

**2021**  
**Zoology**  
**Paper ZCT 315**  
**Taxonomy and Biostatistics**

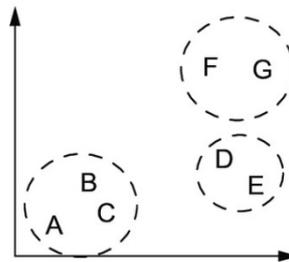
Full marks 40

Time 2 hours

Answer *any four* questions taking two from each group  
 All questions carry equal marks

**Group A**  
**(Taxonomy)**

- Q1. (a) On the basis of some characters, the animals (A to G) are clustered into three groups (X-axis represents relative proximity of animals where Y-axis represents the scale of derived characters). Prepare a dendrogram on it maintaining the axial notes and discuss on their nestedness.



- (b) In your opinion which kind of artifact, plastic or non-plastic, is more advantageous? Justify with examples.

6+4 = 10

- Q2. (a) Illustrate symplesiomorphy and synapomorphy using examples from invertebrate taxa. What is autapomorphy? Cite examples.  
 (b) Elaborate the propositions of (a) Cladistic systematics and (b) Evolutionary systematics as classification methods.  
 (c) What is concerted evolution?

4+4+2 = 10

- Q3. (a) Explain monophyly and paraphyly with suitable examples.  
 (b) Comment on Local and Global alignments with suitable illustrations.  
 (c) Summarize the finding of any one study where the usage of DNA sequences has helped to better understand the then-existing phylogeny.

(2+2) + (2+2) + 2 = 10

- Q4. (a) Provide an outline of the neighbour-joining method used in building a phylogenetic tree.  
 (b) The pair-wise distance information among the six "Operational Taxonomic Units" (A, B, C, D, E, and F) is provided in the table below. Using this information build a phylogenetic tree using the UPGMA method.

	A	B	C	D	E	F
A	0	2	4	6	6	8
B		0	4	6	6	8
C			0	6	6	8
D				0	4	8
E					0	8
F						0

4+6=10

**Group B**  
**(Biostatistics)**

- Q5. (a) The Z score of the measurements of deer antler lengths in a sanctuary has been calculated as 2.0. What does this value mean and how is this calculated?  
 (b) What proportion of the normal curve lies beyond Z of +1?  
 (c) The mean weight of a population of bear is 70 with standard deviation of 10 kg. What is the probability that the mean weight of 100 bears measured will be greater than 80 Kg?  
 [Note: the proportion of a normal curve for Z= 1 is 0.4960; for Z= 1.2 is 0.4168 and for z= 1.3 is 0.3783].

1+2+1+6 = 10.

- Q6. Volunteers are given a psychomotor test. Half of the people are given caffeine before the test. For the other half, it's a placebo (no caffeine). Nobody in the study knows who got caffeine and who got placebo. The results of the psychomotor test are the following:

Caffeine Group: 12, 14, 10, 8, 16, 5, 3, 9, 11

Placebo Group: 21, 18, 14, 20, 11, 19, 8, 12, 13, 15

Are the results of these two independent groups same?

The critical t value at p = 0.05 and df 16 = 2.120, df 17 = 2.110 and 18 = 2.101

10

- Q7. (a) Discuss about the type I and type II errors in statistical hypothesis testing with suitable illustrations.  
 (b) What is homoscedasticity?  
 (c) The impact of four different foods on the body weight gained by twenty-four *Labeo rohita* fingerlings were assessed through application of ANOVA with  $\alpha = 0.05$ . A part of the results is provided in the following ANOVA table. Complete the ANOVA table with supporting hypothesis and the comment on the results. [Given:  $F_{0.05,(1), 3,20} = 3.10$ ;  $F_{0.05,(1), 4,20} = 2.87$ ;  $F_{0.05,(1), 3,23} = 3.03$ ;  $F_{0.05,(1), 4,23} = 2.80$ ;  $F_{0.05,(1), 4,24} = 2.78$ ;  $F_{0.05,(1), 3,24} = 3.01$ ]

Source of variation	Sum of squares	df	Mean squares	F-value
Between food types	1000			
Error				
Total	1160			

3+2+5 = 10

- Q8. (a) Distinguish between one-tailed and two-tailed tests.  
 (b) Using the data provided in the table below, compute a linear regression equation to depict the relationship between pupal weight and wing length of ten female *Aedes aegypti* mosquitoes. Deduce the coefficient of determination for the regression equation. Based on the regression equation, predict the prospective wing length of a female *Ae. aegypti* with 3.2 mg pupal weight.

Female <i>Ae. aegypti</i>	1	2	3	4	5	6	7	8	9	10
Pupal weight (PW, in mg)	2.2	2.4	2.6	2.8	3	2.3	2.7	2.9	3.1	2.0
Wing length (WL, in mm)	1.8	2	2.1	2.3	2.5	1.9	2.3	2.4	2.6	1.5

2+ (5+2+1) = 10