



MACHAKOS UNIVERSITY

University Examinations 2019/2020 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN BIOLOGY

SZL 208: COMPUTER APPLICATIONS IN BIOLOGY

Date.....

Time.....

INSTRUCTION: Answer Question *ONE* which is compulsory and any other *TWO* Questions

Question one (30 marks)

- a) Discuss four advantages of using computer in research (8 marks)
- b) Two different types of drugs A and B were tried on certain patients for increasing weight, 5 persons were given drug A and 7 persons were given drug B. The increase in weight (in Kgs) was as given below:

Drug A	8	12	13	9	3	-	-
Drug B	10	8	12	15	6	8	11

Its t-test output is summarized in table 1

Table 1: Sample t-test output, for the test $H_0 : \mu_A = \mu_B$

	t	df	Sig.(2-tailed)	Mean difference	95% CI of the difference	
					Lower	Upper
Attendance	-0.5	10	0.6269	1.500	-5.443	3.443

- i. State the hypothesis for the above scenario
- ii. Based on the sample t-test output make statistical conclusion
- iii. Interpret the 95% CI lower and upper difference values (7 marks)
- c) Distinguish the following terms as used in scientific research
- i) Probability sampling and non-probability sampling
- ii) Sampling errors and non-sampling errors (4 marks)
- d) Discuss three sources of data for scientific research (6 marks)
- e) Define data integrity and highlight three ways through which it can be compromised (5 marks)

Question Two (20 marks)

- a) Define the term scientific research and justify why it is an ongoing process (6 marks)
- b) Discuss any four types of test-statistics and highlight when appropriate to use each (8 marks)
- c) A lecturer randomly sampled 9 students from his class and noted the gender and the colour of the eyes for each student as summarized below. The Chi- square analysis for gender and eyes colour was carried out and the output is given.

Participant	A	B	C	D	E	F	G	H	I
Black eyes	Yes	No	No	No	Yes	Yes	Yes	No	No
Gender	M	F	F	F	M	F	M	M	F

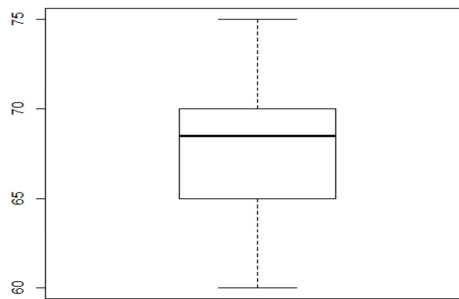
Chi- Square Output table		
$\chi^2=0.95$	df=1	P=0.3296

Based on the data and the output

- State the hypothesis for the above scenario
- Based on the sample t-test output make statistical conclusion (6 marks)

Question Three (20 marks)

- a) Highlight the basic steps for carrying out a scientific research (6 marks)
- b) A BSc student presumed the average abundance of a plant to be 63 per acre. He did a sample count for 10 acres and observed the following: 66, 65, 60, 70, 69, 71, 70, 75, 64, and 68
- Determine the sample mean and the standard deviation of the sample
 - Test if there was a significant difference between the presumed mean and the observed mean at $\alpha = 5\%$ (10 marks)
 - Estimate the sample median and quartiles using the box plot given below



(4 marks)

Question Four (20 marks)

a) Differentiate the following terms as they apply in scientific research

- i) Sample and Population
- ii) Response and independent variables
- iii) Descriptive and inferential statistics
- iv) Null hypothesis and Alternative hypothesis

(8 marks)

b) The data below gives the yields in 100kg sacks per plot for different fertilizers tried.

Fertilizer	Yields (Bags of 100kgs per plot)						
Nitrates	1	3	5	7	2	6	-
Calcium	4	6	4	3	3	5	7
Compound	3	6	7	8	5	-	-

Its analysis of variance output is summarized in Table 2

Table 2: ANOVA Table

Source of Variance	df	Sum sq	Mean sq	F value	Pr(>F)
Fertilizer	2	9.10	x	1.21	0.326
Residue	15	y	3.77		

Using the output values and with justifications;

- i. Determine the values of x and y
 - ii. State if yields differed significantly due to different fertilizers (8 marks)
- c) Highlight four components in a scientific findings report and publication (4 marks)

Question Five (20 marks)

a) Distinguish the following terms as they apply

- i. Computer system and computer software
- ii. Spreadsheet and database

(4 marks)

b) Discuss five ways of dealing with a missing data at analysis stage

(10 marks)

- c) The following data represents the heights of ten randomly sampled students from a BSc biology class 2.3, 2.5, 2.5, 2.7, 2.8 3.2, 3.6, 3.6, 4.5, 5.0

Represent the data in the stem-and-leaf plot

(6 marks)