - (ii) Compute mean, mode, median, standard deviation and coefficient of variation of this data **(7 ½ marks)**
 - (iii) What is the nature of this data in terms of skewness? Show graphically. **(2 marks)**
 - (iv) List any three characteristics of arithmetic mean **(1 ½ marks)**
- (c) The gestation period of dairy cows is normally distributed with a mean of 265 days and a standard deviation of 15 days. If it is stipulated that a calf is premature if born at least three weeks early,
- (i) What percentage of calves is born prematurely? **(2 ½ marks)**
 - (ii) What is the probability that an animal will calve after 295 days **(2 ½ marks)**

QUESTION TWO

- (a) In an analysis of variance table, MSE was equal to 10. Six samples were selected from each of the four populations, where the sum of squares total was 250.
- (i) Set up the null hypothesis and the alternative hypothesis **(1 mark)**
 - (ii) What is the criterion for rejection? use the $\alpha=0.05$ level of significance **(2 marks)**
 - (iii) Complete the ANOVA table. What is the value of F? **(4 marks)**
 - (iv) What is your decision regarding the null hypothesis? **(2 marks)**
- (b) In a random sample of 47 eggs from Tatton farm, the average weight (g) was 62.1 with a standard deviation of 5.6g
- (i) Find a 90% Confidence Interval for the mean of this sample of eggs. **(3 marks)**

- (ii) How many eggs must be sampled so that a 90% confidence interval specifies the mean to within ± 0.9 g? **(3 marks)**

QUESTION THREE

- (a) i) A doctor is interested to see if the average body temperature of Eskimos is significantly lower than the normal average for man, which is 98.6 degrees Fahrenheit. After selecting 8 Eskimos at random, the following temperatures were recorded: 98.4, 97.8, 98.6, 98.7, 98.3, 97.9, 98.0, and 98.4.
Do these results give sufficient evidence to reject the claim that Eskimos have normal body temperatures, on the average? Let $\alpha=0.05$ **(6 marks)**
ii) State the assumption(s) required to validate the test in a (i) above, **(2 marks)**
- (b) A box contains 8 oranges of which 3 are spoilt. If two are picked at random, what is the probability that:
(i) They are spoilt **(2 ½ marks)**
(ii) They are good **(2 ½ marks)**
- (c) State any two properties of standard deviation **(2 marks)**

QUESTION FOUR

- (a) The data below relate to the weight losses in pounds(Y) of 10 people and the number of months(X) they have been on a special reducing diet.

Table 2: Weight loss of 10 persons on special reducing diet

X	4	17	14	1	10	22	9	12	4	7
Y	17	64	53	1	45	71	38	40	11	24

- (i) Plot the observations on a scatter diagram and state the relationship suggested by the diagram **(4 marks)**
- (ii) Using X as the independent variable and Y as the dependent variable, obtain the equation of the relationship suggested in a(i) above **(4 marks)**
- (iii) Using the equation in (ii) above, obtain the predicted weight loss in pounds for people who stay on the diet for 5, 10, 15, and 20 months **(4 marks)**
- (iv) Calculate coefficient of determination and provide its interpretation **(3 marks)**

QUESTION FIVE

- (a) Under what circumstances would a researcher use t-statistic instead of z-statistic **(3 marks)**

- (b) Use the F table to determine the critical values for the following situations
 - (i) $\alpha=0.01$, degrees of freedom between=7, degrees of freedom within=23 **(1 mark)**
 - (ii) $\alpha=0.05$, degrees of freedom between=2, degrees of freedom within=18 **(1 mark)**
 - (iii) $\alpha=0.10$, degrees of freedom between=15, degrees of freedom within=7 **(1 mark)**
 - (iv) $\alpha=0.025$, degrees of freedom between=5, degrees of freedom within=14 **(1 mark)**

- (c) In an experiment conducted at Egerton University, study participants are asked to react to a stimulus. In one experiment, the participants must press a key on seeing a blue screen. Reaction time (in seconds) to press the screen is measured. The same person is then asked to press a key on seeing a red screen, again with reaction time measured. The results for six randomly sampled participants are as follows:

Table 3: Reaction time (seconds) to different stimuli

Participants	1	2	3	4	5	6
Reaction to blue	0.6	0.5	0.8	0.3	0.7	0.5
Reaction to red	0.4	0.4	0.5	0.4	0.5	0.5

Use a paired t-statistic to test the claim that reaction time to blue stimulus is different from the reaction time to red stimulus at the significance level of $\alpha=0.01$ **(5 marks)**

- (d) List the six important functions of the science of statistics **(3 marks)**

QUESTION SIX

- (a) A population of children aged between 2-10 years was observed in a study. The ages were as follows: 2,4,6,8,10
 - (i) What is the sample space if two numbers are drawn in sequence with replacement **(2 marks)**
 - (ii) Use the outcome in (i) above to construct a sample space for the corresponding population of sample means **(2 marks)**
 - (iii) Compute the mean ($\mu_{\bar{x}}$) and standard deviation ($\sigma_{\bar{x}}$) of the sampling distribution of the means **(2 marks)**

- (iv) How does the (μ) of the population of ages compare with ($\mu_{\bar{x}}$) of the sampling distribution of the means (2marks)
- (b) Outline at least two properties of the sampling distribution of the mean (\bar{x}) (3 marks)
- (c) Njoro Cannery Ltd has 15 delivery trucks, used mainly to deliver processed food products in the Kenyan retail outlets. Of these 15 trucks, 6 have break problems. A sample of 5 trucks is randomly selected. What is the probability that 2 of these tested are defective? (4 marks)

QUESTION SEVEN

- (a) A feed company claims that 90 percent of its orders to the commercial stockists in Nakuru town are delivered within 2 hours from the time the order is placed. A sample of 100 orders revealed that 82 were delivered within the promised time. At the 0.01 significance level, can it be concluded that less than 90 percent of the orders are delivered in less than 2 hours?
 - (i) State the null and alternative hypothesis (1 mark)
 - (ii) State and show the decision rule/criterion for rejection graphically (3 marks)
 - (iii) Compute the value of the test statistic (3 marks)
 - (iv) What is your decision regarding the null hypothesis and conclusion about the study (2 marks)
- (b) Define and state the statistical significance of randomization, replication, and experimental error in the design and interpretation of biological studies (6 marks)
