JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY

DEPARTMENT OF BIOLOGICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCES IN BIOLOGICAL SCIENCES

4TH YEAR 1ST SEMESTER 2022/2023 ACADEMIC YEAR

MAIN CAMPUS - REGULAR

COURSE CODE: **SBB 1409**

COURSE TITLE: **BIOSTATISTICS II**

EXAM VENUE: **STREAM: (BSC)**

DATE: **EXAM SESSION:**

TIME: 2 HOURS

Instructions:

1. **Answer ALL questions in Section A and Any two questions in Section B**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

SECTION A: SHORT ANSWER QUESTIONS (30 MARKS)

1. a) Using diagrams, illustrate the null hypothesis for left hand, right hand and two tail test. (1.5 marks)
   b) Differentiate between Type I and Type II errors. (1.5 marks)

2. Five students applied for course transfer from Education to Biological Sciences at JOOUST. The probabilities of the students being accepted are ¼,3/5,2/17,1/5,1/7, respectively. Find the probability that at least one of them being accepted. (3 marks)
3. Explain the application differences between frequency and probability distribution (3 marks)
4. a) State the theory of test of significance considered when dealing with small and large sample sizes. (1.5 marks)
   b) Under what condition do we use logistic regression analysis (1.5 marks)
5. Explain the importance of Correlation analysis and standard error in statistics (3 marks)

6. Explain any three assumptions that must be considered before applying multiple linear regression in biostatistics. (3 marks)
7. Illustrate a normal distribution curve to explain your understanding of rejection and acceptance level for hypothesis test at α of 5%. (3 marks)

8. Differentiate between one-way and two - way ANOVA (analysis of variance). (3 marks)
9. A random sample of 16 BSc Biological Science students at JOOUST revealed that only 9 passed Biostatistics course unit. Provide an approximate 95% confidence interval for that proportion in the BSc. programme. (3 marks)

10. Assuming the mean weight of 4^{th} year BSc Biological Science female students is 60kg with a standard deviation of 20. What is the probability of finding a random sample of 16 female students with a mean weigh of 50 cm, assuming the weights are normally distributed? (3 marks)

SECTION B: ESSAY QUESTIONS (40 MARKS)

11. A microbiology student wanted to determine the effect of varying soil temperature on the microbial density in the field. Based on this information, answer the following questions.

a) State a suitable hypothesis for the above study. (2 marks)
b) Describe the type of data she will collect and describe experimental design used to collect the data (5 marks)
c) Assuming the study was carried and the following data was obtained.

Temperature (°C)	10	12	14	16	18	20
Density	10	15	12	15	20	25

I. Calculate the Standard Error of the mean performance (4 marks)

II. Perform a statistical test based on your data above (assume 95% confidence interval). (9 marks)

12. A survey experiment was carried out to determine the household financial adjustment based on the new tax measures by the Kenya Kwanza government. Out of 100 households

who participated in the survey, 20% did not report any adjustments.

a) What is the 95% confidence interval for the proportion of households who would still not report any adjustment if the new tax is upheld. (5 marks)

b) Assuming the same sample of size n = 100 produced the sample mean of μ= 30. Assuming the population standard deviation = 15, compute a 95% confidence interval for the population mean. (5 marks).

c) Given the following daily financial expenditure was obtained from two random household groups for seven (7) weeks of tax introduction.

Weeks	1	2	3	4	5	6	7
Group A ($)	7	8	12	10	15	16	20
Group B ($)	10	6	7	8	9	5	8

Determine the pearsons correlation coefficient (r) and explain your answer. (10 marks)

13. The following data indicates the number of coliforms obtained when media x was used in Zoology lab under varying concentration.

Media concentration (%)	5	7	10	12	18	20	25	30
Coliforms (#)	8	10	12	15	16	18	20	25

a) Using this data, determine the regression equation. Explain your equation. (10 marks).

b) Draw a scatter plot and compute the proportion of the variance due to regression (r^2) (10 marks).

14. The following SPSS Univariate outputs were generated in an experiment performed for the effect of fertilizer rates on yield of two maize varieties.

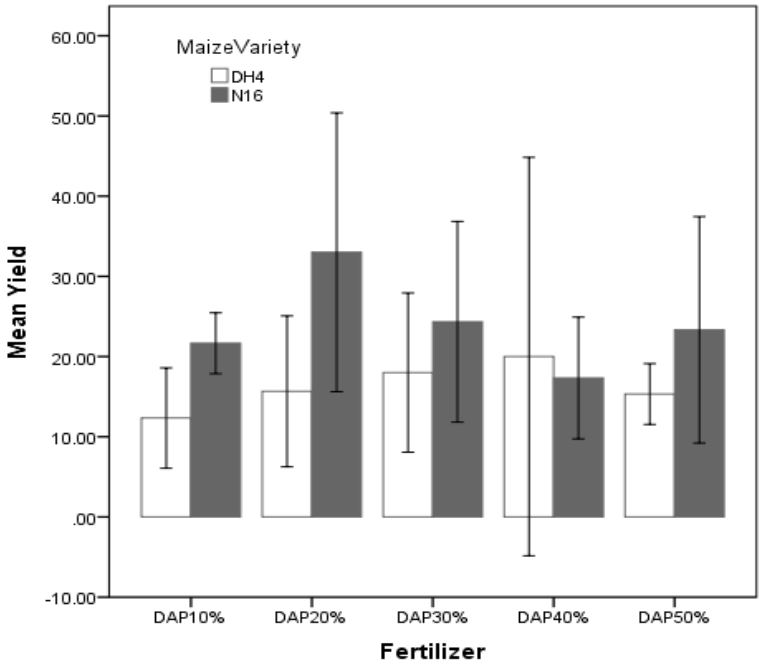

Fig 1.

TABLE A: Tests of Between-Subjects Effects

Dependent Variable: Yield

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	936.033[a]	9	104.004	4.042	.004
Intercept	12120.300	1	12120.300	470.996	.000
Fertilizer	187.867	4	46.967	1.825	.164
MaizeVariety	440.833	1	440.833	17.131	.001
Fertilizer * MaizeVariety	307.333	4	76.833	2.986	.044
Error	514.667	20	25.733		
Total	13571.000	30			
Corrected Total	1450.700	29			

a. R Squared = .645 (Adjusted R Squared = .486)

Table B: Multiple Comparisons

Dependent Variable: Yield

LSD

(I) Fertilizer	(J) Fertilizer	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
DAP10%	DAP20%	-7.3333*	2.92878	.021	-13.4427	-1.2240
	DAP30%	-4.1667	2.92878	.170	-10.2760	1.9427

DAP20%	DAP40%	-1.6667	2.92878	.576	-7.7760	4.4427
	DAP50%	-2.3333	2.92878	.435	-8.4427	3.7760
	DAP10%	7.3333*	2.92878	.021	1.2240	13.4427
	DAP30%	3.1667	2.92878	.292	-2.9427	9.2760
	DAP40%	5.6667	2.92878	.067	-.4427	11.7760
	DAP50%	5.0000	2.92878	.103	-1.1093	11.1093
DAP30%	DAP10%	4.1667	2.92878	.170	-1.9427	10.2760
	DAP20%	-3.1667	2.92878	.292	-9.2760	2.9427
	DAP40%	2.5000	2.92878	.403	-3.6093	8.6093
	DAP50%	1.8333	2.92878	.538	-4.2760	7.9427
DAP40%	DAP10%	1.6667	2.92878	.576	-4.4427	7.7760
	DAP20%	-5.6667	2.92878	.067	-11.7760	.4427
	DAP30%	-2.5000	2.92878	.403	-8.6093	3.6093
	DAP50%	-.6667	2.92878	.822	-6.7760	5.4427
DAP50%	DAP10%	2.3333	2.92878	.435	-3.7760	8.4427
	DAP20%	-5.0000	2.92878	.103	-11.1093	1.1093
	DAP30%	-1.8333	2.92878	.538	-7.9427	4.2760
	DAP40%	.6667	2.92878	.822	-5.4427	6.7760

Based on observed means.

The error term is Mean Square(Error) = 25.733.

*. The mean difference is significant at the .05 level.

Discuss the output (20 marks)

JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BIOLOGICAL SCIENCES

DEGREE OF BACHELOR OF SCIENCE IN BIOLOGICAL SCIENCES

YEAR 4 SEMESTER 1

COURSE OUTLINE

CODE SBI 1409: **TITLE:** BIOSTATISTICS II
Instructor: DR NYONGESAH MAINA
Mobile: 0702469532
Email: jnyongesah@jooust.ac.ke
Contact hours 42 hours , As per the time table
Venue: BotLab
Consultation: Online (Monday 9-11am) /School staffroom (Thur 9-11am)

Introduction

Biostatistics II provides an introduction to selected important topics in biostatistical concepts and reasoning. This course represents an introduction to the field and provides a survey of data and data types. Specific topics include tools for describing central tendency and variability in data; methods for performing inference on population means and proportions via sample data; statistical hypothesis testing and its application to group comparisons; issues of power and sample size in study designs; and random sample and other study types. While there are some formulae and computational elements to the course, the emphasis is on interpretation and concepts.

Learners Outcome

Upon completion of the course, students are able to:

- Recognize and give examples of different types of data arising in biological studies
- Interpret differences in data distributions and Calculate standard normal scores and resulting probabilities
- Calculate and interpret confidence intervals for population means and proportions
- Interpret and explain a p-value
- Perform a two-sample t-test and interpret the results; calculate a 95% confidence interval for the difference in population means
- Select an appropriate test for comparing two populations on a continuous measure, when the two sample t-test is not appropriate
- Understand and interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations
- Choose an appropriate method for comparing proportions between two groups; construct a 95% confidence interval for the difference in population proportions
- Understand and interpret statistical output

Prerequisite

All Basic Knowledge of Biostatistics 1 is a requirement.

Basic Rules

Class attendance is a must. Ensure assignments are handed over within the stipulated period.
Silence in class during the lesson

Cheating in exams is strictly prohibited

Evaluation

Assignments = 30%

Main Examination = 70%

Course Content

LECTURE	CONTENT
Lecture 1	Introduction to Statistics - terminology, types of studies, study design, sampling issues, and data/variable types
Lecture 1	Central ideas of estimation
Lecture 2	Confidence intervals , Probability
Lecture 3	Hypothesis tests , Inference for a Single Population Proportion…t-tests, X square test
Lecture 4-5	Distribution, Large sample hypothesis test; non parametric test
	CAT 1
Lecture 6	Correlation & Regression,
Lecture 7	ANOVA- One way and Two-way ANOVA
Lecture 8-9	Analysis with software- Excel, SPSS, Rstudio
Lecture 10	Tips on report writing
	CAT 2
	FINAL EXAM

REFERENCES

J.H.Zar. *Biostatistical Analysis*, 5th ed., 2009.

Statistical methods (A practical, painless Approach to understanding, using and interpreting statistics. Liwen Vaughan, 2009. Joost Lib

Regression Methods in Biostatistics: Linear, Logistic, Survival, and Repeated Measures Models (E. Vittinghoff, D. V. Glidden, S. C. Shiboski, and C. E. McCulloch) *Michael Elliott*

Armitage P, Berry G. In: Statistical Methods in Medical Research , 3rd edn. Oxford: Blackwell Scientific Publications, 1994:312-41.

PREPARED BY:……..

Dr. Maina Nyongesah

COURSE LECTURER

APPROVED BY…….

Dr Mweresa Collins

COD- BIOLOGICAL SCIENCES