



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – BIOTECHNOLOGY

THIRD SEMESTER – NOVEMBER 2022

PBT 3503 – RESEARCH METHODOLOGY AND BIOINFORMATICS

Date: 28-11-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART A

Answer ALL the questions

I	Choose the correct answer	(5 x 1 = 5)
1	_____ is common in all true experimental and Quasi experimental designs a) Pre-testing b) Randomization c) Pre-testing and post testing d) Control group	
2	Data with extremities are best statistically described for central tendency using a) Arithmetic mean b) Assumed Mean c) Median d) Mode	
3	The process of finding the relative location of genes on a chromosome is called a) Gene tracking b) Genome walking c) Genome mapping d) Chromosome walking	
4	Which of the following is preferably used to know the phylogeny? a) mRNA b) rRNA c) tRNA d) All the above	
5	Which of the following is not a site on internet for alignment of sequence pairs? a) BLASTN b) BLASTX c) BCM search launcher d) SIM	
II	State whether the following are true or false	(5 x 1 = 5)
6	Quota sampling is a form of accidental sampling.	
7	Chi square test is used to infer the significant difference between the observed results and expected results of a given experiment.	
8	PDB for protein sequences is a primary database.	
9	A sequence can be aligned with itself to identify internal repeat elements.	
10	Phylogenetic tree is a three dimensional graph that shows evolutionary relationship between the species.	

III	Complete the following	(5 x 1 = 5)
11	The main aim of the scientific method in the research field is to _____	
12	_____ is an example of software used for biostatistics	
13	The algorithm used in alignment of DNA sequence is _____	
14	Few phylogenetic tools used for drawing cladogram are _____	
15	EST division of EMBL database archives data in _____	
IV	Answer the following within 50 words	(5 x 1 = 5)
16	Define Q study.	
17	Compare: Paired and Unpaired t-test.	
18	Define alignment score.	
19	Interpret Gap penalty.	
20	Mention any two significances of cladogram.	
PART B		
V	Answer the following each within 500 words.	(5 x 8 = 40)
	Draw diagrams wherever necessary	
21	a) What are the characteristics of a research? Explain how quantitative researches differ from qualitative research OR b) Explain the significance of primary data. What are the limitations of primary data? Explain in brief the stages in data processing.	
22	a) Give a brief account on Multivariate analysis OR b) A student measured the petal length from a population of <i>Petunia</i> species, growing in a garden. These are the results: Petal lengths in garden population/mm 2.8 3.1 2.9 3.2 2.9 2.7 3.0 2.8 2.9 3.0 3.2 3.1 3.0 3.2 Calculate the arithmetic mean. Perform a chi -square test. Chi – square value (18 degrees of freedom) = 28.869	
23	a) Define DDBJ. Give an account of all the resources and data submission in DDBJ.	

OR

b) What is BLAST? Give the different categories into which BLAST tools can be categorised.

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a) (i) Distinguish: Species tree and Gene tree (2).

(ii) Explain about molecular clock and its application in Phylogenetics (2).

(iii) List and elaborate on the factors that affect gene frequency in a population(4).

OR

b) Discuss on molecular methods of phylogenetic classification.

25

a) Give brief account of megablast algorithm

OR

b) Let S1 = GGACT and S2 = TGCTT

Obtain the optimal global alignment using dynamic programming method. Use Scoring scheme (match 1, Mismatch -1, Gap -2)

PART C

VI

Answer any TWO of the following, each within 1500 words.

(2 x 20 = 40)

Draw diagrams wherever necessary.

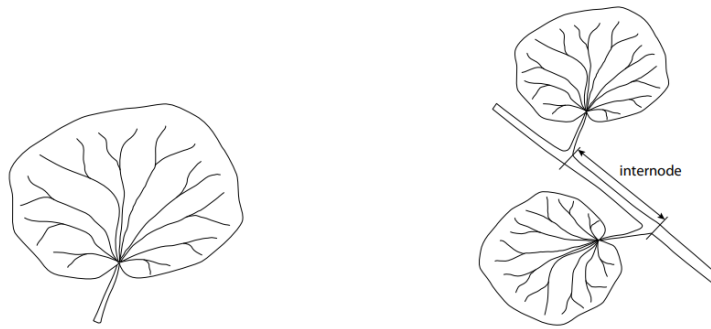
26

Briefly describe the different steps involved in research.

27

A student noticed that the leaves on a plant growing close to a wall had two sorts of leaves. The leaves next to the wall were in the shade and looked different from the leaves on the side away from the wall that were exposed to the sun. The length of the internodes on the stem also looked different.

The student decided to investigate the differences by measuring some features of 30 leaves and internodes from each side of the plant. The figure on the left shows the leaf shape. The figure on the right shows an internode.



	Shaded leaves	Exposed leaves
mean internode length / mm	23 ± 4	15 ± 3
mean surface area of leaves / mm ²	2750 ± 12	1800 ± 15
mean mass of leaves / mg	50 ± 8	60 ± 10
mean leaf surface area : leaf mass ratio	55 ± 9	30 ± 6
rate of water loss / mg mm ⁻² h ⁻¹	50 ± 11	65 ± 12

- a) State the independent variable being investigated. Outline the procedures the student could use to obtain these results. [6]
- b) The student carried out t-tests for the leaf surface area:leaf mass ratio. Find the value of t. State and explain the meaning of these results. [14]

The formula for the t-test is:

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right)}}$$

The table shows the critical values at $p = < 0.05$ for the t-test.

The number of degrees of freedom is 58.

Degrees of freedom	18	20	21	22	23	24	25	26	27	28	29	30	40	60	∞
Critical value	2.10	2.09	2.08	2.07	2.06	2.06	2.06	2.06	2.05	2.05	2.04	2.04	2.02	2.00	1.96

28 Describe: Abintio & comparative gene predictions. Prediction of Cis acting elements

29 a) Define evolution. Discuss the evidences for evolution in detail. (5)

b) Elaborate on the principles of darwinism in detail with respect to evolution. (10)

c) Mutation is the primary cause of evolution. Justify. (5)