UNIVERSITY OF EMBU

2016/2017 ACADEMIC YEAR

FIRST SEMESTER EXAMINATION

FIRST YEAR EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE (AGROFORESTRY)

ACS 600: BIOMETRICS FOR AGRICULTURAL SCIENCES

SCHOOL-BASED

DATE: DECEMBER 1, 2016   TIME: 8:00-11:00AM

INSTRUCTIONS:

Answer ANY FOUR Questions

QUESTION ONE (25 MARKS)

a) Distinguish between the following terms as used in Biometrics:

  i) A simple random sample and a stratified random sample   (2 marks)

  ii) An interval scale and a ratio scale of measurement   (2 marks)

b) The ages (in years) of a sample of 10 attendees to a five-day regional trade fair are:

  41, 23, 13, 26, 28, 10, 23, 35, 8, and 43.

  Using these data, determine the following measures
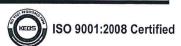
  i) Mean age   (2 marks)

  ii) Median age   (2 marks)

  iii) Variance of the ages   (4 marks)

c) A civil society group concerned with environmental conservation is planning a survey to estimate the proportion of citizens who support a proposed excision of a forest reserve to resettle some squatters. The estimate of the proportion should be within a margin of error of ±2% with 95% confidence. Based on an opinion poll conducted earlier, the proportion that

supports the excision is expected to be around 60%. How many people need to be included in the sample? (3 marks)

d) Briefly describe the following principles of experimental design:

      i)   Randomization (2 marks)

      ii)   Replication (2 marks)

      iii)   Error control/Blocking (2 marks)

e) A study was designed to compare rates of survival of male and female rats after being exposed to some radiations. The following table shows the number of male and female rats that died or survived during the study.

Gender	Survived		Total
	No	Yes	
Female	10	25	35
Male	30	35	65
Total	40	60	100

Based on these data, compute

i) The probability of death for males (2 marks)

ii) The odds of death for males (2 marks)

QUESTION TWO (25 MARKS)

The table below shows the oven-dry weight of aboveground biomass and belowground biomass for some seven mangrove tree seedlings.

Weight (in grams) of aboveground biomass	6.1	7.9	5.7	7.8	8.4	7.3	7.1
Weight (in grams) of belowground biomass	0.4	0.6	1.1	1.9	1.1	1.8	1.6

Using these data

a) Plot a scatter diagram for the above data (2 marks)

b) Obtain the Pearson's product-moment correlation coefficient and interpret the value obtained (12 marks)

c) Obtain the least squares regression line of belowground biomass weight on aboveground biomass weight (8 marks)

d) Use the result in part (c) above to predict the value of belowground biomass weight when aboveground biomass weight is equal to 8.5g (3 marks)

QUESTION THREE (25 MARKS)

a) Distinguish between Type I and Type II errors as used in hypothesis testing. (2 marks)

b) A researcher conducted an experiment to assess the effect of two types of foliar feeds – Hopen and Phoem – on maize heights. Two experimental plots were set up and maize seeds planted (twenty in the seedbed for Hopen and nineteen in the seedbed for Phoem). After forty five days, the seedlings were sprayed with respective foliar feeds. The seedlings were again sprayed after the next forty five days had elapsed 45 days. The measurements of the plant heights were taken on the 100th day. The table below shows the means and standard deviations of the heights (in mm) of the plants

	Mean	Standard deviation
Plot 1 (Hopen)	26.7	3.63
Plot 2 (Phoem)	27.1	2.57

Do these data indicate a significant difference between the two foliar feeds? Assume that the population ariances are equal but unknown (use a two-tailed test with a 5% level of significance) (12 marks)

c) The following grouped frequency distribution shows the heights (in centimeters) of three-month-old eucalyptus trees in a botanical garden.

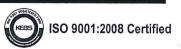| Height (in cm)	Number of trees
95-99	2
100-104	5
105-109	13
110-114	6
115-119	5
120-124	19

Determine:

i) The mean height of the trees (4 marks)

ii) The inter-quartile range of the tree heights (7 marks)

QUESTION FOUR (25 MARKS)

a) A research was carried out to assess the effect of ultraviolet rays on the stomata of bean leaves. Ten leaves of a bean plant were monitored before and after exposure to ultraviolet rays and the number of open stomata below the leaf surface were recorded as shown in the table below

Leaf	Number of open stomata before exposure	Number of open stomata after exposure
1	11	13
2	13	14
3	12	15
4	10	13
5	14	15
6	12	14
7	10	13
8	15	16
9	9	13
10	13	14

Is there a significant effect of ultra violet rays on opening of stomata? (Use a 2-tailed test at 5% level of significance.)   (14 marks)

b) Twenty tapeworms of the same size were divided into two equal groups and maintained in water with different salinities: one group was maintained at 1000 ppm NaCl while the other group was maintained at 2000 ppm NaCl. Both groups were given the same quantity of food, and their weights were measured after four weeks. The table below shows the results of the body weights (in g) for the two groups:

Group A (1000 ppm NaCl)	10	9.3	9.4	9.8	9.9	9.0	9.4	9.5	9.7	9.5
Group B (2000 ppm NaCl)	11	10	10.1	10.4	10.5	10.5	9.9	10.3	10.5	10.3

Is there any significant difference between the weights of these two groups of tapeworms? (use a two-tailed test with a 5% level of significance)   (11 marks)

QUESTION FIVE (25 MARKS)

a) Distinguish between a response variable and an explanatory variable   (4 marks)

b) A research was carried out to assess the effect of magnesium on wheat yields. Four levels of magnesium percentage were considered; namely, 5%, 10%, 15% and 20%. For each percentage of magnesium in the soil, wheat yields (in kg) were taken on five experimental units and a completely randomized design analysis was used to see if there were yield differences due to the percentage of magnesium. The table below shows the results

Percentage of magnesium in the soil			
5%	10%	15%	20%
2	4	6	5
1	5	1	8
4	2	2	6
1	3	4	2
2	6	2	4

Test the claim at 1% level of significance that at least one of the four percentages of magnesium in the soil has a different effect on wheat yields. (21 marks)

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