MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2018/2019 ACADEMIC YEAR

PhD, *SECOND* SEMESTER

SCHOOL OF SCIENCE

BACHELOR OF SCIENCE IN APPLIED STATISTICS WITH COMPUTING

COURSE CODE:

COURSE TITLE: BIOSTATISTICS

MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR
FIRST YEAR SECOND SEMESTER

SCHOOL OF SCIENCE
DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL STUDIES

COURSE CODE: SES 911

COURSE TITLE: BIOSTATISTICS

DATE: 5TH DECEMBER 2018 TIME: 1100 – 1300HRS

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **TWO** questions
2. No writing on the Question paper
3. Use of mobile phone in the exam room is prohibited

This paper consists of two printed pages. Please turn over.

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QUESTION ONE (COMPULSORY, 30 MARKS)

(a) Distinguish between type I and type II errors **[4 Marks]**

(b) The International Rhino Federation estimates that there are 17,470 rhinoceroses living in the world in Africa and Asia. A break down on the number of rhinos of each species is reported in the accompanying table.

Rhino Species	**Population Estimates**
African Black	3610
African White	11 100
(Asian) Sumatran	300
(Asian) Japan	60
(Asian) Indian	2 400
TOTAL	**17 470**

i) Construct a relative frequency table **[3 Marks]**

ii) What proportion of rhinos are from Africa **[2 Marks]**

(c) Differentiate between the following terms as used in biostatistics.

i) Descriptive and inferential statistics **[2 Marks]**

ii) Population and sample **[2 Marks]**

iii) Qualitative and quantitative data **[2 Marks]**

(d) Discuss any two properties of a good estimator. **[2 Marks]**

(e) The theory of assortative mating states that the height of husband (Y) is related to the height of the wife (X). Loise et al compared the heights of 12 randomly picked couples and the results were shown below.

X	162	171	175	162	165	171	176	162	174	170	168	165
Y	154	159	156	172	159	172	186	159	179	156	176	159

Use the data to calculate the Spearman's rank correlation coefficient **[5 Marks]**

(f) A tea company applied fertilizers A, B, C and D and observes their yields in three plots I, II and III. The figures are given in the following table.

Plots	**Fertilizers**				
	A	**B**	**C**	**D**	**Plots' Total**
I	36	36	21	35	**128**
II	28	29	31	32	**120**
III	26	28	29	28	**112**
Fertilizers' Totals	**90**	**93**	**81**	**96**	**360**

Using $\alpha = 0.05$

i. Do the fertilizers significantly differ in performance? **[4 Marks]**

ii. Is there a significant difference between the plots? **[4 Marks]**

QUESTION TWO ***[20 MARKS]***

(a) Define the following terms,

i) Statistical Hypothesis **[2 Marks]**

ii) Producer risk **[2 Marks]**

iii) Critical value **[2 Marks]**

(b) In an anti a malarial campaign in a certain area. Quinine was administered to 812 persons out of a total population of 3248. The number of fever cases is shown below.

Treatment	**Fever**	**No Fever**	**Total**
Quinine	20	792	**812**
No Quinine	220	2216	**2436**
Total	**240**	**3008**	**3248**

Using $\alpha = 0.05$

Discuss the usefulness of Quinine in checking Malaria **[10 Marks]**

c) Group of ten patients in a hospital are to be tested (on a voluntary basis) with a new sleep-inducing drug over a period of time. For each patient, the average number of hours slept before (x) and after (y) using the drug will be recorded. Design a decision rule, involving the sample difference mean and standard deviation for testing the effectiveness of the drug at the 5% level of significance. The average increase (y-x) in the number of hours slept for a particular ten patients were

2.0, 0.2, -0.4, 0.3, 0.7, 1.2, 0.6, 1.8, -0.2 and 1.0

Use the above rule to test whether the drug is shown to be effective. **[4 Marks]**

QUESTION THREE ***[20 MARKS]***

a) Define the following terms as used in design of experiment.

i. Treatments **[2 Marks]**

ii. Placebo **[2 Marks]**

b) Discuss the three principles of experimental design. **[6 Marks]**

c) Students are randomly assigned to groups which are taught Spanish by three different methods

- classroom instruction and language laboratory
- only class room instructions
- only self-study in language laboratory

Following are final examination scores of samples of students from the three groups

Method 1: 94, 88, 91, 74, 86, 97

Method 2: 85, 82, 79, 84, 61, 72, 80

Method 3: 89, 67, 72, 76, 69

Use Kruskal-Wallis test at the 0.05 level of significance to test the null hypothesis that the population sampled are identical. **[10 Marks]**

QUESTION FOUR *[20 MARKS]*

a) Trace metals in drinking water affect the flavor of the water, and un usually high concentration can pose a health hazard. Table below shows trace-metal concentrations (zinc, in mg/L) for both surface water and bottom water at six different river locations. Our aim is to see if surface water concentration (x) is predictive of bottom water concentration(y).

LOCATION	BOTTOM	SURFACE
1	0.430	0.415
2	0.266	0.238
3	0.567	0.390
4	0.531	0.410
5	0.707	0.605
6	0.716	0.609

i) Draw a scatter diagram to show a possible association between the concentrations and check to see if a linear model is justified. **[5 Marks]**

ii) Estimate the regression parameters, the bottom water concentration for location with a surface water concentration of 0.5 mg/L, and draw the regression line on the same graph with the scatter diagram. **[8 Marks]**

iii) Test to see if the two concentrations are independent; state your hypotheses and choice of test size. **[7 Marks]**