

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**M.Sc. DEGREE EXAMINATION – BIOTECHNOLOGY****SECOND SEMESTER – APRIL 2023****PBT2MC04 – RESEARCH METHODOLOGY AND BIOSTATISTICS**

Date: 08-05-2023

Dept. No.

Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

SECTION A – K1 (CO1)**Answer ALL the questions****(5 x 1 = 5)****1. Choose the best option**

a) Independent variables that are not related to the purpose of study is referred as

- a) Extraneous variable
- b) Dependent variable
- c) Controlled variable
- d) Experimental variable

b) A typical example of interval scale

- a) Temperature
- b) Wind velocity
- c) Blood pressure
- d) All the above

c) For two normal population say $N(\mu_1, \sigma_1^2)$ and $N(\mu_2, \sigma_2^2)$, if we write a hypothesis like $H_1: \mu_1 \neq \mu_2$, then H_1 is known as:

- a) Complementary hypothesis
- b) Alternative hypothesis
- c) Composite hypothesis
- d) All the above

d) Find the false statement for peer review

- a) Protects the quality of published research
- b) Gives us access to feedback from experts in our field
- c) Helps to identify any weaknesses in your argument
- d) Less risk of publication bias

e) To read critically means

- a) Taking an opposing point of view to the ideas and opinions expressed
- b) Skimming through the material because most of it is just padding
- c) Evaluating what you read in terms of your own research questions
- d) Being negative about something before you read it

SECTION A – K2 (CO1)**Answer ALL the questions****(5 x 1 = 5)****2. Answer in one or two sentences**

a) How to treat anomalies in a given data?

b) Illustrate: Probability curve for a standard normal distribution following the empirical rule.

c) What is independent sample t-test? Give example.

d) Why plagiarism is so serious?

e) Mention any one of the significance of research ethics.

SECTION B – K3 (CO2)**Answer any THREE of the following in 300 words****(3 x 10 = 30)****3. Define and elaborate on different types of sampling design.**

4. Interpret the following statistical result obtained for the height of a plant species.

Plant Height	
Mean	24.05
Standard Error	1.74
Median	24.50
Mode	37.00
Standard Deviation	7.77
Sample Variance	60.37
Kurtosis	-0.69
Skewness	-0.02
Range	27.00
Minimum	10.00
Maximum	37.00
Sum	481.00
Count	20.00
Largest(1)	37.00
Smallest(1)	10.00
Confidence Level(95.0%)	3.64

5. Define hypothesis. Sketch the steps involved in hypothesis testing using an example.

6. Illustrate and explain about report writing in a scientific paper format.

7. With help of a flowchart, describe the steps involved in publishing an article.

SECTION C – K4 (CO3)

Answer any TWO of the following in 500 words

(2 x 12.5 = 25)

8. Under what circumstances would you recommend

- (a) A probability sample?
- (b) A non-probability sample?
- (c) A stratified sample?
- (d) A cluster sample?

Give suitable example

9. Five black cumin (*Nigella sativa L.*) plants were assessed after 30 and 45 days for number of flowers produced by each plant and result obtained has been given below.

No. of Plants	30 days	45 days
1	6	10
2	7	12
3	4	8
4	5	12
5	3	4

Test whether mean number of flowers per plant in black cumin was same in two different dates using appropriate statistical test.

(Table value at 5% level of significance - 2.132)

10. Peer review is an important process in evaluating a submission to an academic journal. Discuss..

11. Elaborate on types of plagiarism and its consequences. Suggest measures to avoid plagiarism.

SECTION D – K5 (CO4)

Answer any ONE of the following in 750 words

(1 x 15 = 15)

12. Various steps are involved to effectively carry out the process of research. Elaborate and Justify.

13. The duration of time from first exposure to HIV infection to AIDS diagnosis is called the incubation period.
 The incubation periods of a random sample of 7 HIV infected individuals is given (in years):
- | | | | | | | |
|----|------|-----|-----|------|------|-----|
| 12 | 10.5 | 9.5 | 6.3 | 13.5 | 12.5 | 7.2 |
|----|------|-----|-----|------|------|-----|
- a. Calculate the sample mean (2 marks).
 b. Calculate the sample median (1 mark).
 c. Calculate the sample standard deviation (2 marks).
 d. If the number 6.3 above were changed to 1.5, what would happen to the sample mean, median, and standard deviation? State whether each would increase, decrease, or remain the same. (5 marks)
 e. Suppose instead of 7 individuals, we had 14 individuals. (we added 7 more randomly selected observations to the original 7)

12	10.5	5.2	9.5	6.3	13.1	13.5
12.5	10.7	7.2	14.9	6.5	8.1	7.9

Make an educated guess of whether the sample mean and sample standard deviation for the 14 observations would increase, decrease, or remain roughly the same compared to your answer in part(c) based on only 7 observations. Now actually calculate the sample mean standard deviation to see if you were right. How does your calculation compare to your educated guess? Why do you think this is? (5 marks)

SECTION E – K6 (CO5)

Answer any ONE of the following in 1000 words (1 x 20 = 20)

14. The allele for grey fur in a species of animal is dominant to white, and the allele for long tail is dominant to short.
- a) Using the symbols G and g for coat colour, and T and t for tail length, draw a genetic diagram to show the genotypes and phenotypes of the offspring you would expect from a cross between a pure-breeding grey animal with a long tail and a pure-breeding white animal with a short tail. (5 marks)
- b) If this first generation of offspring were bred together, what would be the expected phenotypes in the second generation of offspring, and in what ratios would they occur? (5 marks)
- | | |
|--------------|----|
| grey, long | 54 |
| grey, short | 4 |
| white, long | 4 |
| white, short | 18 |
- c) In the actual crosses between the animals in this generation, the numbers of each phenotype obtained in the offspring were:
- Use a χ^2 test to determine whether or not the difference between these observed results and the expected results is significant (10 marks).
- (Chi - square value at 5% level of significance - 7.815)

15. a) (i) Write an regression equation and identify and describe the variables in it (3 marks).
 (ii) What is the significance of regression analysis? (4 marks)
 (iii) Explain R^2 (2 marks).
 b) Discuss on ethical issues faced in research methodology (10 marks)

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